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

Funding/financing schemes for SCC solutions

Report D8.1

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BOO	Build Own Operate
BOT	Build Operate and Transfer
CEF	Connecting Europe Facility
COSME	Competitiveness of Enterprises and Small and Medium-sized Enterprises
DBFO	Design Build Finance and Operate
EASME	Executive Agency for SMEs
EC	European Commission
EE	Energy Efficiency
EFSI	European Fund for Strategic Investments
EIB	European Investment Bank
ELENA	European Local Energy Assistance
ERDF	European Regional Development Fund
ESCO	Energy Service Company
ESF	European Social Fund
ESIF	European Structural and Investment Fund
EU	European Union
H2020	Horizon 2020
INEA	Innovation and Network Executive Agency
ICT	Information and Communication Technologies
JPI	Joint Programming Initiative
MS	Member States
PPP	Public Private Partnership
REA	Research Executive Agency
R&D	Research and Development
RD&I	Research, Development and Innovation
SC	Smart City
SCC	Smart Cities and Communities
SME	Small and Medium-sized Enterprises
VC	Venture Capital

1. Introduction

This report seeks to provide an understanding of how SCC solutions are funded/financed and which schemes are most appropriate for their success. The analysis and findings are presented according to the following structure:

Chapter 2: General context

This section provides the definitions of the key terms (especially the difference between funding and financing) and a description of the main schemes, both public, private and mixed.

Chapter 3: Main insights supported by real cases

Based on the case studies developed as part of the overall research work of this project and on a literature review, this chapter analyses the main trends and findings with respect to the funding/financing schemes that have been used for SCC solutions, also looking at how these change and affect the solutions in different domains (e.g. Sustainable Districts & Built Environment, Integrated Infrastructure, Mobility).

Chapter 4: Conclusions and recommendations

The final chapter of this report draws conclusions from the analysis and turns these into a set of seven key recommendations and operational guidelines intended for both the European Commission and National/City Authorities.

2. General context

2.1 Key definitions

Financing and funding represent two key elements in the creation and roll out of a Smart City (SC) initiative. 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 SC and Communities (SCC) solutions on a wide scale.

Similarly, limited access to finance also 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.

Before introducing the different types of sources for providing the necessary capital for SC projects, a first conceptual distinction between **funding** and **financing** is necessary:

- **Funding** is the long-term cash inflow to pay for the implementation of a project. **It does not imply any repayment**. Instead, it represents the payment of benefits (both direct and indirect) from those that primarily benefit from the project. Typical examples of sources of funding include government bodies and the corporate sector through their corporate social responsibility programmes;
- **Financing** is the source of capital to pay for a specific project (equivalently, who lends or invest in the project). Financing is a temporary provision of cash-flow resources that is **expected to be paid back** at a specific point in time. Sources of financing may be multiple, such as bank loans both from commercial banking institutions or governmental banks, or development banks such as the European Investment Bank (EIB). Other options include bonds, equity, leasing and vendor financing solutions.

2.2 Funding

Government-supported funds and programmes – at EU, national and regional level – represent one of the main sources of capital for SCC projects. At EU, a macro distinction can be made between European Structural and Investment Funds (ESIF) and other EU Programmes. The tables on the following pages illustrate ESIF's characteristics (*Cfr.* Table 1) and the EU Programmes (*Cfr.* Table 2) that support SCC solutions.

ESIFs (*Cfr.* Table 1) are usually coordinated at EU level, although Member States (MSs) are mainly responsible for their management. They provide funding opportunities for a variety of areas (see Annex II[1]), including some that are relevant for SCs, namely:

- Research, Development and Innovation (RDI);

[1] Annex II provides an overview of the typology and budget allocated via ESIF funds to support SC related areas across the 28 MS.

- Environment Protection & Resource Efficiency;
- Network Infrastructures in Transport and Energy;
- Information & Communication Technologies.

However, **these fields appear to have a silo structure, which may limit the possibility of supporting the type of integrated and cross-sectorial solutions relevant to SCs.** Moreover, the availability of one or more of the previously listed funding opportunities at MS level depends upon the details of the Partnership Agreement [2] signed between a country and the European Commission (EC). This implies that not all countries may benefit from the same funding opportunities.

The structuring of support programmes is often organised in siloes especially at national level through the OPs. Maybe the most glaring example in which it was sought to overcome such sectorial separation is represented by CEF. CEF was indeed proposed as a common financing programme for the sectors of transport, energy and telecom. Covering all the three sectors, it is supposed to enable synergies which – in turn – enhance the effectiveness of the EU action and optimise implementing costs. For transport and energy, the programme also aimed at building synergies with Horizon 2020 and complement research through support for pilot projects in innovation and new technologies in these sectors. However there were no combined CEF call so far covering two or three sector together. Some are planned for transport and energy.

EU Programmes are typically managed directly by EU Institutions. Among others, the **Horizon 2020 programme appears to be the most aligned with the SCC solutions' financial needs,** as dedicated calls for funding integrated SCC solutions have been published in the past.

Besides the funding opportunities available at EU level, single MS have also established their own funding schemes with the aim to support solutions in the SC domain. Annex III provides an example of the dedicated programmes in the field of smart cities in place at national level.

[2] The partnership agreement is the document that sets down the strategy for the optimal use of ESIF throughout the country.

Table 1: ESIF

	ERDF	ESF	Cohesion
Description	Focuses on improving social cohesion in the EU through the reduction of economic, environmental and social disparities among territories.	Focuses on enhancing employment and social inclusion.	Focuses on MS that have a low Gross National Income and funds projects across different areas, from transport to energy.
Action areas	Innovation and research, Digital Agenda, support for Small and Medium Sized Enterprises (SMEs), low-carbon economy.	Public service quality improvements, capacity building and education and training.	Trans-European Transport Network, environmental integrated projects across energy and transport including the adoption of renewable energy, the development of sustainable mobility and the enhancement of the public transportation network.
Total budget	€ 183.3 Bln	€ 83.2 Bln	€ 63.4 Bln
Time period	2014-2020		
Beneficiaries	Large companies, SMEs, cities/regions, civil society.	Large companies, SMEs, cities/regions, civil society.	Cities/regions.
How and when to access funding	Need to meet the selection criteria and investment priority of the relevant regional programme.		
Managing authority	National/Regional Authority.		
Eligible countries	All MS.	All MS.	BG, HR, CY, CZ, EE, GR, HU, LV, LT, MT, PL, PT, SK, RO, SI.

Source: Our elaboration based on: http://ec.europa.eu/regional_policy/en/information/legislation/regulations/, https://ec.europa.eu/programmes/horizon2020/, http://ec.europa.eu/research/era/joint-programming_en.html,https://ec.europa.eu/inea/en/connecting-europe-facility,http://ec.europa.eu/environment/life/, https://ec.europa.eu/easme/en/cosme and http://www.eib.org/products/advising/elena/index.htm

Table 2: EU Programmes

	H2020	JPI	CEF	Life	COSME	ELENA
Description	Its primary aim is to foster economic growth and create new jobs by generating leading innovations and also improving cooperation between public and private actors.	Through coordinating research activities and public funds, it **enables MS to coordinate activities and generate new SC solutions.**	Supports the development of infrastructure in different fields. Improves collaboration and interaction between the public administration, businesses and civil society.	The EU's financial instrument to support environmental, nature conservation and climate action projects throughout the EU.	Supports SMEs and entrepreneurs to create the right conditions for innovation. **With COSME, cities could introduce new business models needed to manage SC projects.**	Provides technical support to local and regional authorities to prepare, implement and finance investments to enhance energy efficiency (EE).
Action areas	R&I projects.	Improve interurban transport, logistics, social cohesion, integration, and sustainability.	Transport, energy and digital services.	Sustainability, nature conservation and climate.	SMEs and entrepreneurs.	Energy efficiency, urban transport supporting EE and renewable energy sources.
Total budget	> € 70 Bln	€ 26 ln	€ 33 Bln	€ 3.4 Bln	€ 2.3 Bln	€ 15 mln (annually)
Beneficiaries	Large companies, SMEs, civil society.	Large companies, SMEs, cities/ regions, civil society.			SMEs, cities/ regions.	Local and regional authorities.
How to access funding	Call for proposals, each with different requirements.					Need to have an investment plan.
Managing authority	INEA, REA, EASME and others.	National Authorities.	INEA.	EASME and EIB.	EASME.	EIB.
Eligible countries	All MS.					

Source: Same as for Table 2 above and http://www.eib.org/attachments/documents/elena_faq_en.pdf.

