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STRATEGIES, POLICIES AND FINANCIAL MECHANISMS THAT CITIES CAN ADOPT TO EFFECTIVELY INVOLVE STAKEHOLDERS IN THE IMPLEMENTATION OF THEIR PLANS AND ACTIONS

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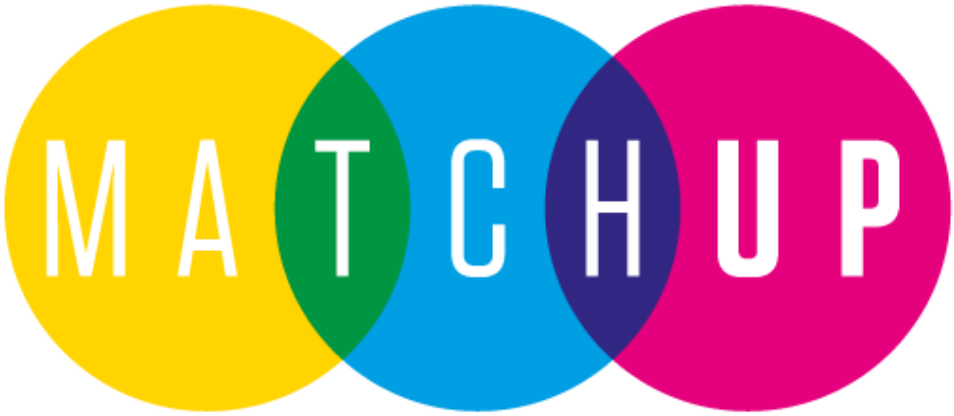

MAtchUP

D6.5: Strategies, policies and financial mechanisms that cities can adopt to effectively involve stakeholders in the implementation of their plans and actions

WP6, T 6.3

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[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
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Table of Content

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N°774477

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N°774477

List of Tables

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N°774477

List of Figures

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N°774477

0 Abstract

A smart city stakeholder is “any entity, an institution or an individual, that has an interest in smart and sustainable cities” or that can “significantly influence or be influenced by its deployment” (ITU-T, 2015). Stakeholders – public and private - are relevant actors of urban transformation processes and of smart city solutions. Involving stakeholders in smart city development brings their knowledge, resources, skills, and needs into the decision-making processes and into the design, operation and funding of smart city solutions. Their involvement can enable to overcome a series of challenges - operational, financial, technological and human resources – that hamper the diffusion and uptake of smart city solutions.

This deliverable aims to investigate stakeholders’ involvement in smart city projects and in their business models, by leveraging the results and information collected within several activities of the MAtchUP project, including: a mapping of stakeholders involved in MAtchUP actions; a questionnaire survey submitted to MAtchUP stakeholders; workshops conducted with project partners, a collection of case studies from MAtchUP cities and an analysis of selected literature on these topics.

The deliverable is structured as follows:

- **Chapter 1** provides an introduction to the document.
- **Chapter 2** describes the methodological approach adopted, its main building blocks and activities;
- **Chapter 3** provides an overview of main stakeholders in smart cities and in particular in MAtchUP smart solutions
- **Chapter 4** describes and categorizes the barriers encountered by stakeholders in the implementation of business models and the possible solutions to overcome them
- **Chapter 5** identifies the market opportunities for stakeholders in business models adopted in cities
- **Chapter 6** presents examples of mechanisms and approaches that can be used to involve stakeholders in smart city planning and in the main dimensions of smart city solutions and their business models: design, governance and funding /financing
- **Chapter 7** presents a set of case studies of stakeholders involvement in smart city actions in MAtchUP cities
- **Chapter 8** reports the possible risks and hurdles perceived by stakeholders in procurement processes of smart city solutions.

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1 Introduction

MAtchUP is an EU-funded Smart City project involving three lighthouse cities (Valencia, Dresden, Antalya) and four follower cities (Herzliya, Kerava, Ostend, Skopje), that are working together to reshape their social, economic and environmental models and promote social inclusion, liveability and prosperity for their citizens. Within the MAtchUP project, lighthouse cities have designed and have been implementing a set of innovative solutions in the energy, mobility and ICT sectors that can promote a smart and sustainable transformation and be replicated in other cities in Europe and beyond.

Several public and private actors collaborate and interact for the implementation of smart innovative solutions in cities, to ensure their realization and achieve their expected results. At the same time, these solutions have the potential to deliver different types of value to several actors. This deliverable aims to analyse the role of different actors in the business models of smart city solutions, and to identify the strategies and mechanisms that can be used to involve different stakeholders in smart city business models.

The deliverable relies on insights collected from the MAtchUP project and MAtchUP cities' experiences, as well as from the relevant literature on this topic.

1.1 Purpose and target groups

WP6 of the MAtchUP project is focused on exploitation and market deployment, as well as on the identification and analysis of innovative business models defined and tested within the project. This deliverable was developed under the activities of Task 6.3, which specifically aims to:

- deepen the role and the market opportunities for stakeholders in business models adopted in cities,
- identify and categorize the barriers encountered during the implementation of smart city business models and the possible solutions to overcome them,
- identify the possible risks perceived by stakeholders in different procurement models of smart city solutions.
- map the possible strategies, policies, and mechanisms that cities can adopt to effectively involve stakeholders in smart city business models.

The main target groups of this deliverable are city governments that could be interested in involving stakeholders in the implementation of smart city solutions; practitioners interested in stakeholder involvement in smart city projects; researchers working on the role of stakeholders in smart city business modelling.

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1.2 Contribution of partners

The following Table depicts the main contributions from participant partners in the development of this deliverable.

Partner	Task	Contribution
22- UBIEFE	6.3	• Overall D6.5 coordination and writing Elaboration of questionnaire survey targeted to stakeholders on their role in smart city business models • Elaboration of questionnaire results • Research activities on smart city business models • Organization of workshops and elaboration of results •
23-ICE	6.7	• Provided questions for the survey aimed to identify and map the market opportunities for stakeholders
1-VAL 2-LNV 3-WIT 4-UPV 5-ETRA 6-ITE 7-KVEL 8-DRE 9-DWG 10-DVB 11-VON 12-FHG 13-TUD 14-ANT 15-SAM 16-DEM 18-TAY	6.3	• MAtchUP lighthouse cities and their local partners contributed to the questionnaire survey implemented as part of Task 6.3 activities, either participating directly in the questionnaire as internal stakeholders or diffusing the questionnaire to external stakeholders. • They also participated in the workshops and contributed to the selection and documentation of case studies of stakeholder engagement in the business models
26 - OST 28 - KER	6.3	• Contributed to the selection and documentation of case studies
1-VAL 2 – LNV	6.3	• D6.5. Review

Table 1: Contribution from partners

The authors would like to thank all the partners and the external stakeholders that contributed to the contents of this report directly or by filling in the questionnaire-survey.

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1.3 Table of acronyms

Acronym	Definition
CoM	Covenant of Mayors
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ENOLL	European Network of Living Labs
EPC	Energy Performance Contracting
ESCO	Energy Service Company
EU	European Union
EV	Electric vehicle
GHG	Greenhouse Gas Emissions
IAP2	International Association for Public Participation
ICT	Information and Communication Technology
IoT	Internet of Things
ITU	International Telecommunication Union
JRC	Joint Research Centre
LH	Lighthouse city
LL	Living Lab
NGO	Non-Governmental Organization
NTA	Non-Technical Actions
PPP	Public Private Partnership
PV	Photovoltaic
RE	Renewable energy
RES	Renewable Energy Sources
SSC	Smart and Sustainable City
STEM	Science, technology, engineering, and mathematics
TEM	Tenant Electricity Model

Table 2: Table of acronyms

1.4 Relation to other project activities

The following Table depicts the main relationship of this deliverable to other activities (or deliverables) developed within the MAtchUP Project and that should be considered along with this document for further understanding of its contents.

Partner	Task	Relation to other project activities
UBIEFE	6.1	Task 6.1 defined the business model evaluation framework and Task 6.2 has applied it to the business models implemented in the project. WP6 performs an in-depth analysis of business models associated with the interventions implemented in the demo-cases by

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		the MAtchUP lighthouse cities, focusing on their key elements, their strengths and weaknesses, success and failure factors.
ICONS	6.6, 6.7	These tasks performed a market analysis of products and services relevant for MAtchUP sectors, in order to define relevant market opportunities.
UBIEFE	5.2	WP5 will provide the measurement and the evaluation of the business model performances, according to the framework defined in Deliverable 5.2 (Economic Evaluation Framework).
CAR, UBIEFE	1.3.1	Sub-task 1.3.1 defined an approach to characterize the business models associated with SCTPs (Smart City Technology Packages) to be demonstrated in MAtchUP Lighthouse cities and address their bankability.
VAL, DRE, ANT	2.1.2, 3.1.2, 4.1.2	As part of WP2-3-4, these tasks designed the financial and business models of LH cities interventions, which are analysed within WP6 activities.