2.3 Financing

Once the funding model has been identified, cities must shift project costs and benefits through financing mechanisms, to match – at the most convenient conditions – the time when resources are necessary and the time when these are available.

The opportunities for financing are numerous and continuously growing. However, cities have been overall reluctant or unable to innovate the way they raise finance.

Financing, which typically takes the form of debt, equity and guarantees, can come either from the government and public institutions or from private entities. A distinction ought to be made between the following:

- Financial products supported by **public funding** (including, for example, European Funds for Strategic Investments (EFSI), InnovFin and Financial Instruments);
- Financial products provided by **commercial banks;**
- Specific programmes supported by **development banks** or similar (e.g. European Investment Bank, *Cassa Depositi e Prestiti, Kreditanstalt für Wiederaufbau*).

Table 3 below summarizes the features of EFSI and InnovFin.

Table 3: EFSI and InnovFin

	EFSI	**InnovFin**
Description	Joint initiative launched by the EIB in cooperation with the EC. The aim is to provide funding options for projects with a higher risk profile that could have a positive impact on the European economy. More specifically: ▪ Strategic infrastructure (i.e. in the digital, transport and energy domains); ▪ Education, RDI; ▪ Renewable energy and resource efficiency; ▪ Support to smaller businesses.	Joint initiative launched by the EIB in cooperation with the EC. Its aim is to improve the access to capital for innovative businesses in Europe. A special focus is placed on firms operating in the R&I field, but also public entities and universities. Different types of products are available depending on the type of enterprise (i.e. <500; <3000; >3000 employees).
Total budget	€ 21 Bln (of which € 16 Bln from EC and € 5 Bln from the EIB)	€ 24 Bln
Beneficiaries	Large companies, SMEs, cities/regions, civil society.	
Financial products available	The idea behind EFSI is that, by protecting the EIB line of credit, EIB financing can support up to 3 times the guarantee value. This, in turn, would attract private investors, which, thanks to the guarantee provided by the EFSI, would invest	Loans, guarantees and equity provided through a variety of instruments, including: SME Guarantee, SME Venture Capital, MidCap Guarantee, MidCap Growth Finance, Large Projects, Energy Demo Projects, Infectious Diseases,

	EFSI	InnovFin
	their capital (approximately five times the value invested by the EIB).	Advisory.

Source: Our elaboration based on: http://www.eib.org/efsi/ and http://www.eib.org/products/blending/innovfin/

Another interesting form of financing consists in **Financial Instruments** [3] that translate part of the resources made available via ESIF into financial products such as loans, guarantees and equity. The main innovation is that, as opposed to grants, final recipients supposed to repay the contribution received. Projects expected to generate the necessary income to pay back the support received are the recipients of such products.

Financial Instruments may be managed by European (i.e. EIB), national or regional financial institutions and support a range of investment areas, including: RDI, EE, Rural and Urban Development, ICT and last mile infrastructure. The Operational Programmes of the country or region concerned should include provisions concerning Financial Instruments.

Overall, the capital made available by the EIB for SC projects amounts to € 56 Bln in the 2010-2014 period (technical assistance included). Examples of smart projects supported range from the deployment of electric vehicle charging infrastructure to smart LED street lighting, from smart meters to district heating, and from key public facilities acting as agents for change to sustainable eco-districts. Investments are promoted through a mix of lending and blending, since EIB loans can be blended with EU or national grant funding.

Besides individually financing SC projects, the EIB partners with financial intermediaries to provide the necessary capital to support SC initiatives. The **EIB/Belfius Smart Cities & Sustainable Development Programme** is an example of this[4].

EIB/Belfius Smart Cities & Sustainable Development Programme

The programme involves cooperation between the Belgian Belfius Banque and the EIB to finance the implementation of projects focused on SCs. More than 80 projects in the domains of **mobility, urban development and EE** have been taken into consideration.

Some examples include, inter alia, the **redevelopment of a brownfield** in the East Flanders region and the construction of **near-zero energy** sheltered accommodation in the municipality of Schelle.

One of the aims of the programme is to reduce the cost of borrowing for municipalities that are ultimately supporting the development of a more innovative and sustainability-oriented approach.

[3] As regulated by the Common Provision Regulation, Title IV.

[4] For further information, see http://www.eib.org/infocentre/press/releases/all/2016/2016-039-deux-nouveaux-projets-intelligents-et-durables-a-silly-grace-au-programme-de-financement-de-belfius-et-la-bei-smart-cities-sustainable-development.htm or https://www.belfius.be/publicsocial/FR/Themes/Smart-Cities/Funding/index.aspx

2.3.1 Additional financing sources

As for additional financing sources, a distinction should be made between:

- **Bond financing,** which includes a wide spectrum of different bond options issued by states, local authorities, or corporates to finance different projects;
- Pension fund **private placement bonds,** which is a peculiar case of bond financing that entails pension funds with large amounts of capital to invest through non-public offerings.
- **Equity investment and infrastructure fund managers,** which includes investments made as part of a e.g. diversified securities portfolio.
- **Venture capital (VC),** which includes money provided to seed, early-stage and emerging growth companies. Venture capitalists invest in companies in exchange for equity in the companies they invest in;
- **Crowdfunding,** which enables groups of individuals (i.e. financiers) to financially support a certain solution by pooling their resources. It uses the internet as a major channel whereby financiers are able to fund a project according to their geographical interests or emotional preferences;
- **Venture philanthropy** refers to private investors, foundations or private-equity firms using VC approaches to provide financial support to viable projects with high levels of social interest.

These sources and their relevance to SCC solutions are described in greater detail in Table 4 on the following page.

Table 4: Different financing tools for SCC solutions

Type of tool		Scope
Bonds	**General obligation bonds**	Debt instrument issued by state or local authorities. Used for projects that do not generate any direct source of revenue, including core infrastructure like parks, schools, libraries etc.
	Revenue bonds	Debt instrument issued by states, cities and municipalities to finance revenue-generating projects.
	Industrial bonds	Type of revenue bonds issued by a public authority and directed to the private sector for a specific business purpose.
	Green bonds	Debt instrument issued by state, local authorities or corporates to boost projects based on environmental sustainability.
	Qualified energy conservation bonds	Type of bond which enables states or local governments to borrow money for energy conservation projects.

Type of tool		Scope
	Mini-bonds	Debt instrument that provides SMEs with access to the capital market.
(Pension Fund) private placement bonds		Debt instrument, which cost is generally lower than for public placement bond issuance. It offers higher opportunities for flexibility and is available for companies, which are not publicly listed.
Equity investment and infrastructure fund managers		Fund Managers invest in a portfolio of securities from infrastructure companies (e.g. shares, bonds etc. – shares only in the case of *equity investors*) to meet the profitability goals of investors.
Venture capital		Private investors, either in the form of large corporations or in the form of smaller sized investors providing capital to support start-ups or small firms with long term potential.
Crowdfunding	**Reward-based**	Tangible or intangible reward for those contributing to a certain project
	Equity-based	Similar to equity investment models – possibility to gain shares along with the possibility to have all the different types of rights arising from the participation in the enterprise or project.
	Lending-based	Similar to traditional forms of lending with funds repaid at lower interest rate
	Donation-based	Similar to philanthropy
Venture philanthropy		Private investors, foundations or private-equity firms supporting projects with high social interests.

Source: Our elaboration based on: E.Reviglio et al (2013). Smart City development projects and financial instruments. Cassa Depositi e Prestiti. Available at: http://www.cdp.it/static/upload/mon/monographic-report_smart-city.pdf; and K.C. Desouza et al. Smart cities financing guide. Expert analysis of 28 municipal finance tools for city leaders investing in the future. Smart Cities Council.

With regards to **Venture Capital (VC)**, the current expansion of the Internet of Things (IoT) technologies represents an important opportunity for SC projects, as well as for Venture Capitalists willing to invest in start-ups focusing on these types of projects.

Table 4 includes some examples of the main VC firms investing in start-ups and which are currently developing tools for SCs.

Table 5: Main Venture Funds supporting start-ups in the SCC domain

Venture fund	Company	Technology	Location

Venture fund	Company	Technology	Location
ABB Technology Ventures	TaKaDu	Water distribution network monitoring	Israel
Siemens Technology Ventures	PPC (Power Plus Communications)	Powerlines for smart metering and smart grids	Germany
Siemens Venture Capital	Power Plus Communication	Broadband power line system for smart grids	Germany
	Tendril	Home energy management solutions	North America and Europe
	Sunverge Energy	Distributed energy management systems	Germany
	Sensys Network	System for traffic detention	Germany
Robert Bosch Venture Capital	GreenPeak Technologies	Data communication technologies	The Netherlands
	EpiGaN	Efficient power electronics material	Belgium
T-Venture Fund	Streetlight Data	Tool helping city officials to plan and implement Smart Cities solutions	USA
Aster Capital	Lucibel	EE lighting	France
	Digital Lumens	EE lighting	USA
Cisco Ventures	Worldsensing	Wireless sensor technologies for Smart Cities	UK/Spain
BMW I	Moovit	Public transportation app	USA

Source: Our elaboration based on:
http://finance.siemens.com/financialservices/venturecapital/pages/venture_capital.aspx, http://www.rbvc.com/en/rbvc/home/home.html, https://www.telekom.com/dtsi, http://aster.com/, http://www.ciscoinvestments.com/, http://www.bmw.com/com/en/insights/corporation/bmwi_ventures/.

2.3.2 Financing schemes

Project financing

Project financing consists of a financial transaction used by public administrations or banks to finance public works, especially large-scale infrastructure projects. Compared to more traditional forms of lending, project financing focuses on the financial assessment of a given project, rather than on the business/enterprise as a whole. The remuneration is set according to the estimated cash flows and profits generated by

the project. Some of the positive outcomes include the fact that it mitigates government risks and it allows them to acquire precious skills that may not be available.

Public-Private Partnership

Within a Public-Private Partnership (PPP), private sources of financing along with funding from a public source come together to support the development and implementation of SCC solutions. One of the main aspects that has to be taken into consideration while implementing an SCC solution is the level of risk (from market risk to policy risk) embedded in the initiative which could discourage private partners from actively participating and could limit access to finance. The advantage of a well structured PPP is that it allows for a balanced allocation of risks among private and public partners.

The following types of PPP contractual models should be mentioned:

- **Build-Operate-Transfer (BOT):** This involves an agreement between the private and public counterparts committed to covering the design, building and operational phases of the investment project. Revenues for the operator company are usually obtained in the form of a fee charged to the community/government;
- **Design-Build-Finance-Operate (DBFO),** whereby a single contractor with financing capabilities designs, builds and operates the project for a certain period of time;
- **Build-Own-Operate (BOO),** which involves a private sector partner taking under its responsibility all the phases in a project from building and financing to operations. The main difference with other models, especially DBFO, is related to the fact that a company could build, operate but also own a project for all its physical lifecycle;
- **Energy Service Companies (ESCO):** To provide direct financing to the investment and use their in-house expertise and know-how to develop projects further. The main steps that are usually followed by ESCOs in relation to projects involve: a first analysis of data gathered, contracting, designing, execution, monitoring and maintenance;
- **Financial Lease** involves three main actors; a financing entity, the contractor (private entity) and the principal (public entity). Under this contractual form, capital is provided to the contractor by the financing entity, which is then repaid by the public entity through lease payments;
- **Sponsorship Agreement,** which allows public entities to cooperate with the private sector in order to promote innovative projects in the government sector and to execute public works, increasing the quality of services. The role played by the private entity is usually related to the provision of capital or goods, whereas the public entity is mostly focused on setting goals and objectives for the project.

Whatever the case, it is worth reminding that a PPP is a way to finance, procure and implementat. PPPs do not represent a solution per se, but rather a mean through which a solution is implemented. The success of PPPs depends on how well these are structured and implemented.

2.3.3 Investment Platforms

Among the new opportunities the EFSI enables to leverage from, it is worth mentioning the investment platforms. These are co-investment arrangements structured with a view to catalysing investments in a portfolio of projects (as opposed to individual projects) with a thematic or geographic focus[5].

Through the use of Investment Platforms, it is possible to reduce transaction and information costs and provide for more efficient risk allocation between various investors. Ultimately this enables financing solutions to be spread to a wider range of projects, which would otherwise could not be reached by e.g. the EIB.

The range of products that can be provided through platforms is vast and includes:

- **Equity** and **quasi-equity** investment in projects or funds;
- **Loans to projects**, including subordinated loans to those provided by e.g. National Promotional Banks or private investors;
- **Guarantees,** which can include both guarantees directly to projects or guarantees and/or counter-guarantees to intermediaries which invest in projects.

Investment Platforms are flexible instruments also in terms of sectorial scope (in this case reference is made to mono-sector focus vs. or multi-sector focus), thus entailing a unique window for e.g. both energy and mobility SCC projects. Similarly, aggregating projects, Platforms are best suited to provide financial products to support small or medium-size projects, which would not be otherwise able to benefit from the opportunities offered by the wide range of financing solutions available in the market[6].

[5] http://ec.europa.eu/economy_finance/financial_operations/documents/efsi_rules_applicable_to_operations_en.pdf

[6] http://ec.europa.eu/regional_policy/sources/thefunds/fin_inst/pdf/efsi_esif_compl_en.pdf
http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R1017&from=EN

3. Main insights supported by real cases

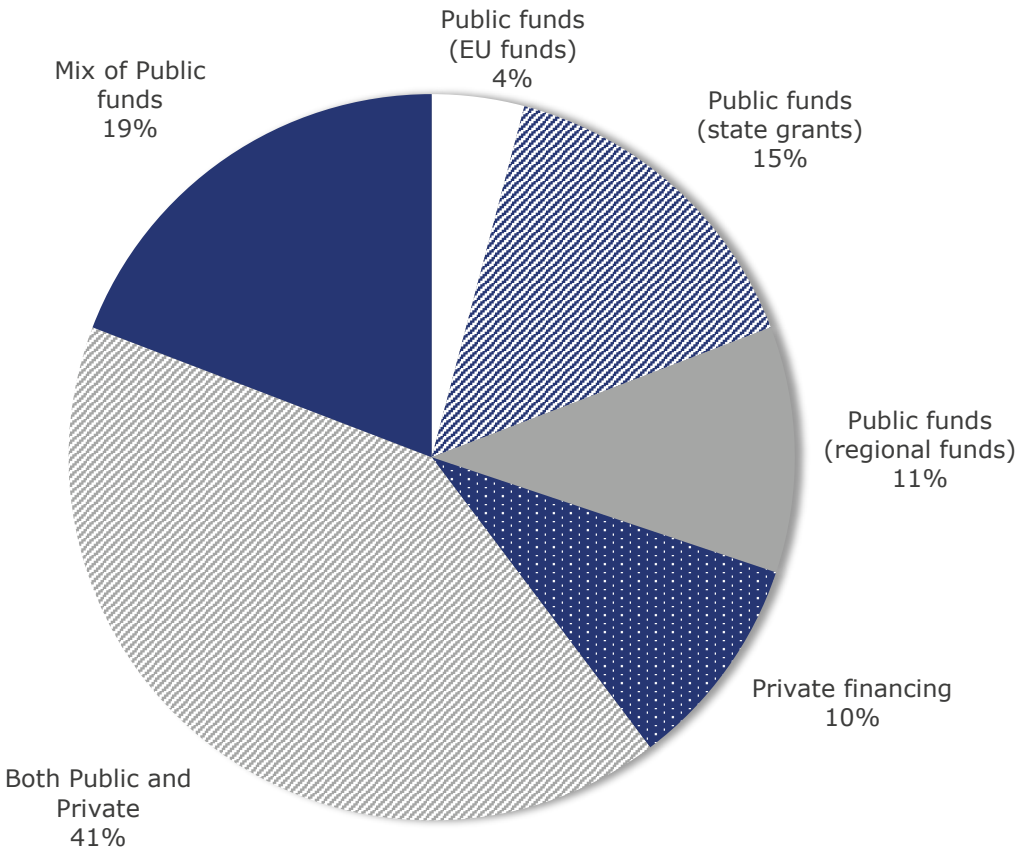
3.1 Public versus private funding/financing

An initial categorization of the 80 best practices has been made by dividing the different financing/funding options into the following six major clusters:

- EU fund (both ESIF as well as other EU programmes);
- State grants;
- Regional funds (funds made available by single regions from national budget);
- Mix of public funds (including the use of one or more of the previously mentioned funding options);
- Private financing;
- Both private and public financing/funding (mix of private financing including for example loans and public funding in the form of EU funds, State grants, Regional funds).

These categories were used to group the funding/financing options chosen by SCC solutions, as is illustrated in Figure 1 below.

Figure 1: funding/financing options chosen by SCC solutions



The majority of solutions analysed (*Cfr.* Figure 1 above) have adopted a mix of public-private funding/financing (e.g. Hafen City Hamburg, University of California San Diego, Hudson Yards New York, etc.) in order to sustain SC projects.