Table 3: Relation to other project activities

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2 Methodology

This chapter describes the methodological approach that was adopted in the development of this deliverable. In the first part of the methodology, a brief overview of how the business model concept is understood and analysed within MAtchUP is provided. Then, the methodology is presented according to the following main blocks and related activities:

- A **mapping of stakeholders involved in MAtchUP** lighthouse cities' solutions business models was carried out
- A **questionnaire-based survey** was elaborated and diffused to MAtchUP lighthouse cities and their solutions' stakeholders, in order to collect their insights on several topics: barriers encountered in the implementation of smart city solutions, suggestions to overcome them, main user needs, main market opportunities, risks on contracts and procurement models.
- **Two thematic workshops with partners** were organized in occasion of project meetings, to address and deepen two main topics:
    - Main strategies, tools and mechanisms to involve stakeholders in smart city business models
    - Procurement models adopted in lighthouse cities
- **A selection and documentation of relevant case studies** of stakeholder involvement in business models was performed by Bocconi University in collaboration with lighthouse cities, in order to identify relevant experiences to be described in the deliverable.

2.1 Business model analysis in MAtchUP

The concept of business model was born in the corporate world and has been defined in several ways according to the domain of application. In the context of MAtchUP, a review of the literature on business model definitions and evaluation frameworks was performed in order to establish a definition in the field of smart city solutions that could applied within the project (Deliverable 6.1). Based on these results, a business model was defined as how smart city solutions *"create, deliver and capture value"*, meaning not only its financial performance **(private value)** but also its wider social, economic and environmental (**public) value.**

In MAtchUP, business models are analysed at **"action bundle" level** rather than at individual solution level. Bundles are groupings of actions that are interlinked among them from a **financing** point of view, and/or that are **jointly able to generate costs and revenues.**

The aim of this approach is to identify the **economies of scope** in these groupings, which can derive from **synergies in the joint design/implementation/monitoring** of

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smart solutions, as well as the **economies of scale** deriving from the up-scaling of single solutions to other parts of the city.

The following table displays the main action bundle categories identified in MAtchUP:

Energy	Mobility	ICT	NTA
Construction of (private) residential building	Electric Vehicle (EV) cars (private sector)	Use of open data for new business	Employment initiatives
Construction of public tertiary building	EV cars (public sector)	Inputs and Outputs of Urban platform	50/50 Programmes
Retrofitting of private residential buildings	EV bus (public sector)		Shared private-public investment models for sustainable energy consumption and circular economy
Building integrated Renewable Energy System (RES) in a residential building	EV bike (public sector)		Prosumer Energy Cooperatives
Building integrated RES in a tertiary building	Demand management/ Smart charging		
Urban scale RES	Multimodality		
Smart public lighting	Expansion charging infrastructure		
Smart controls and domotics in tertiary building			

Table 4: Main action bundle categories in the project - by pillar (Source: Matchup)

Also for the analysis of stakeholders involved in MAtchUP actions, a bundle perspective was adopted. For the purposes of this deliverable, the stakeholders of MAtchUP demonstrators were mapped and analysed at action bundle level, as it will be presented in next chapters.

The images below display the action bundles considered in the stakeholders' survey, for each lighthouse city and categorized by MAtchUP pillar:

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Overview of Valencia "Smart City initiatives"			
Energy	**Mobility**	**ICT**	**Non-Technical actions**
1. Reconstruction of private residential building. 2. Retrofitting of private residential buildings. 3. Reconstruction of Cabanyal Civic Centre. 4. Retrofitting of public tertiary buildings. 5. Building integrated Renewable Energy System in Nazaret Sport Centre. 6. Urban Renewable Energy System. 7. Smart lighting. 8. Streetlights with electric vehicle charger (Humble lampposts).	9. Electric Vehicles (public sector). 10. Deployment of charging points for electric vehicles. 11. Demand management "Vehicle to grid". 12. Electrical Logistics. 13. Multimodality. 14. Intelligent Transport System for parking management.	15. Transparency and promotion of new business opportunities. 16. Management and optimization of the information displayed on the urban platform.	17. Employment, entrepreneurship and social innovation initiatives. 18. 50/50 Programmes. 19. Shared private-public investment models for sustainable energy consumption and circular economy. 20. Prosumer Energy Cooperatives. 21. District refurbishment local investment fund (financial instrument).

Overview of Dresden "Smart City" initiatives	
Energy	**Mobility**
1. Tenant electricity for Blasewitzer Straße 2. Tenant electricity for District Future House 3. Energetic renovation of the real estate 4. Smart controls (central building control center) 5. Adaptive street lighting	6. Electric vehicles for the private sector 7. Expansion of the charging infrastructure 8. Intermodal mobility hubs 9. Smart charging

Overview of Antalya Smart City initiatives	
Enerji	**Ulaşım**
1. ANT_BM-01 New construction of residential building 2. ANT_BM-02 Retrofit of public buildings 3. ANT_BM-03 Smart public lighting 4. ANT_BM-04 Solar power plant with storage 5. ANT_BM-05 LFG Utilization	6. ANT_BM-06 E-bus (Hybrid Buses) 7. ANT_BM-07 E-car 8. ANT_BM-08 E-Scooter 9. ANT_BM-09 Multimodal hubs 10. ANT_BM-10 Intelligent transport system

Figure 1: Overview of action bundles considered in the stakeholders' survey - by city and pillar

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2.2 Mapping of stakeholders involved in MAtchUP solutions

In order to identify, categorize and analyse the stakeholders involved in MAtchUP solutions, a template was developed by Bocconi University and filled out by lighthouse cities. The template is based on the "Smart Sustainable Cities Stakeholders' Engagement Proposed Model" (Ibrahim et. al, 2017), which defines a possible approach to support the engagement of different types of stakeholders into a smart city project. The template developed for MAtchUP aims to:

- **list stakeholders** involved in each business model
- **analyse** them according to their **role and stake in the business model** (e.g. in operating/managing/funding/using the product/service/project)
- **rate the relevance** of stakeholders in each business model

Action bundle name: …… **Related business model:** …….			
Stakeholder name	**Stakeholder type**	**Stakeholder role&stake in the business model**	**Stakeholder's degree of relevance**
Stakeholder 1	*[Selection of stakeholders' type from a longlist, eg. ITU-T, 2015]*	*[Description of the stakeholder's role and stake in the business model]*	*[Rating 0 to 5 attributed by the lighthouse cities, based on the role&stake of the stakeholder]*
Stakeholder 2	…	…	…
Stakeholder 3	…	…	…

Table 5: Template to map and rate stakeholders of action bundles (Source: based on Ibrahim et al., 2017)

Proposed relevance rating scale:

0 = No relevance in the business model

1 = Very low relevance in the business model

2 = Low relevance in the business model

3 = Average relevance in the business model

4 = High relevance in the business model

5 = Critical relevance in the business model

The lighthouse cities completed the template in Excel format, identifying a mix of internal and external stakeholders for each action bundle. Internal stakeholders are

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organizations participating in MAtchUP as partners, whereas external stakeholders are organizations not participating in the project as partners.

The compilation of the template provided a comprehensive overview of stakeholders of all action bundles being implemented by lighthouse cities. The information of the templates was used to identify the most relevant stakeholders that could be targeted by the questionnaire survey. Bocconi University reviewed the Excels compiled by the cities with the stakeholders' identification and rating and provided them with suggestions on how many/which stakeholders to contact. Cities made the final decision about which stakeholders to contact (see also next paragraph about the questionnaire-based survey).

2.3 Questionnaire-based survey

A survey was implemented in the context of Task 6.3, targeting a range of stakeholders involved in the action bundles developed by the lighthouse cities. As mentioned, the survey was directed both to internal and external stakeholders of action bundles.

Bocconi University developed a questionnaire template for the survey and shared it with ICE for their inputs on aspects related to market opportunities, and then shared it with partners for their suggestions on the questionnaire contents, format and dissemination strategies. The questionnaire is structured on the action bundle unit. In particular, it was decided:

- for stakeholders external to the project, the questionnaire should be available in the LH cities' local languages (Spanish, German, Turkish), in order to facilitate the compilation; LH cities provided the translation of the questionnaire text into their respective local languages; for internal stakeholders, the questionnaire was available in English;
- the action bundles were renamed in order to make them more understandable/recognizable by stakeholders;
- the survey invitation was accompanied with a collective (electronic) letter;
- when needed, brief descriptions of the action bundles haven been included in the questionnaire, to facilitate the stakeholders in the compilation.