Example of a mix of public funds
New Fleet Management System, Donostia, San Sebastian (ES)

The "New Fleet Management System" became fully operational in 2010 and currently enables the efficient planning and management, via an ICT platform, of the public transportation system in the city. The solution was funded through a mix of public resources, with 70% coming from EU funds while the remaining part was made up of from regional funds. The funding coming from the EU was raised through the 7th Framework Research Programme.

Public-private funding/financing is followed by a mix of public funds (e.g. Bus integrated management system in Donostia, San Sebastian; MnPass Minneapolis), which consists of state grants (e.g. MeRegio, Future City Glasgow), regional funds (e.g. Citizens Connect), private financing (e.g. Vienna Citizens' solar power plant) and the use of individual EU public funding options (Interoperable open platform – Iscope, Energy Efficient Housing 3eHouses)[7].

Example of private financing
Green Bond financing of Smart City projects, Gothenburg (SE)

The City of Gothenburg became the first city in the world to use **Green Bonds** for financing projects in 2013. The total amount of green bonds issued for the City of Gothenburg in three years amounts to € 353 Mln. A special focus of the utilized Green Bonds has been environment related projects that are part of the wider city's Environmental and Climate Programmes. Some examples of projects that have been financed via Green Bonds include: Gothenburg Energy Celsius Project (district heating system), *Lokalforvaltningen* (several projects related to sustainable housing and schools) and other investments in deploying approximately 100 electric cars across the city.

Example of EU fund
Efficiency financing via EFSI (FR)

One of the main projects involving the deployment of EFSI funds relates to the plan to improve EE performance in more than 40,000 houses and flats across France.

The aim of the project is to improve the insulation as well as to renovate the heating and ventilation system, therefore reducing energy consumption.

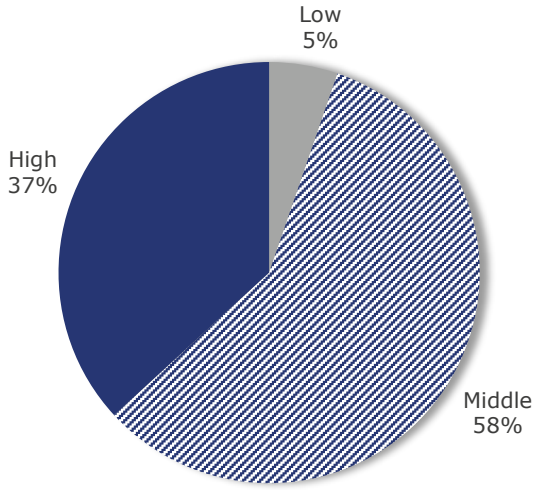
The overall capital received by the EIB amount to € 400 Mln and cover half of the total project cost. The capital will be provided by the EIB via local intermediaries.

[7] For the full list of best practices, please refer to Annex I.

3.2 Ease of access to funding

Another aspect that emerges from the analysis of best practices is the relative ease that projects encounter in accessing sources of financing/funding. Figure 2[8] classifies the ease of getting access to financing/funding sources into low, middle or high. The majority of solutions found only a few hurdles or difficulties in accessing capital.

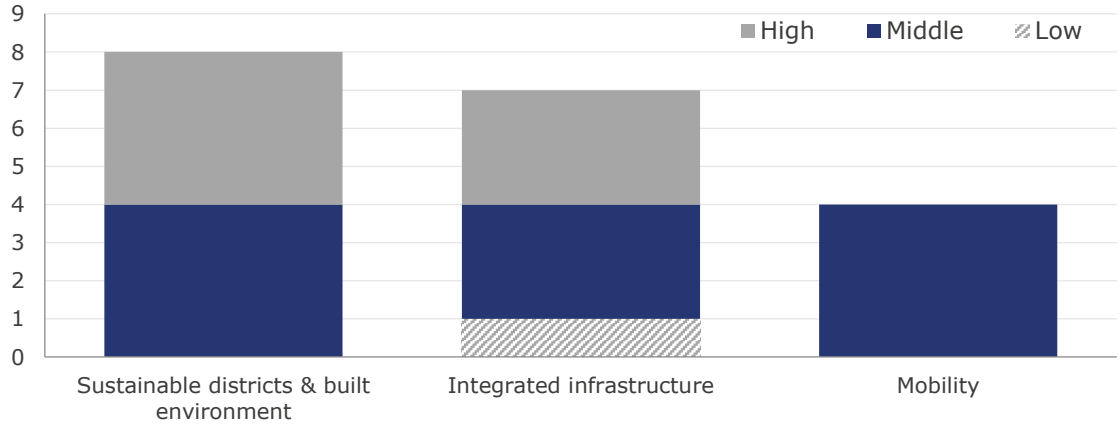
Figure 2: Ease of accessing financing/funding



Source: Our elaboration

In addition to the evidence presented by Figure 2 above, when looking at the issue of how easy it is to access to finance/funding across the different domains, Figure 3 below shows that few difficulties were encountered when raising capital.

Figure 3: Ease of accessing financing/funding for each domain[9]



Source: Our elaboration

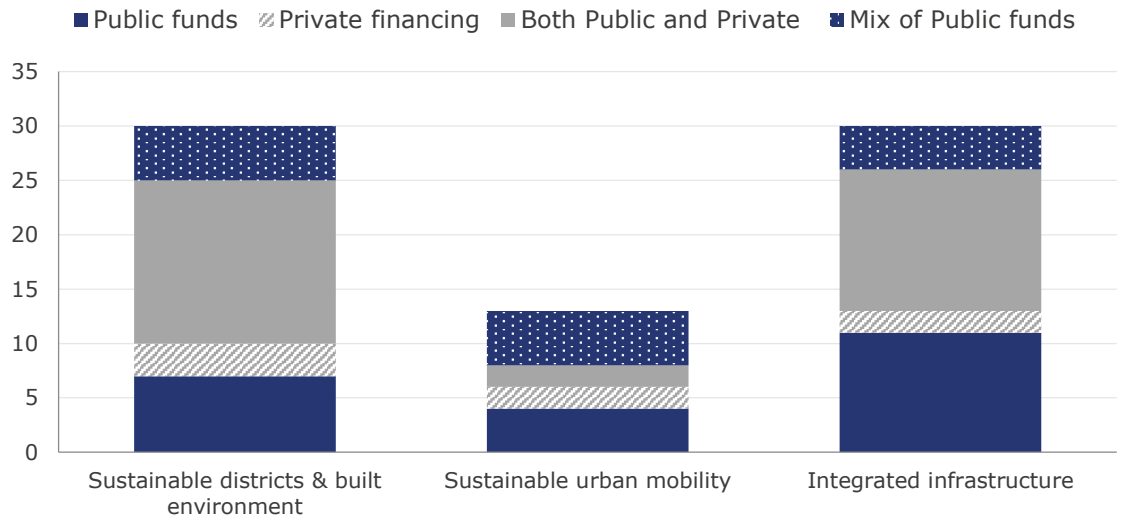
[8] The sample taken into consideration for this specific graph is made up of 20 solutions.

[9] The bar chart was made using the data available from 20 best practices of SCC solutions.

3.3 Public-private partnerships

It is worth noting that, according to the data available in relation to the 80 best practices, **PPP seems be especially popular in SC projects focusing on the Sustainable Districts & Built Environment domain.** The bar chart shown in Figure 4 below shows the distribution of the above-mentioned funding/financing options,[10] applied to the three major domains of SC projects.

Figure 4: Funding/financing options for each domain[11]



Source: Our elaboration

The widespread use of PPP to fund Sustainable Districts & Built Environment projects may be due to the complexity of these projects, which often require access to a larger amount of capital and resources. Moreover, since they often involve large urban redevelopments, specific institutions become operational in order to oversee the different project phases. Therefore, **the presence of a solid, but also dynamic organizational structure, results in a more direct and effective control over some of the critical aspects of a PPP** including financial management, project evaluation and risk allocation.

Public funds, both in the form of individual funding options and a mix of public funds, appear to be the preferred choice for Sustainable Urban Mobility and for Integrated Infrastructure projects. The presence of a wide range of regional, national or EU funding options and schemes aimed at fostering the diffusion of specific technologies, especially in the domain of electro-mobility[12], smart grids or renewable energies may be the explanation for this. Regarding private financing, all the three different Smart Cities domains account for similar shares and no major trends can be identified.

[10] To make the chart more readable, the wide range of public funding options have been clustered into the more general "public funds" definition.

[11] The bar chart was made using the data available from 70 best practices of SCC solutions.