Bocconi University implemented the questionnaire on the e-platform "Qualtrics". The initial plan to disseminate the survey in Autumn 2020 was changed due to the difficult evolution of the pandemic in many countries in this period. It was decided to postpone the survey in the first months of 2021. The survey was open from February to March 2021. The LH cities disseminated the invitation and link to compile the questionnaire to their selected stakeholders. Bocconi University monitored the response rate and informed the cities about the compilation status, to decide about possible extensions of the deadline. Reminders were sent by the cities to stakeholders to increase response rate. Overall 128 responses were collected:

- 75 for Valencia (referred to 21 action bundles in the four project pillars: energy, mobility, ICT, Non-Technical actions)

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- 19 for Dresden (referred to 9 action bundles in energy and mobility pillars)
- 34 for Antalya (referred to 10 action bundles in energy and mobility pillars)

2.4 Thematic workshops

Two thematic workshops with partners were organized in occasion of project meetings, to address and deepen two main topics:

- Main strategies, tools and mechanisms to involve stakeholders in smart city business models
- Procurement models adopted in lighthouse cities

The workshops combined techniques like brainstorming and open discussions through a set of guided questions, with interactive exercises on collaborative tools like Miro board.

2.5 Selection and documentation of case studies

A selection and documentation of relevant case studies of stakeholder involvement in business models was performed by Bocconi University and MAtchUP cities. The case studies regard different phases of smart city action bundle development and different mechanisms to involve stakeholders in the planning, governance and funding/financing aspects of smart actions. Each case study has been described with the following structure:

- Description of the model & process
- Involved stakeholders
- Main results
- Critical aspects
- Mechanisms used to involve stakeholders

The results presented in the next chapters of the deliverable are based on the cross-cutting analysis of the questionnaire results, the workshop results and findings from relevant literature. Through a web-search based on relevant keywords, several publications from peer-reviewed journals as well as grey-literature were identified and considered. Selected publications address the topics of key stakeholders in smart city projects, stakeholder engagement in smart city projects and related business models, as well as possible mechanisms to be used for this purpose.

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3 Main stakeholders of smart city business models

3.1 Stakeholders in the smart city context

The concept of “stakeholder” in the domain of smart cities can be understood as “any entity, an institution or an individual, that has an interest in smart sustainable cities” or that can “significantly influence or be influenced by its deployment” (ITU-T, 2015).

It is generally acknowledged that the involvement of stakeholders into smart and sustainable urban transformations is necessary and beneficial, since the establishment of smart and sustainable cities is a complex task that cannot be achieved by a single actor (ITU-T, 2015). Smart cities have been defined as “multi-stakeholder, municipally based partnerships” (EU, 2014), and this definition underlines the roles and functions of different actors in their deployment.

Collaboration and dialogue with all stakeholders have been found as two of the main success factors for integrated lighthouse smart city projects (STEP-UP project). The involvement of stakeholders brings their knowledge, skills, as well as their needs, into the decision-making processes and into the design and operation of smart city solutions (Ibrahim et al., 2017). This contributes to overcome a series of operational, financial, technological and human resource challenges related to smart urban transformation processes (ITU-T, 2015).

Financial challenges relate in particular to the lack of funding for city projects, exacerbated by the economic crisis and the tightness of public budgets, and the lack of business models that enable significant returns from investments (ITU-T, 2015). The involvement of stakeholders in financing schemes enabling public-private collaborations can provide alternative financing options. Furthermore, smart city projects may enable employment and new business opportunities that can benefit a range of stakeholders (ibid).

As highlighted in D1.2. of the MAtchUP project, the key stakeholders of smart urban transformations can be identified according to a quadruple-helix model (Figure 2):

- Public administration, represented by the Municipality;
- Suppliers, representing the private sector, industry, financial entities;
- Citizens and other stakeholders (NGO, etc.);
- University, research or the academy.

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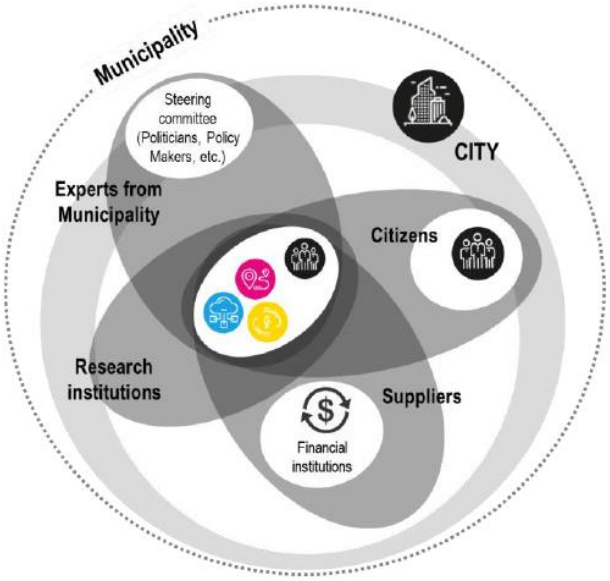

Figure 2: Key stakeholders for smart cities (Source: MAtchUP project)

The following table (based on ITU-T, 2015) lists the main typologies of Smart and Sustainable City (SCC) stakeholders and their role and influence on smart city initiatives:

Typologies of SCC stakeholders	SCC stakeholders' roles
1. **Municipalities, City Council and city administration**	They are responsible for city management, and therefore they are the main promoters of SSC initiatives on each specific city.
2. **National and regional governments**	They have remit on policies that can affect SSC implementation.
3. **City services companies**	They implement SSC solutions to increase city services efficiency.
4. **Utility providers**	They are responsible for the deployment of some of the features of SSC such as smart grid or smart water management.
5. **ICT Companies** (Telecom Operators, Start-ups, Software Companies)	They are the providers of the global and integrated solutions, the city platforms, as well as the ICT infrastructure to support SSC deployment.
6. **NGOs**	They are involved in all initiatives that can influence society and therefore are considered a stakeholder in SSC initiatives, especially on the axis of social sustainability.
7. **International, Regional and Multilateral Organizations**	They include UN agencies and multilateral organizations. They can be promoters of initiatives towards human development, environmental sustainability and improvement of quality of life worldwide. They can offer funding opportunities, and are promoters of SSC initiatives.

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8. **Industry associations**	Since industries are interested in the deployment of SSC, industry associations also work towards the success of this new model.
9. **Academia, research organizations and specialized bodies**	They study SSC initiatives and associated trends, including its impacts and contributions to sustainable development.
10. **Citizens and citizen organizations**	As inhabitants of cities, citizens are affected both directly and indirectly by the deployment of SSC initiatives
11. **Urban Planners**	Their expertise is important to better understand how to include ICTs into medium and long term city planning, as well as to consider urban complexities.
12. Standardization bodies	These organizations are critical to ensure a common terminology and minimum characteristics of a SSC initiative, as well as to define measurement methods to assess the performance and sustainability of city services based on ICT technologies.
13. Financial institutions (banks, foundations, capital management bodies, large private investors)	They aggregate flows of investment needed to support SSC initiatives .
14. European institutions and agencies	They provide the European-level policy setting for smart cities and can offer funding opportunities.

Table 6: Typologies of smart city stakeholders and roles (Source: based on ITU-T, 2015)

Stakeholders in fact play a variety of roles in the “smartization” process, and their involvement can support the development of smart city services increasing the innovation potential (Bifulco et al., 2017).

3.2 Stakeholders in MAtchUP lighthouse cities’ action bundles

Based on the stakeholders’ mapping performed by lighthouse cities through the approach described in Chapter 2.2, it is possible to identify the variety of stakeholders involved in the different action bundles implemented within the project.

In terms of frequency of involvement, measured by the number of times that each stakeholder type has been identified as involved in an action bundle, the highest participation can be found from the Municipalities, City Councils and city administrations, (which also include city council’s agencies), followed by city service companies, ICT companies, Universities/research organizations/specialized bodies, citizens and citizen organizations and NGOs (see Graph 1).

Among the stakeholders most frequently involved in the business models, citizens have been rated on average as the most important, followed by Municipalities and city service companies. These results are consistent with an idea of smart city business models

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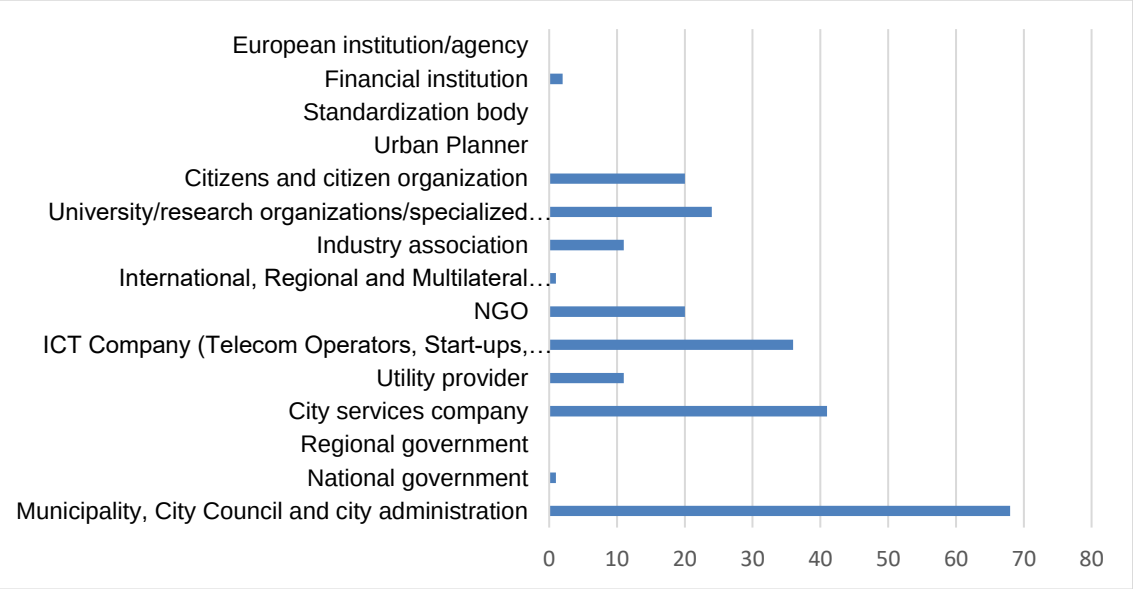
which aim to deliver relevant services for society and highlight the role of public administrations in the analysed smart city solutions.