[12] e.g. Smart City Malaga.

Public funding of an integrated infrastructure project
SC Platform, Valencia (ES)

The platform was unveiled by the Valencia City Council in 2014 with the aim of collecting different indicators related to transport management, air quality, waste collection, public lighting and local police.

The solution is entirely funded by the local government. A four-year contract has been established between the Municipality and Telefonica, the Spanish telecommunication operator that won the contract. The total budget amounts to € 4.8 Mln. It is estimated that the project will produce a high amount of savings that will cover the cost of the service.

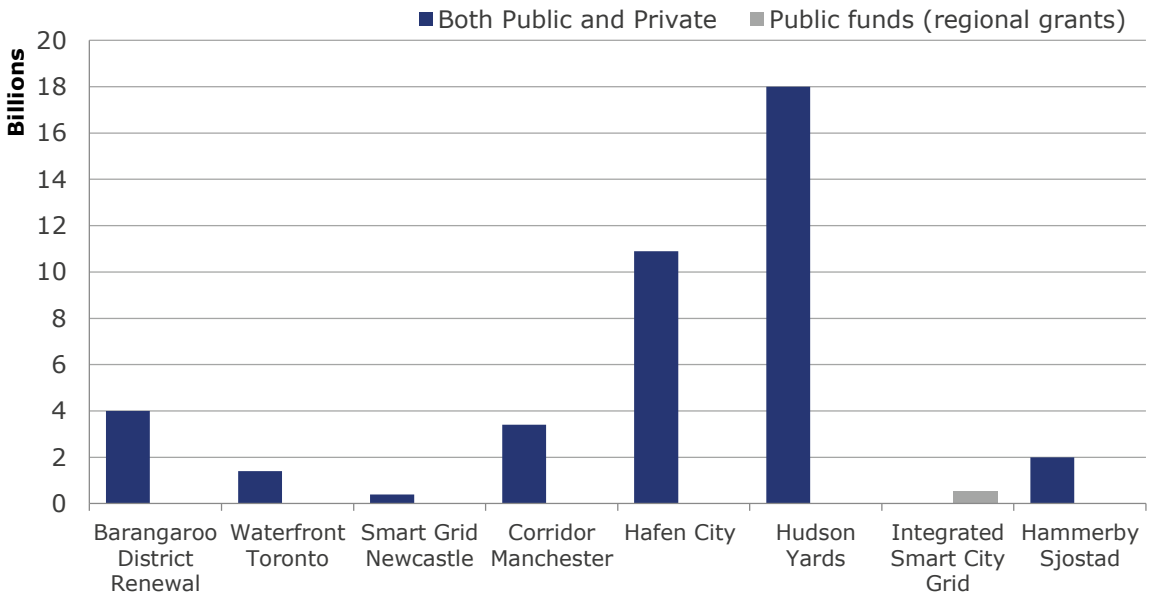
The city administration is analysing three different financial models to ensure the long-term sustainability of the platform.

These are:

- Introduction of a fee in the specification of the urban services offered by the platform, during the bidding process;
- Introduction of a mix of contributions from local public authorities;
- Introduction of a fee for all providers of urban services from 2014 onwards.

Six out of the top eight SCC projects in terms of budget (values are in billions of euros) **have been financed via a PPP** (*Cfr.* Figure 5). Moreover, all these projects belong to the Sustainable Districts & Built Infrastructure domain, with the only exception of Smart Grid Newcastle and Integrated Smart City Grid, which belong to the Integrated Infrastructure domain and which are the only two that have been funded via Public Funds (state funds).

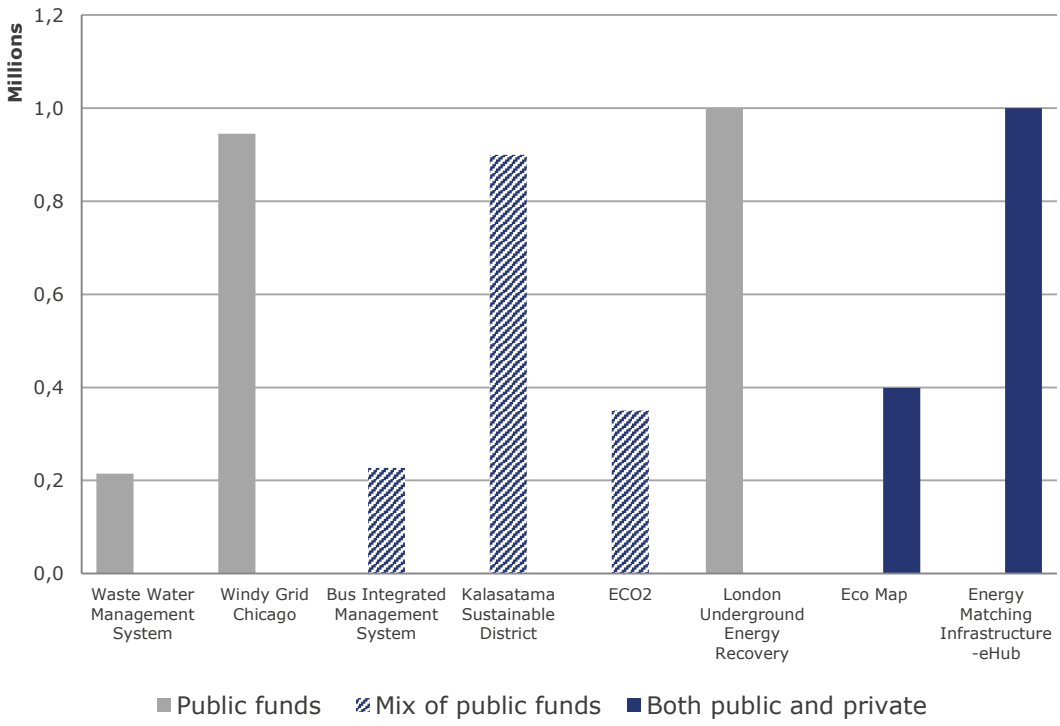
Figure 5: Financing/funding models for the top 8 projects in terms of budget



Source: Our elaboration

Public funds (*Cfr.* Figure 6) – both in terms of individual funding options (EU, state, regional) as well as a combination of all of them – **are the preferred way of financing low budget projects.** The only exception are projects like Energy Matching Infrastructure e-HUB and Urban Eco Map, which have been funded via a PPP.

Figure 6: Financing/funding models for the bottom 8 projects in terms of budget



Source: Our elaboration

PPP for the development of Hamburg's HafenCity

HafenCity is a major urban development project in the hearth of Hamburg that aims to realize a new generation of **EE buildings** as well as new facilities and solutions focused on sustainability. The project started in 2007 and it is still ongoing.

A **mix of public and private investments** financed the project: around € 8.5 Bln have been invested by private actors and € 2.4 Bln by public entities. In order to oversee and manage the development of HafenCity, a **specific organization** named HafenCity Hamburg GmbH has been created. The organization is fully financed by the city of Hamburg but it operates independently.

A large part of the private investments are made by the direct acquisition and development of public properties. The revenue generated from selling large land areas are used by the Municipality to finance infrastructures including, roads, bridges and parks. One of the aims of the management of HafenCity is to balance public investments for developing infrastructures with revenues generated from the sale of special assets, therefore avoiding the creation of deficit.

One particularly interesting example of PPP behind the HafenCity project is the tendering process that the City opened in order to contract the building, operation and management of the **district heating system,** awarded in 2009 to Dalkia Energie. The time span set for the contract is 25 years. This type of contract can be considered as a **DBFO type of PPP** with the private company providing financing capabilities along with the required competencies to design, construct and operate the project for a certain period of time.

Smaller sized projects with a target focus on mobility (e.g. Bus integrated management system in Donostia, San Sebastian) or integrated infrastructure (e.g. Windy Grid Chicago, London energy recovery) are usually funded via public funding options.

Public funding for the Smart Santander project

In 2009, the city of Santander decided to deploy 20,000 sensors across the urban area in order to monitor different activities from mobility to the level of air and soil humidity. Besides monitoring different activities across the city, the project sought to improve the use of resources and reduce costs, while also making the **municipality act as a living lab** for testing new technologies and attracting talents and IT providers.

EU public funds (within the framework of the Horizon2020 program) for a total of € 8.6 Mln subsidized the solution. Within Smart Santander, the overall number of projects receiving EU support is 11. The municipality carries out maintenance costs for a total of € 2.5 Mln per year. Moreover, a PPP was established with different contractors bearing the costs for the project expansion. In total, 25 companies and institutions from 10 countries participated in the programme.