Graph 1: Frequency of involvement of stakeholders in MAtchUP action bundles per stakeholder typology (absolute number)

As mentioned, this rating exercise has been used to identify stakeholders and recipients that could be targeted by the questionnaire survey. The survey dissemination was prioritized towards the stakeholders evaluated as most relevant. In the next graph (Graph 2), the typologies of stakeholders that actually participated in the survey are displayed. The main contribution in terms of responses to the survey has been from Municipalities, City Councils and city administrations, city service companies as well as from Universities/research organizations/specialized bodies. Instead, it proved more difficult to obtain responses from citizens because the survey was structured and targeted to organizations rather than to individuals. Even if citizens emerge as relevant actors for smart city solutions addressed by the project, it was not always possible to identify a relevant citizen organization that could be engaged in the survey.

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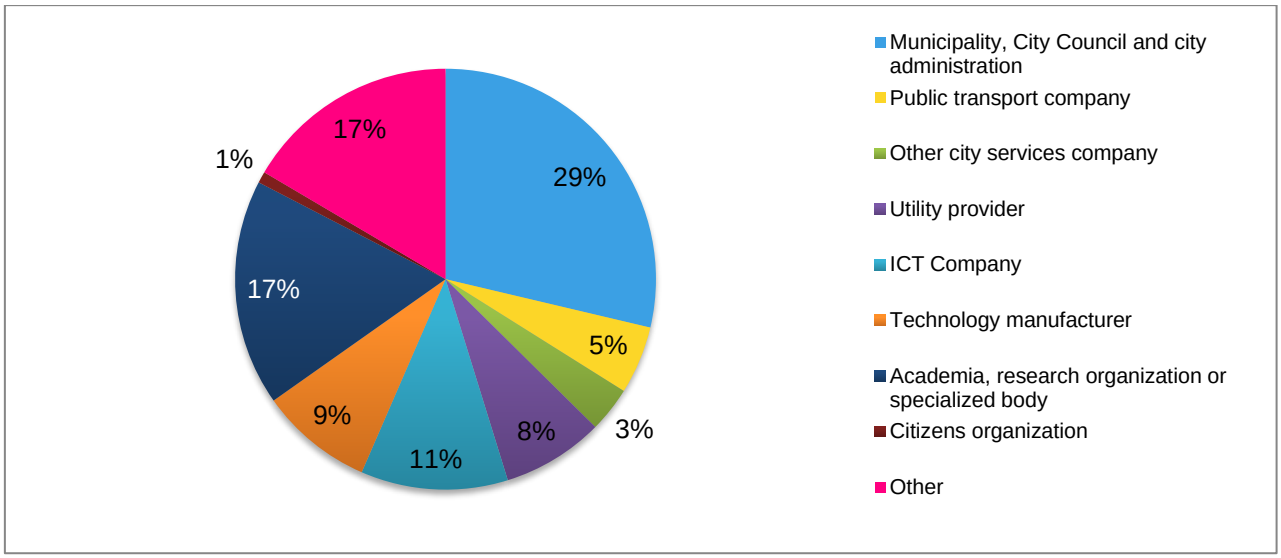

Graph 2: Survey respondents by type

Based on the survey results, it is possible to draw some insights on the roles and involvement of each stakeholder typology in the different phases of a smart city action bundle. These phases have been identified as:

- Funding
- Design
- Construction
- Management
- Use of solution
- Monitoring
- Communication
- Others

As shown in Graph 3, city governments have a transversal role and are involved across all the main phases of these initiatives, whereas some stakeholders are more involved in specific phases (e.g. academia, technology manufacturers, ICT companies in the monitoring phase; public transport company in the design and management phases; citizens mainly in the use of solutions).

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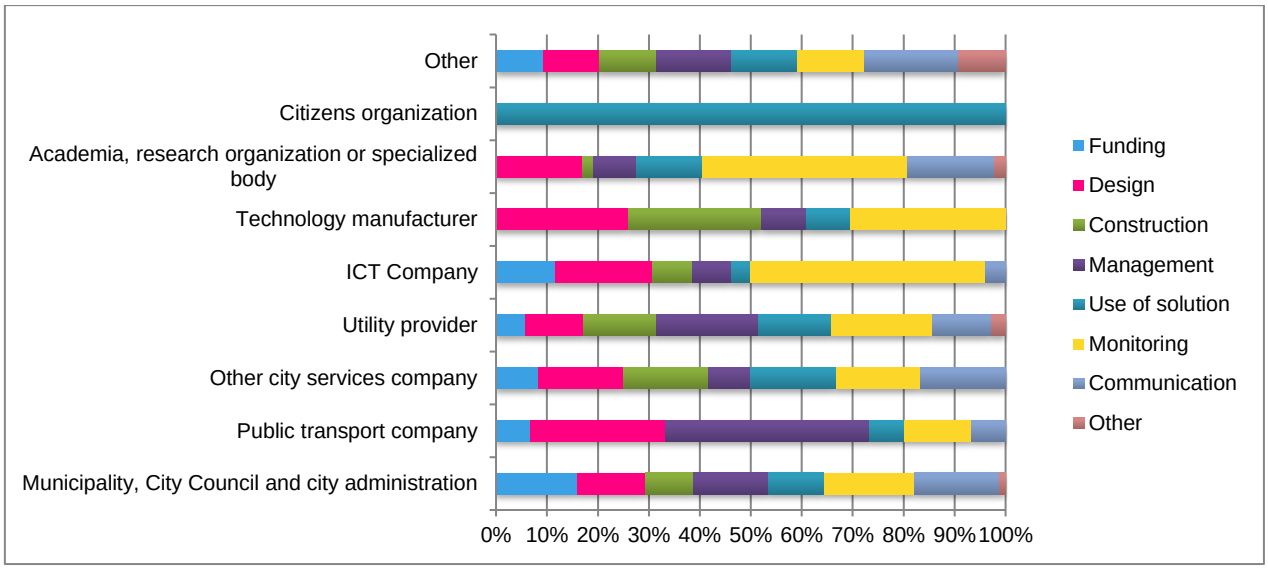

Graph 3: Stakeholder involvement in the different phases

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4 Barriers encountered by stakeholders in the implementation of business models

4.1 Categorization of barriers

A smart city should be “a sustainable and efficient urban centre that provides a high quality of life to its inhabitants through optimal management of its resources” (Razmjoo et al., 2021). The deployment of smart solutions that can contribute to achieve urban sustainability and efficiency has been ongoing for many years, but in some cases there is a lack of diffusion and uptake, even when these solutions are able to demonstrate tangible benefits and results. Several barriers affect smart city investments, as well as the design and implementation of effective business models.

In the literature, there are several categorizations of barriers to smart city development. Razmjoo et al. (2021) define the following barrier categories: governance, social, technological, environmental and economic. Schuch De Azambuja (2021) identifies 57 drivers and 63 barriers that influence the progress of smart and sustainable cities, and categorizes them according to the following main domains: social, environmental, economic, governance, and urban infrastructure. Mosannenzadeh et al. (2017) find that various financial, administrative, technical, and social barriers hamper the implementation of smart and sustainable energy city projects. From the analysis of 43 cases in Europe, they find that key barriers are the lack of or fragmented political support on the long term at the policy level, lack of good cooperation and acceptance among project partners, insufficient external financial support, lack of skilled and trained personnel, and fragmented ownership at the project level.

Barriers of smart city solutions have been analysed also in MAtchUP throughout the business model and exploitation activities of the project. They have been categorized in four main typologies: political-institutional, socio-cultural and behavioural, economic-financial and technological ones (Table 7).