Besides the aforementioned sources of funding/financing, some of the 80 SCC projects also accounted for other less traditional sources of financing, namely **crowdfunding** and **venture philanthropy**. By 2013, approximately 450 crowdfunding platforms had been developed worldwide, with the highest concentration in the US followed by the UK and other European countries.

Crowdfunding of a SC project
Vienna Citizen Solar Power Plant (AT)

The project started in 2012 and in the site of Donaustadt, and lately it has expaned to another 19 locations across the city of Vienna. Currently, 19 citizen solar power plants provide energy to approximately 1,700 households. In order to start the solution, an initial funding amounting to € 200,000-300,000 has been raised from the Municipality of Vienna.

The project enables citizens to buy a whole or half a solar panel at a price of € 950 or € 475. Individual purchasers can than receive an annual profit of 2.25% on their investment. Once the service life of the solar plant reaches an end, approximately after 25 years, the original amount invested is transferred back to the citizens that purchased it. This type of crowdfunding can be considered as similar to a lending based model: the overall investments incurred by citizens enabled the municipality to return the initial capitals invested for launching the solution.

4. Conclusions and recommendations

4.1 Conclusions

The analysis has emphasized the **central role played by PPPs in funding and financing SCC projects.** Moreover, large and complex solutions in the domain of **Sustainable Districts & Built Environment** appear to be those more significantly financed by a mix of public and private funds. The use of PPP schemes is facilitated in these cases by an overall large size of projects (PPPs allow for large amounts of capital to be made available) and relatively standardised contracts.

Public funds appear to be a very common funding option for Sustainable Urban Mobility and Integrated Infrastructure projects. A possible reason is that such projects are generally characterised by a relatively small size, high risks and limited private involvement. Coherently, specific funding schemes both at regional, state and EU level have been made available for projects focusing on these domains.

Private financing is equally distributed among the different SCC domains. It is worth noticing that some SCC solutions adopted less traditional sources of financing, namely: crowdfunding and venture philanthropy.

Finally, a plurality of funding and financing instruments/opportunities offered by public entities, development banks, financial intermediaries as well as private investors make a wide offer and **relatively easy access** to capital both in terms of financing and funding for SCC projects across Europe.

4.2 Recommendations

The results of the analysis, appropriately supported and integrated with the results of the literature review, enable the identification of actions and initiatives that could help to foster the efficient development of SCC solutions.

Each of the recommendations presented below is targeted at different actors, although they are primarily addressed to the EC.

Recommendation 1

Rationalize the supporting role of the EC to SCC projects, depending on whether these can potentially generate revenues or not.

Mainly relevant to the EC.

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. The support in this case should focus on providing the conditions for them to

be effectively market-based: technical assistance, financial instruments, etc. could decrease project risks, help to achieve profitability and attract private capital.

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.

Recommendation 2

Centralize EU competences and roles both for the provision of grants and forms of financing and other support (e.g. technical assistance).

Mainly relevant to the EC.

There are a number of opportunities that support SCC initiatives (as presented in Table 1, Table 2 and Table 3), with varying characteristics and managed by different entities/institutions. 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.

Recommendation 3

Create forms of technical assistance for project design and implementation.

Mainly relevant to the EC and national governments.

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.

Recommendation 4

Develop business accelerators in the field of SCC initiatives, bringing together private and public investors and entrepreneurs.

Mainly relevant to the EC and all stakeholders.

A central role that the Commission might want to play supporting SCC projects and initiatives, is to make it 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.

As reported in chapter 3, projects have mostly been integrating the public and private sectors to succeed. Indeed, more efficient ways to collect capital, skills and partners can be achieved putting together stakeholders. At the same time, solutions can be tested and practices can be shared so that more and more cities can adopt winning solutions. This can be achieved by, for example:

- Creating a physical space for stakeholders to meet at specific dates, but also through on-line platforms that facilitate cooperation and co-development;
- Focusing on replicable schemes/ business models/ specifications, etc., which could interest stakeholders;
- Sharing practices and recommendations on the basis of experiences, to target future efforts on the success stories;
- Potentially using open specifications/ standards, to further facilitate synergies between players and industries.
- 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.

Recommendation 5

Develop integrated forms of funding opportunities, thereby addressing the issue of "silo" funding.

Mainly relevant to the EC and national governments.

Regardless of the fact that some SCC solutions generate revenues and that some other do not, and that, therefore, as detailed in Recommendation 1, "tailored" forms of funding/financing should be provided. SCC solutions should benefit from an integrated form of funding/financing, differing from the current practice in a "silo" fashion.

This recommended approach would support the creation of even more integrated solutions, encompassing energy, transport and ICT domains. In this respect, the Integrated Territorial Investment model adopted in the field of Urban Development may be an example.

Recommendation 6

Consider various ways of funding opportunities, along with the possibility of blending different financial products

Mainly relevant to City Authorities.

Public administrations should be aware that there are many ways of economically supporting a SCC solution, including leasing, crowdfunding, etc.

Funding opportunities in the form of grants could be blended with various financial products to increase the financial sustainability of a solution (e.g. financial instruments and grants).

Recommendation 7

Deploy mitigation efforts to attract funding and national authorities.

Mainly relevant to City Authorities.

City' authorities should increase mitigation efforts to make the city competitive in order to attract financing. Tools available include: planning, credit enhancements, tax incentives, concession agreements, and upgraded reporting and management systems. In this respect, the public administration should work to ensure a consistent, predictable, and transparent business climate for both domestic and global investors with regular and meaningful industry dialogue.

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Annex I. Overview of 80 best practices of financing/funding models

Solution	City	Total investment (€ Mln)	Funding/Financing models					
			Both Public and Private	Mix of Public Funds	Private Financing	Public Funds (EU funds)	Public Funds (Regional Funds)	Public Funds (State grants)
Barangaroo District Renewal	Sydney	4.000.00	X					
Waterfront Toronto	Toronto	1,200.00	X					
Smart Building – Pudong New Area	Shanghai Pudong New Area	-	X					
Octopus System	Hong Kong	-						
Water Network Monitoring and Management	Jerusalem	1.50		X				
Water Management System	Mumbai	26.00					X	
Smart Melit	Toyota City	168.00	X					
Integrated Smart City Grid	Yokohama	560.00						X
Smart Traffic Management System	Buncheon City	10.00					X	
Island Integrated Smart Grid	Jeju Island	82.00	X					
Citizens Connect	Boston	-					X	
City Services Smart Platform	Carson City	-						
Envision Charlotte	Charlotte	4.90	X					
Fiber Optics Smart Grid	Chattanooga	213.00						X
Windy Grid	Chicago	0.00						X
AMI smart grid initiative	Glendale	48.10		X				

Solution	City	Total investment (€ Mln)	Funding/Financing models					
			Both Public and Private	Mix of Public Funds	Private Financing	Public Funds (EU funds)	Public Funds (Regional Funds)	Public Funds (State grants)
Streetline Parker	Los Angeles	290.00						X
Big Belly Smart City Waste Management	Philadelphia	1.90						X
University of California San Diego Microgrid	San Diego	7.30	X					
Vienna Citizens' Solar Power Plant	Vienna	25.00			X			
Blue Gate District	Antwerp	6.10	X					
Center of Operations	Rio de Janeiro	13.00					X	
Hengquin Smart Grid	Zhuhai Hengqin New Area of Guangdong province	48.50						X
MeRegio Smart Grid	Baden Württemberg Region	21.00						X
Bremen Building Management System	Bremen	-						
Klimastrasse	Cologne	1.70			X			
Connected Smart Port Logistics	Hamburg	-			X			
Smart Power - Intelligent Network of Urban Infrastructures	Hamburg	-		X				
E Energy Mannheim	Mannheim	5.50	X					
Nordhavn Smart District	Copenhagen	65.00		X				
Waste Water management System	Copenhagen	0.00					X	
Copenhagen Intelligent	Copenhagen	9.10	X					