Each element can act either as an enabling condition (if it is connoted in a positive way) or as a barrier (if it is connoted in a negative way). For example, internal coordination in the city government can act as an enabler if city departments work efficiently and in collaborative way, whereas it can be a barrier if city departments are organized in silos that do not cooperate and interact with each other. Considering the socio-cultural elements, citizens’ awareness on the benefits deriving from smart city solutions can act as enabler, if citizens are highly informed and aware about smart city technologies’ advantages; on the contrary, it is a barrier if citizens have limited knowledge about the potential benefits from these solutions.

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Political-Institutional	Socio-cultural and behavioural
• Legislative framework and regulations (at the national/ regional/local level) • Priority level of innovation and sustainability in policies (in the national/regional/local government) • Vision and commitment on innovation and sustainability (in the national/regional/local government) • Priority level of innovation and sustainability in political parties and their programmes • Internal coordination/interdepartmental cooperation in public authorities • Policy coherence between different levels (national/ regional/local) • Cooperation between stakeholders • Level of stakeholders engagement • Procurement processes • Bureaucracy	• Habits and lifestyles • Education levels • Income levels • Centre-periphery differences • ICT accessibility • ICT skills • Citizens' awareness /knowledge of benefits from smart solutions • Citizens' awareness on environmental issues • Citizens' opinions and knowledge about smart solutions (e.g. accuracy, safety and privacy)
Economic-financial	**Technological**
• Solution costs • Solution Return on Investment • Energy production and electricity costs • Incentives • Market features • Economic landscape (e.g. economic crisis) • Funding and financing availability • Public budgets features	• Standards • Security • Integration of solutions • Data standardization and integration • Data traffic and network infrastructure • Data availability • Performances of smart technologies • Legacy systems • Technology life cycle • Level of ICT skills • Level of technological knowledge

Table 7: Categorization of barriers to smart city solutions' business models (Source: Croci and Molteni, 2021)

The stakeholder survey was used as means to ask stakeholders their opinion about the main barriers of the business models implemented in MAtchUP lighthouse cities, as well as to identify further barriers that had not been detected in previous activities. The following paragraphs describe the results about the barriers' relevance perceived by stakeholders participating in the survey.

4.2 Relevance of barriers according to surveyed stakeholders

On average, among all the investigated barrier typologies, political-institutional and economic barriers were mentioned to be the most relevant by stakeholders. The detailed information is provided for each category of barriers.

Political-institutional barriers refer to features of the political, policy and regulatory context of targeted cities, considering also the overall multilevel policy framework (international-national-regional-local) that can have an impact on smart cities and on smart city-related policy sectors (energy, transport, ICT, innovation, etc.). This barrier category includes elements related to the internal organization and coordination of local

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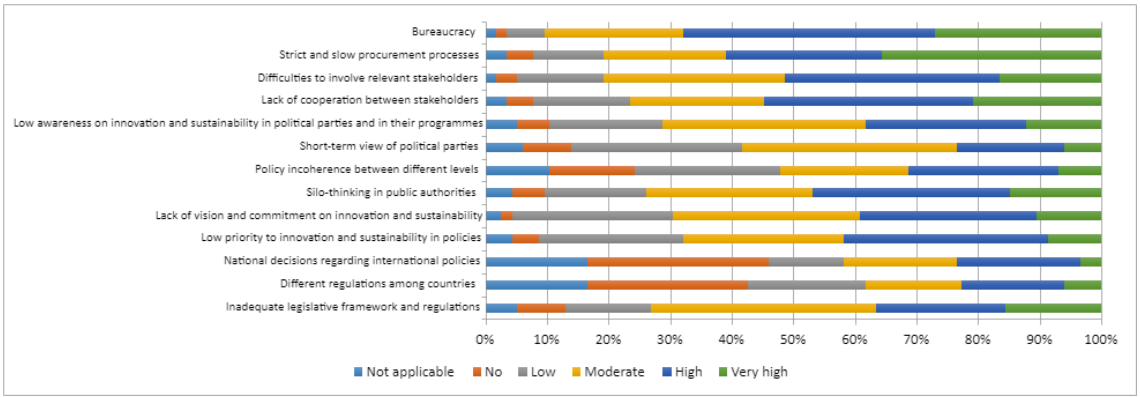
authorities, as well as about the relevance of innovation and sustainability within the political agenda and cooperation mechanisms between stakeholders.

Among the investigated barriers, stakeholders rated as most relevant two elements that characterize and hamper the efficiency of public administrations, that are **bureaucracy** and the **strictness and slowness of procurement processes** involved in smart city solutions (rated as highly or very highly relevant by 66% and 59% of stakeholders respectively). These are followed by the **lack of cooperation between stakeholders** (54%) and the **difficulties to involve relevant stakeholders** (53%) (Graph 4).



Graph 4: Relevance of political-institutional barriers

Other barriers mentioned by stakeholders refer to **project management issues** and **internal organization** of administration and companies included in these solutions, like:

- the lack of human resources for an effective management of project and solutions;
- the lack of STEM (Science, Technology, Engineering and Mathematics) profiles, whose competences could be leveraged in the design, implementation and operation of smart city solutions;
- organizational changes which can affect the timelines of initiatives;
- resistance to innovation from the mid-level management responsible for operations.

Further mentioned barriers of regulatory type are related to the presence of **legal and institutional barriers** to data disclosure or the impossibility to address specific technologies (e.g. storage system regulation) in a broader legislative framework (in the case of Turkey).

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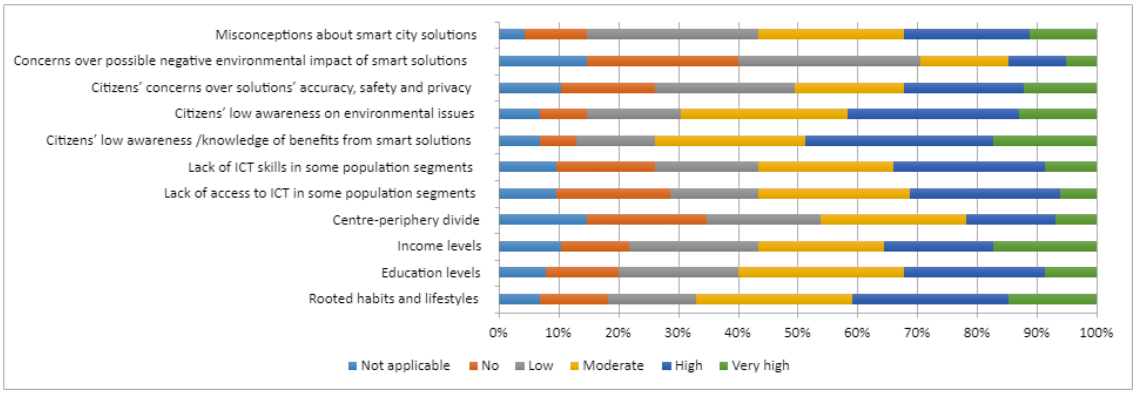
According to stakeholders' answers, **socio-cultural and behavioural barriers** have a relative lower importance in hampering smart city solutions and their business models deployment. This barrier category includes elements related to the knowledge of smart city solutions and their functioning or characteristics (e.g. benefits, malfunctioning), as well as the availability of competences in the population to use such solutions. It also investigates the potential influence of socio-economic characteristics such as income or education levels of the population.

Based on the results, the most relevant barrier is considered to be **citizens' low awareness/knowledge of benefits from smart solutions** and of **environmental issues** (rated as highly or very highly relevant by 47% and 40% of stakeholders respectively), as well as by the presence of **rooted habits and lifestyles** that do not foresee the use of smart solutions (41%) (Graph 5).



Graph 5: relevance of socio-cultural and behavioural barriers

Some stakeholders highlight that there is a relation between the lack of awareness of benefits from smart city solution systems, and the lack for incentives and funding. This has an impact also on their scalability and replication capabilities, both at a public and private level. As the advantages of these solutions are not enough known and recognized, their deployment is not promoted. There is also unawareness about the possible services and business models that can be originated from specific technologies. For example, an interviewee states that the deployment of a camera system and associated software development to monitor the availability of parking spaces may in the future lead to a series of services developed around it (parking space reservation, usage ratios, visibility for citizens ...).

Providing their view on this category of barriers, stakeholders report that there is a "prejudice of the unknown" and a lack of confidence and trust in the management of solutions, with "smart solutions that are yet to be adapted to our lives". There is also a limited awareness in citizens of the impact that the solutions have when they are used in daily life.