Solution	City	Total investment (€ Mln)	Funding/Financing models					
			Both Public and Private	Mix of Public Funds	Private Financing	Public Funds (EU funds)	Public Funds (Regional Funds)	Public Funds (State grants)
Traffic Solutions								
Island EcoGrid	Bornholm	21.00	X					
Tallinn Smart Card	Tallinn	6.70		X				
City Protocol	Barcelona	-	X					
Smart Street Sant Cugat	Barcelona	-	X					
Urban Platform	Barcelona	1.30	X					
Districlima Network	Barcelona	47.00	X					
Neighbourhood Urban Observatory	Bilbao	-					X	
Bus Integrated Management System	Donostia-San Sebastian	0.00		X				
Integrated Security and Emergencies Center	Madrid	20.00						
Kalasatama Sustainable District	Helsinki	0.00		X				
ECO2-Tampere	Tampere	0.00		X				
Issy Grid	Issy-les-Moulineaux	2.00			X			
Lyon Smart Community	Lyon	50.00	X					
Connected Boulevard	Nice	-	X					
Intelligent urban mobility management and traffic control system	Thessaloniki	2.92		X				
Data One Smart Portal	Hong Kong	0.00						X
Interoperable Open Platform -iScope	Zadar	4.00				X		

Solution	City	Total investment (€ Mln)	Funding/Financing models					
			Both Public and Private	Mix of Public Funds	Private Financing	Public Funds (EU funds)	Public Funds (Regional Funds)	Public Funds (State grants)
Open move	Trento	0.00	X					
Climate Street	Amsterdam	4.00						
Power Matching City	Hoogkerk	5.00		X				
Schools Energy Management System	Lisbon	-			X			
Smart District Heating - CELSIUS	Gothenburg	26.00				X		
Hyllie Sustainable District	Malmö	21.00	X					
Stockolm Royal Seaport	Stockholm	13.60					X	
Energy Efficient Housing - 3eHouses	Bristol	2.00				X		
Future City Glasgow	Glasgow	34.00						X
Mass-retrofitting - Hackbridge	London	37.80	X					
Corridor Manchester	Manchester	3,400.00	X					
MK: Smart	Milton Keynes	22.00	X					
Urban EcoMap	San Francisco	0.00	X					
Smart Grid New Castle	New Castle	390.00	X					
MNPass	Minneapolis	93.00		X				
HafenCity	Hamburg	10,900.00	X					
Energy Matching Infrastructure -Ehub	Leuven	1.00	X					
Smart Gateway System	Stavanger	250.00			X			
Hudson Yard	New York	18,000.00	X					
Vehicle2Grid	Amsterdam	1.60	X					

Solution	City	Total investment (€ Mln)	Funding/Financing models					
			Both Public and Private	Mix of Public Funds	Private Financing	Public Funds (EU funds)	Public Funds (Regional Funds)	Public Funds (State grants)
Singapore congestion charging	Singapore	130.00						X
Data –driven Pop-up Busses	Boston	3.70			X			
London Underground energy recovery	London	1.00						X
Malaga Integrated Smart Grid	Malaga	31.00						
Växjo - Fossil Fuel Free City	Växjo	-		X				
Hammerby Sjöstad	Stockholm	2,000.00	X					
Nice-grid	Carros	30.00	X					
Tram Smart Enhancement	Melbourne	-						
Valencia Smart City Platform	Valencia	4.80					X	
Integrated Mobility Platform	Vienna	7.70		X				
Smart Santander Urban Platform	Santander	8.40		X				

Source: Our elaboration

Annex II. ESIF budget allocated to MS to support SC-related fields

Countries	Total budget (€ Mln)	Fields	Programmes involved	Budget allocated (€ Mln)
Austria	4,922.87	Environment Protection & Resource Efficiency	ERDF	1,267.90
			EAFRD	4.85
		Research & Innovation	ERDF	206.23
			EAFRD	51.47
		Information & Communication Technologies	EAFRD	26.69
Belgium	2,710.29	Environment Protection & Resource Efficiency	ERDF	169.44
			EAFRD	105.82
			EMFF	26.24
		Research & Innovation	ERDF	263.52
			EAFRD	14.40
Bulgaria	9,877.57	Environment Protection & Resource Efficiency	CF	1,066.87
			EAFRD	438.15
			ERDF	651.57
			EMFF	27.18
		Network Infrastructures in Transport and Energy	CF	1,144.69
			ERDF	281.54
		Research & Innovation	EAFRD	46.22
			ERDF	494.37
		Information & Communication Technologies	AFRD	25.50
Cyprus	874.36	Environment Protection & Resource Efficiency	EAFRD	36.98
			CF	127.00
			ERDF	30.00
			EMFF	23.40
		Network Infrastructures in Transport and Energy	CF	85.00
			ERDF	14.25
		Information & Communication Technologies	EAFRD	0.00
			ERDF	73.50
		Research & Innovation	EAFRD	0.00
			ERDF	70.00
Croatia	10,742.12	Environment Protection & Resource Efficiency	ERDF	338.02
			EAFRD	270.36
			EMFF	66.22
			CF	1,649.34
		Network Infrastructures in Transport and Energy	ERDF	400.00
			CF	910.21
		Research & Innovation	ERDF	664.79
			EAFRD	25.50
		Information & Communication Technologies	ERDF	307.95
Czech Republic	24,203.71	Network Infrastructures in Transport and Energy	CF	3,723.02
			ERDF	2,519.75
		Environment Protection & Resource Efficiency	EAFRD	739.06
			CF	1,235.34
			ERDF	777.01
			EMFF	8.20

Countries	Total budget (€ Mln)	Fields	Programmes involved	Budget allocated (€ Mln)
		Research & Innovation	EAFRD	86.07
			ERDF	2,421.05
		Information & Communication Technologies	ERDF	1,073.91
Denmark	1,250.99	Environment Protection & Resource Efficiency	EAFRD	208.08
			EMFF	128.68
		Research & Innovation	EAFRD	16.22
			ERDF	87.55
Estonia	4,458.87	Research & Innovation	EAFRD	24.03
			ERDF	642.31
		Network Infrastructures in Transport and Energy	CF	475.90
		Information & Communication Technologies	ERDF	84.57
Finland	3,759.26	Environment Protection & Resource Efficiency	EAFRD	790.42
			EMFF	38.26
		Research & Innovation	EAFRD	81.60
			ERDF	316.63
		Information & Communication Technologies	EAFRD	12.60
France	26,736.00	Environment Protection & Resource Efficiency	EAFRD	3,327.42
			ERDF	1,065.26
			EMFF	213.91
		Research & Innovation	EAFRD	267.28
			ERDF	1,659.85
		Information & Communication Technologies	EAFRD	63.46
			ERDF	939.66
		Network Infrastructures in Transport and Energy	ERDF	376.72
Germany	27,872.86	Research & Innovation	ERDF	3,819.05
			EAFRD	221.53
		Environment Protection & Resource Efficiency	ERDF	655.78
			EAFRD	2,242.31
			EMFF	113.34
		Information & Communication Technologies	EAFRD	223.80
Greece	20,382.32	Environment Protection & Resource Efficiency	EAFRD	1.397,27
			ERDF	1.017,05
			CF	1.739,94
			EMFF	136,13
		Network Infrastructures in Transport and Energy	ERDF	1,664.80
			CF	883.79
		Information & Communication Technologies	EAFRD	65,571.56
			ERDF	785.30
Hungary	25,013.87	Network Infrastructures in Transport and Energy	CF	2,700.71
			ERDF	631.10
		Environment Protection & Resource Efficiency	CF	1,397.48
			EAFRD	494.08
			ERDF	1,011.76
			EMFF	19.87
		Information & Communication	ERDF	689.26

Countries	Total budget (€ Mln)	Fields	Programmes involved	Budget allocated (€ Mln)
		Technologies		
		Research & Innovation	EAFRD	83.27
			ERDF	2,148.86
Ireland	3,357.98	Environment Protection & Resource Efficiency	EAFRD	784.60
			EMFF	99.63
			ERDF	37.00
		Research & Innovation	EAFRD	7.95
			ERDF	142.00
		Information & Communication Technologies	ERDF	75.00
Italy	42,767.90	Environment Protection & Resource Efficiency	EAFRD	1,949.06
			ERDF	2,591.29
			EMFF	215.47
		Research & Innovation	EAFRD	483.68
			ERDF	3,516.74
		Network Infrastructures in Transport and Energy	ERDF	2,446.98
		Information & Communication Technologies	EAFRD	266.08
			ERDF	1,635.86
Latvia	5,633.67	Network Infrastructures in Transport and Energy	ERDF	235.48
			CF	924.29
		Research & Innovation	EAFRD	7.10
			ERDF	467.52
		Information & Communication Technologies	ERDF	172.78
Lithuania	8,358.92	Network Infrastructures in Transport and Energy	ERDF	390.63
			CF	763.16
		Research & Innovation	ERDF	678.88
			EAFRD	24.27
		Information & Communication Technologies	ERDF	244.04
			EAFRD	3.77
Luxembourg	140.13	Environment Protection & Resource Efficiency	EAFRD	31.10
		Research & Innovation	ERDF	9.17
Malta	827.94	Environment Protection & Resource Efficiency	EAFRD	20.13
			ERDF	68.87
			EMFF	12.52
			CF	141.53
		Network Infrastructures in Transport and Energy	ERDF	28.40
			CF	76.21
		Research & Innovation	EAFRD	15.14
			ERDF	57.65
		Information & Communication Technologies	ERDF	30.75
Netherlands	1,723.47	Environment Protection & Resource Efficiency	EAFRD	178.97
			EMFF	75.54
		Research & Innovation	EAFRD	21.61
			ERDF	33.25
Poland	85,995.96	Network Infrastructures in Transport and Energy	CF	14,542.08
		Research & Innovation	ERDF	9,326.05