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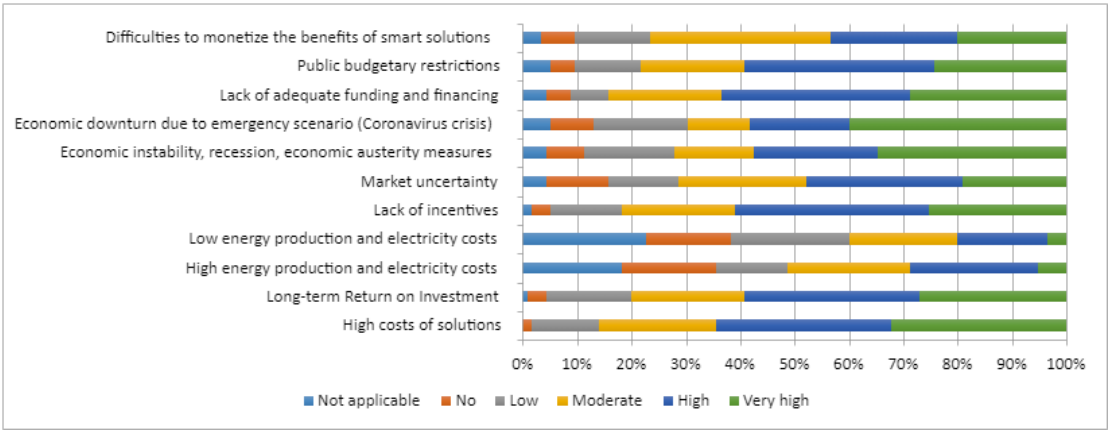
Economic-financial barriers have been evaluated by stakeholders as the most important ones among all categories. They refer to lack of resources for funding and financing, as well as to market and economic conditions, or specific economic-financial performances of smart city solutions.

The most relevant barrier is considered the **lack of adequate funding and financing** (rated as highly or very highly relevant by 60% of stakeholders), followed by the **high cost of solutions** (59%) and the **lack of incentives** in the field (57%). Further important barriers are public budgetary restrictions, the economic downturn due to emergency scenario caused by the pandemic and the long-term Return on Investment of the solutions (55%).

About these barriers, stakeholders also report that there is an orientation on economic benefits only, which disregards the social and environmental impacts.

Regarding the EV charging points, for example, one stakeholder reports that a main barrier for their massive deployment is the uncertainty of whether they are really going to be used or not. Likewise, the cost is high and there is an obsolescence risk linked to the evolution of e-vehicles, which can hamper the investments.



Graph 6: Relevance of economic-financial barriers

The last category of barrier is the **technological** one, which includes elements related to the performances of technologies, data management/characteristics and availability, standards and security, as well as the availability of the technical knowledge and skills needed to develop and operate such solutions.

The most important barrier is related to the **use of different technologies and high cost of investments for increasing interoperability** (rated as highly or very highly relevant by 51% of stakeholders), followed by lack of **standards** (46%), **security issues** (45%), and lack of **data standardization and integration** (42%).

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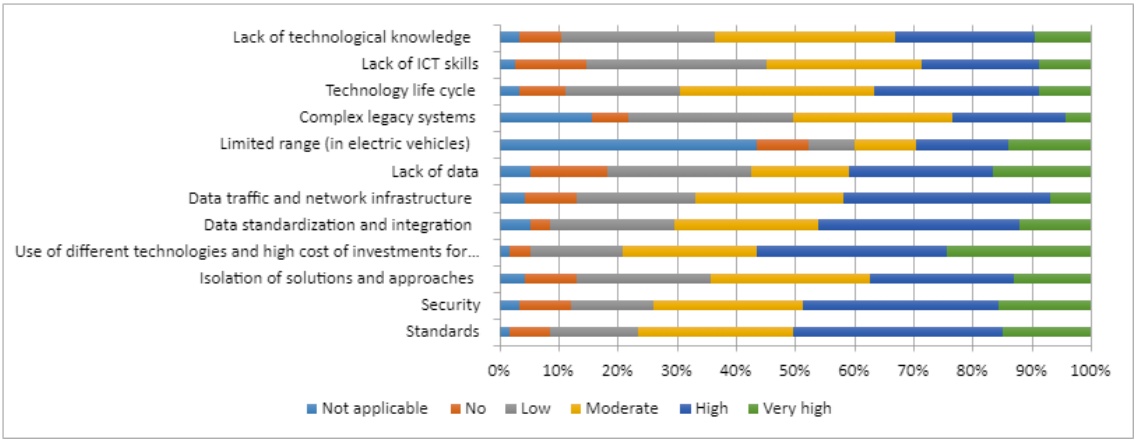

Graph 7: Relevance of technological barriers

About these barriers, stakeholders also report that the lack of alternatives in manufacturers results in higher costs. One stakeholder also considers that the technological aspects are linked to the lack of an overall strategy that coordinates the smart initiatives and their implementation in the city.

For a respondent from Germany, the current metering infrastructure represents an issue for the implementation of smart electricity solutions in the building sector.

4.3 Solutions & strategies to overcome barriers

The stakeholder survey provided also insights from stakeholders about the possible solutions to overcome the barriers of the business models implemented in MAtchUP lighthouse cities. These suggestions and proposals were submitted within the questionnaire through open responses, they have been analysed and categorized into several typologies.

Political-institutional solutions

According to interviewed stakeholders, the **political commitment** in the local authority and **institutional support** are key aspects for the deployment of smart city solutions, and they should be increased and reinforced.

Policies (from the central level to the local one) should incorporate **new targets and mandatory requirements** for renewable energy and public transportation, in order to support their deployment and usage, also through changes in the legal setup. For example, a stakeholder from Spain suggested to carry out a strong policy of electrification of municipal fleets.

An **entity or a dedicated figure** could be set-up in the local authority to **coordinate all the smart initiatives** in the city and establish a model for smart urban transformation.

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There is a strong need for boosting and improving the **efficiency and agility of administrative processes** and of **tendering procedures,** reducing the bureaucratic hurdles, as well as to improve **transparency** to allow easier detection of relevant issues. For example, there is a suggestion of simplifying the processes, as well as the bonus/malus components in contracts.

A **stronger involvement of different stakeholders** and an **improvement of coordination** among the stakeholders involved in these solutions, both internal - within the city administration and city agencies - and with external stakeholders, are needed, as well as the development of **public-private sector cooperation**.

In projects involving e-vehicles, the **direct involvement of vehicle manufacturers** could help overcome some barriers related to data sharing and performance monitoring, and improve the cooperation between vehicles manufacturers and the providers of ICT solutions. There is some resistance from vehicle manufacturers to provide information on their vehicles or their performance and install sensors, and this makes difficult to develop tools (software and hardware) to improve such performance. By involving manufacturers in this type of projects, they would commit to actively collaborate with solution developers.

In the context of mobility, improving the involvement and cooperation between the different mobility operators is essential to develop complete, impactful and meaningful solutions.

In terms of **project management**, a stakeholder suggests to foresee and involve **facilitators** in the project, that could identify and target barriers in order to minimize them, supported by the development of an action plan. Another proposal is to create **working groups** fully dedicated to the smart city project, and not to address it as additional task to the usual daily work.

A relevant topic highlighted by several stakeholders is the need for **qualified personnel** for these projects, which can be addressed by increasing training opportunities.

A specific set of suggestions from stakeholders regards the **improvement or completion in regulations** that apply to the different fields concerned by the action bundles of Matchup.

This regards for example the legislative framework for e-scooters in **Turkey**, which has been under discussion for a long time. The regulation on the use of e-scooters in traffic and their use with other means of transport is under preparation and must be completed as soon as possible, together with the definition of the areas of use.

For stakeholders in **Germany**, it is necessary to develop new or improved laws and regulations regarding smart tenant concepts and commercial measures, as well as to simplify the complex legal requirements for measurement and billing, and foresee new regulations regarding stable energy costs (EEG-Surcharge[2]).

[2] The EEG surcharge is paid by all electricity consumers as part of their electricity procurement costs and serves to finance the expansion of renewable energies, as defined in the Renewable Energy Sources Act (EEG).

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For stakeholders in **Spain**, the legal framework on energy communities should be further developed with new regulations. Furthermore, a clear data privacy policy regarding the cameras should be defined.

Communication, dissemination, awareness raising solutions

Communication, information about smart city solutions and services and their promotion have to be improved and strengthened, according to the interviewed stakeholders. **Information and awareness campaigns** on the available solutions can improve their popularity and usage.

A clear recommendation to overcome many barriers, suggested by a variety of stakeholders from all the three countries, refers to **communicate, highlight and give greater visibility to the benefits** (in the short and long-term) of smart city solutions. Benefits and advantages of these solutions compared to others should be clearly communicated and emphasized to **political decision-makers, investors, users, the media and the wider public**.

Targeted **communication, information and training actions and campaigns** should regard **citizens**, in order to increase awareness about environmental issues, about how smart solutions can contribute to improve environmental performances and also their economic and financial returns. Citizens should be provided with **information and support on the use of solutions**, when needed. Training for citizens on new technologies and services should be implemented, as well as investments in improving their **skills and reducing the digital gap**.

Specific communication and training actions can target the **staff of local administrations**, keeping employees aware of new technological developments.