Countries	Total budget (€ Mln)	Fields	Programmes involved	Budget allocated (€ Mln)
			ERDF	8,351.43
			EAFRD	84.63
		Environment Protection & Resource Efficiency	CF	2,808.17
			ERDF	2,712.67
			EAFRD	1,319.98
			EMFF	149.79
		Information & Communication Technologies	ERDF	3,136.72
Portugal	25,792.82	Environment Protection & Resource Efficiency	CF	1,045.00
			ERDF	809.63
			EAFRD	902.70
			EMFF	106.78
		Research & Innovation	ERDF	2,328.81
			EAFRD	78.65
		Network Infrastructures in Transport and Energy	CF	609.00
			ERDF	250.00
		Information & Communication Technologies	ERDF	294.92
Romania	30,837.53	Network Infrastructures in Transport and Energy	CF	3,404.26
			ERDF	2,678.21
		Environment Protection & Resource Efficiency	EAFRD	1,558.46
			CF	2,892.44
			EMFF	37.05
			ERDF	926.40
		Research & Innovation	EAFRD	88.41
			ERDF	973.40
		Information & Communication Technologies	ERDF	531.91
Slovak Republic	15,329.37	Network Infrastructures in Transport and Energy	ERDF	1,187.99
			CF	2,307.14
		Environment Protection & Resource Efficiency	EAFRD	331.04
			ERDF	88.33
			CF	1,441.77
			EMFF	2.17
		Research & Innovation	EAFRD	38.82
			ERDF	1,795.73
		Information & Communication Technologies	EAFRD	20.17
			ERDF	805.52
Slovenia	3,874.56	Environment Protection & Resource Efficiency	ERDF	131.13
			EAFRD	206.32
			CF	269.11
			EMFF	8.17
		Research & Innovation	ERDF	461.73
			EAFRD	24.13
		Network Infrastructures in Transport and Energy	ERDF	39.67
			CF	223.09
		Information & Communication Technologies	ERDF	68.52
			EAFRD	0.75
Spain	37,400.96	Research & Innovation	EAFRD	295.79
			ERDF	4,736.20

Countries	Total budget (€ Mln)	Fields	Programmes involved	Budget allocated (€ Mln)
		Environment Protection & Resource Efficiency	EAFRD	1,847.37
			ERDF	2,293.87
			EMFF	362.23
		Network Infrastructures in Transport and Energy	ERDF	2.222.00
		Information & Communication Technologies	EAFRD	16.75
			ERDF	2,029.84
Sweden	3,647.23	Environment Protection & Resource Efficiency	EAFRD	505.73
			EMFF	83.75
		Research & Innovation	EAFRD	97.94
			ERDF	261.13
		Information & Communication Technologies	EAFRD	157.27
			ERDF	95.34
		Network Infrastructures in Transport and Energy	ERDF	76.43
United Kingdom	16,417.08	Environment Protection & Resource Efficiency	EAFRD	1,884.36
			ERDF	164.68
			EMFF	142.14
		Research & Innovation	EAFRD	177.47
			ERDF	1,419.03
		Information & Communication Technologies	EAFRD	25.07
			ERDF	230.87
		Network Infrastructures in Transport and Energy	ERDF	164.31

Source: Our elaboration based on: http://www.agendadigital.gob.es/planes-actuaciones/Paginas/plan-nacional-ciudades-inteligentes.aspx, http://hubmiur.pubblica.istruzione.it/web/ricerca/smart-cities-and-communities-and-social-innovation, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/249423/bis-13-1217-smart-city-market-opportunties-uk.pdf, https://cohesiondata.ec.europa.eu/countries

Annex III. Main funding options for SCs in a sample of MS

Part 1: AT, BE, DK, FR, DE

Austria	Belgium	Denmark	France	Germany
Austria's Climate and Energy Fund Aims to initiate major demonstration and pilot projects, which pursue the integration of existing or existing well-developed technologies and systems into innovative, interactive total systems. 3 major objectives: ▪ Using urban regions as a test-bed; ▪ Achieving optimization of the individual systems/ system solutions; ▪ Generating added value compared to individual systems/system solutions.	**Belfius smart cities & sustainable communities** Framework Loan of a series of municipal investments around the notion of "smart cities & sustainable development" notably in the domains of sustainable urban regeneration, renewable energy, energy efficiency and mobility. Total investment equals to €400 Mln for the 2014-2017 period. EIB co-finances €200 Mln.	**Denmark Green Investment Fund** Aims to support the transition to a greener economy, seeing this as a main challenge to fostering smart cities. The initiative is investing €1.9 Bln in green infrastructure, garnering €7.3 Bln from the private sector to fund green projects. The fund includes up to €800 Mln of loan capital. It allows loans to private companies, housing associations and certain public entities. It finances measures and projects to reduce energy consumption, while facilitating the sustainable development of society.	**Investir pour l'avenir (PIA)** Aims to provide cheap loans for competitiveness, growth and employment missions. ▪ PIA I, 2010-2013: €35 Bln. ▪ PIA II, 2013-2015: €12 Bln ▪ PIA III, 2015-2017: €10 Bln By the end of 2015, nearly €37 Bln have been committed to support almost 2,500 projects in the fields of: higher education, research and training; industrial sectors; sustainable development; digital economy; health and biotechnology.	Germany does not have yet a dedicated programme at national level in the field of SC. However, in 2009 it signed a Memorandum of Understanding (MoU) with Austria and Switzerland specifically in the field of SC. The MoU establishes a transnational platform for knowledge sharing and collaboration in the areas of smart grids and electric mobility. The collaboration focuses on the development of intelligent electricity networks, also referred to "Internet of Energy" or "smart grids". No specific funds have been dedicated to this initiative.

Part 2: IT, NL, ES, SE, UK

Italy	Netherlands	Spain	Sweden	UK
Ministero dell'Istruzione, dell'Università e della Ricerca. **Smart Cities and Communities and Social Innovation (2012).** Total budget: €655.5 Mln. The aim of the ministry is to finance 80 selected projects, including 48 that focus on social innovation, and 32 on industrial research.	**Top Sector Energy – Innovation Contracts (TKIs).** The programme has been investing around €80 Mln per year, from 2012 to 2016. Companies, together with academia and the Dutch government, cooperate as a public-private partnership in the Top Sector Energy. The following Innovation Contracts (TKIs) have been defined in 2012: ▪ SWITCH2 SmartGrids; ▪ Wind-on-Sea, ▪ EnerGO (energy conservation in the built environment); ▪ Solar Energy; ▪ Gas; ▪ Bio-based economy; ▪ ISPT (Institute for Sustainable Process Technology).	**Plan Nacional de Ciudades Inteligentes (2015).** Total Budget: €152.9 Mln. This covers 5 priorities: ▪ I: support to towns in the process of transforming into SCs (€74.416 Mln); ▪ II: establish demonstration projects for ICT efficiency in the reduction of costs, improved citizen satisfaction, creation of new business models (€65.5 Mln) ▪ III: foster the development of the ICT industry focusing on SCs (€11.7 Mln) ▪ IV: Communication and diffusion of the Plan (€0.77 Mln) ▪ V: Transversal actions (€0.50 Mln)	**Smart Mobility and Accessibility.** Announcement of funding for research programme: the **Swedish Foundation for Strategic Environmental Research (Mistra)** invites research groups, together with other partners, to submit proposals for a new research programme on mobility and accessibility. 80% of the expected programme budget comes from Mistra's financial contribution; the remaining 20% is co-funded by participants.	**Research Councils UK, funding research in the SC domain.** Total budget: £95 Mln (2013). **Establishment of the Future City Catapult centre.** Total Budget £50 Mln (2013). **Technology Strategy Board, Future Cities Demonstrator Programme.** Total Budget £33 Mln (2013).

Source: Our elaboration