Stakeholders also highlight that **demonstrator projects** and **communicating the good results** obtained by projects can contribute to raise awareness about the impact of smart city solutions. Some stakeholders also suggest to implement **participatory demonstration projects**, in order to involve actors and end-users in their development and deployment.

Exemplary actions from public institutions, organizations and individual people (from influencers to high-profile figures) can sensitize a wide share of the public.

A set of suggestions regards the relevance of promoting **information exchange and knowledge transfer** among different countries or municipalities.

Finally, several stakeholders underline the need for **employment and qualified personnel** to be trained in this field.

Economic-financial solutions

Many stakeholders suggest to set **incentives and economic support** for **citizens** that join the actions (e.g. like discounts) to promote usage of smart solutions, and for **companies** that experience important barriers. Specific support could be defined for companies that are engaged in technological developments, which could be entitled for

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state support. For e-vehicles, it is suggested to define tax reductions or exemptions from excise tax.

According to interviewed stakeholders, **more economic support is required** from the **central government towards municipalities** to support investments in innovative energy systems, building renovation and other solutions.

Furthermore, more public funding should be targeted for investments in innovative technologies.

Costs of solutions could be reduced by **increasing competition with alternative manufacturers.**

New **models of public-private collaboration** could be implemented to improve financing of actions.

Technological solutions

Several stakeholders underline the importance of **standards, interoperable protocols and technologies**, as well the need to address **security issues** in smart city technologies. **System integration** is needed to overcome isolation and improve interoperability. Some stakeholders highlight the need for improvement of standards for specific technologies, systems and components, like wireless standards for sensors and standards for building automation.

For **e-vehicles,** the availability of **charging infrastructure** is a key topic. The deployment of recharging infrastructure is the first step to promote the use of electric vehicles. Thus, for a stakeholder from Spain it is a key point that the government takes the initiative and is committed to broadly strengthening the charging infrastructure. Also, incentives should be given to those citizens wanting to install a charging point in their homes. At the same time, the usage of charging infrastructure should be closely monitored in order to orientate investments and policies.

Data generation for supporting policies was mentioned also for energy demand. **Monitoring** is key to identify issues and opportunities, and prove the benefits of solutions. According to stakeholders, the data generation and collection processes should be eased, fine-tuned and supported. In the mobility field, during the integration of different transportation methods, an IT infrastructure should be established for the monitoring.

Implementing and testing the solutions and services, and learning from experience, was mentioned by several participants as a key strategy to address barriers.

One stakeholder reports that solutions should be oriented to provide **value for citizens**, and that **user experience and interaction** should not be overlooked.

According to many, technological development is still needed, and in specific fields (e.g. innovative technologies for renewable energy generation) there is need to develop technology with lower implementation cost.

The establishment of **Technology Transfer Offices** could support technology producing companies in their activity.

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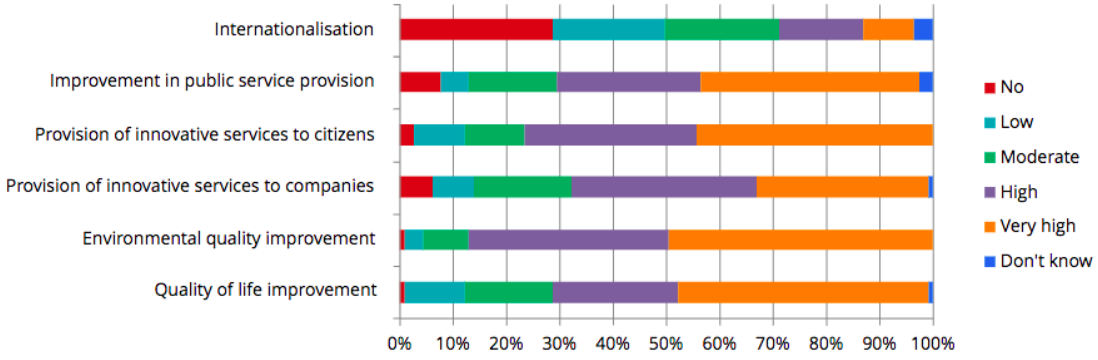
5 Identification of market opportunities for stakeholders

The market of smart city solutions is in constant evolution. The global smart city market was estimated to value USD 1,090.64 billion in 2021 and is expected to grow with a compound annual growth rate of 24.2% from 2022 to 2030 (Grand View Research, 2022). The COVID-19 pandemic has highlighted the vulnerability of cities to many challenges, but at the same time, it has generated the need for a further adoption of digital solutions for the management of city services.

ICT technologies and smart city services have provided useful tools to cope and manage some aspects of the pandemic, like for example through ticketing and booking services which can spread the peak of visitors in public facilities over different timespans or through control and monitoring of entrances and accesses. At the same time, innovation and digital technologies have helped to alleviate the impact of COVID-19 on individuals, businesses and governments, in particular during lockdown phases, by offering several services online and enabling business and service continuity.

Specific market analyses for MAtchUP actions and technologies have been performed by ICONS as part of WP6 activities and published in the deliverable D6.8 “Market analysis reports – Final". In deliverable 6.5, the focus is rather to explore MAtchUP stakeholders’ perception of the market opportunities connected to the solutions tested in the project. Specific questions on this topic were included in the stakeholders’ questionnaire survey.

In terms of overall **impact**, smart city bundles are considered to contribute in a relevant way to **environmental quality improvement** and **provision of innovative services to citizens** (Graph 8). On the contrary, their effect on internationalisation is considered rather low or absent in half of responses.



Graph 8: Stakeholders’ opinion on action bundles impact

In 41% of responses collected from stakeholders, the smart city action bundles implemented in MAtchUP opened new market opportunities for their organization. The value is higher for bundles in the energy sector (47%) and mobility (40%) compared to ICT and Non-Technical actions.

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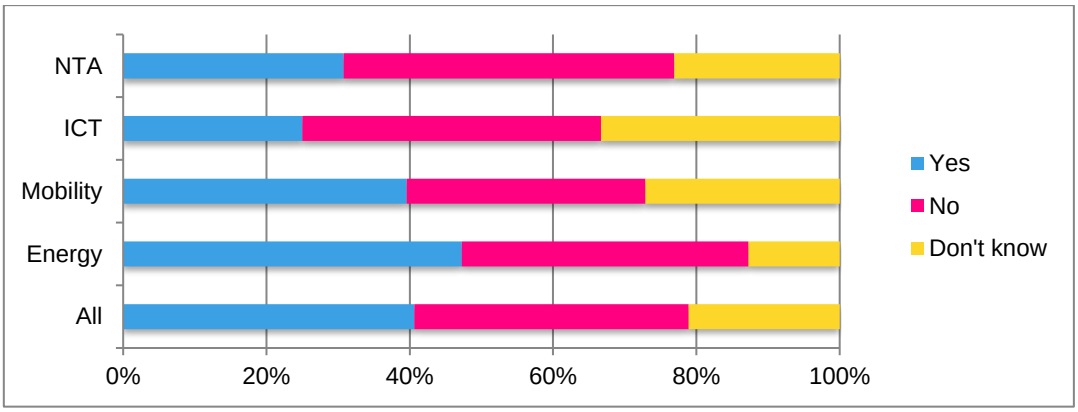
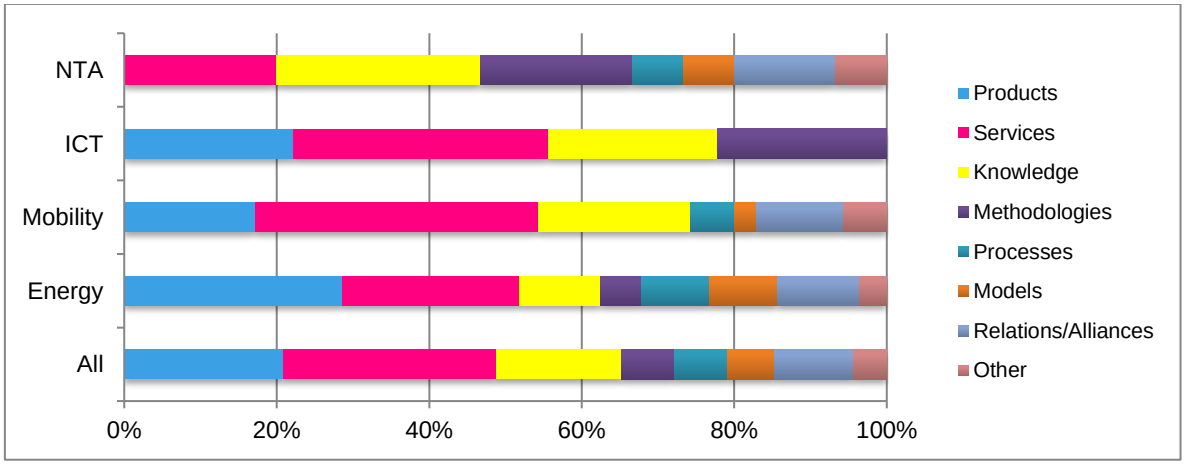


Graph 9: Opening up of market opportunities for stakeholders – by MAtchUP pillar

To further analyse the market opportunities deriving from MAtchUP solutions, they were differentiated among the following typologies:

- Products
- Services
- Knowledge
- Methodologies
- Processes
- Models
- Relations/Alliances
- Other

Based on stakeholders' responses, most market opportunities can be categorized as services (28%), products (21%) and knowledge (17%). In the energy pillar, the most represented typologies are products (29%) and services (23%). In the mobility pillar, they are services (37%) and knowledge (20%); in ICT mainly services (33%) and for Non-Technical actions mainly knowledge (27%).



Graph 10: Market opportunities for stakeholders by typologies and MAtchUP pillar

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Stakeholders were also inquired about which **innovative financing and funding tools** could support the **exploitation** of these market opportunities. Their responses have been aggregated into the following categories:

Tool category	Description
Municipal funding programmes/measures	They include municipal programmes supporting specific technologies or initiatives (e.g. open data initiatives, purchase of e-vehicles, energy retrofits), or the design of different payment and lending plans for municipalities.
Regional/national/other funding programmes/measures	They include national or regional financial support programmes for specific technologies or initiatives, which can target municipalities or other organizations, as well as support from financial institutions or other organizations (e.g. development agencies).
European funding programmes	They include EU funding across different programmes (Horizon Europe), innovation programmes as well as European Investment Bank.
Public purchase of innovation	It refers to the public sector using its purchasing power to act as early adopter of innovative solutions.
Simplification measures	They include measures to reduce bureaucracy and approval processes, and to clarify regulation.
Involvement of other companies	This refers to the participation and collaboration with other companies in the development of the solution, creating spin-offs to exploit results and raise private investment.
Leverage of energy savings	This refers to models that use energy savings as source for further investments, Energy Performance Contracting models, models where energy saving benefits are shared with participants of the initiative.
Public-private partnerships	This refers to the creation of PPPs and agreements between different actors (e.g. between municipalities and actors like e-car fleets rental, or private charging station manufacturers, EV manufacturers, private electric scooter companies), combination of public investments with citizens'.
Joint ventures	This refers to business arrangements in which two or more companies, or also municipalities and other actors, combine resources on a specific project or service.
Cross-subsidization	This refers to funding a smart solution, technology or service with the profits generated by another one, for example additional Smart Living offerings (car sharing, charging stations, etc.).
Fee setting	This refers to fund the initiative by setting a small fee (e.g. from charging processes).

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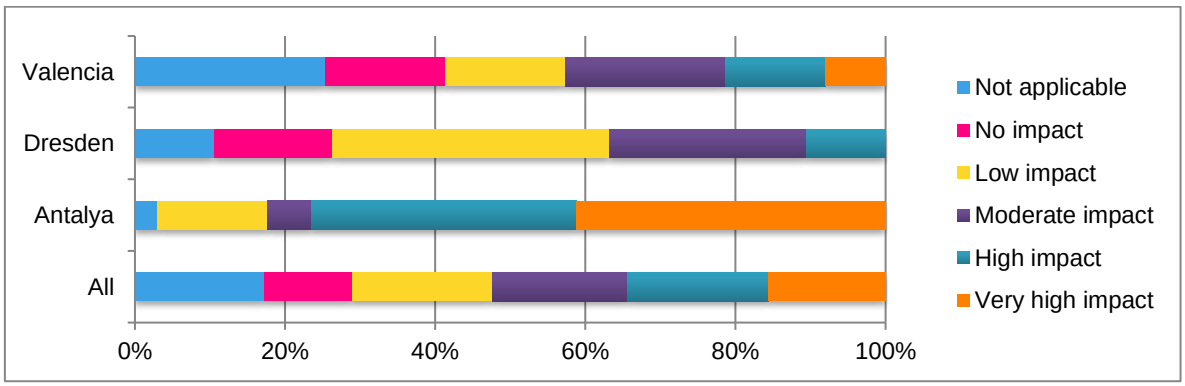
Collective models	This includes collective purchasing, co-ownership of infrastructures, or involving users/tenants in energy production models (e.g. prosumers).

Table 8: Innovative financing and funding tools to support the exploitation of market opportunities (Source: elaboration on MAtchUP stakeholders' survey)

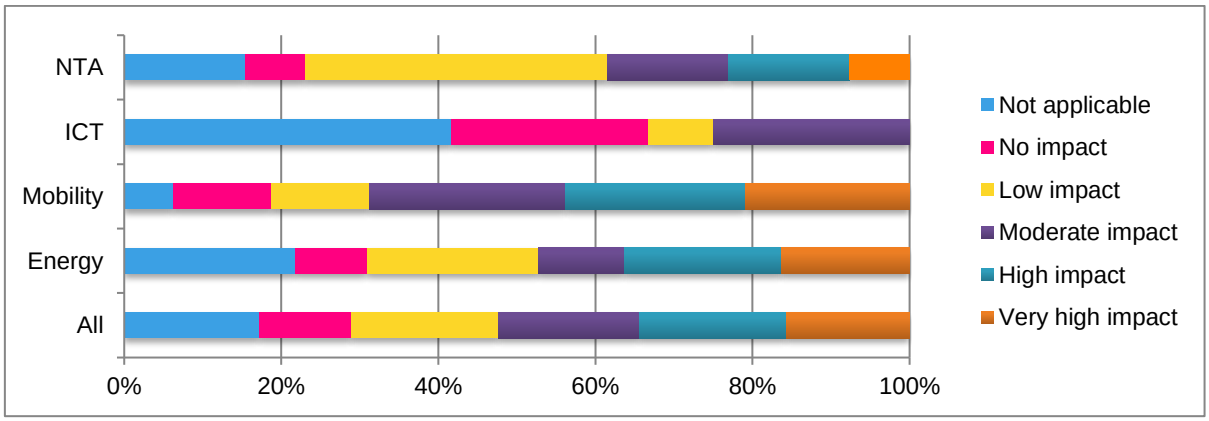
As the survey was implemented during the pandemic, specific questions about the **impact of COVID-19 on market opportunities** for their organizations were submitted to stakeholders. Overall, 35% of responses report a high or very high impact of COVID on market opportunities related to the smart city action.

Turkey's stakeholders seem to have experienced a wider impact compared to the other cities (76% high or very high impact in Antalya, compared to 21% in Valencia and 11% in Dresden) (Graph 11).



Graph 11: Impact of COVID-19 on market opportunities linked to smart city initiatives – by city

If we differentiate the responses by pillar, market opportunities connected to mobility seem to have experienced a stronger impact from COVID compared to the others (44% high or very high, compared to 36% in the energy pillar) (Graph 12).



Graph 12: Impact of COVID-19 on market opportunities linked to smart city initiatives – by pillar

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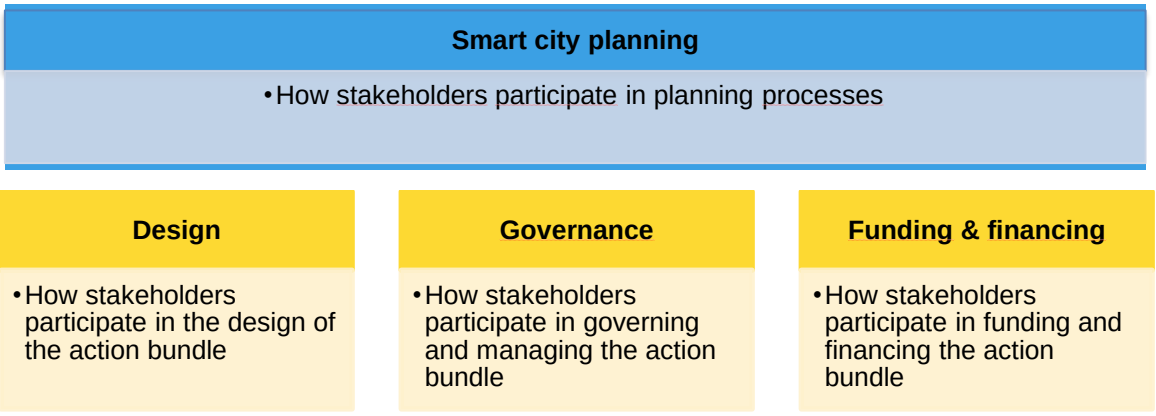
6 Mechanisms to involve stakeholders in smart city solutions & their business models

Cities are complex structures, comprising relations and interactions between human, economic, built, technological and natural capital, and they are increasingly facing complex challenges related to housing, infrastructures, mobility, air quality, health, social and economic inequalities. The intersection of multiple crises - pandemic, economic crisis, climate change, rising inflation - is further exacerbating these challenges and the need to find suitable approaches and solutions to manage them. It has been highlighted that to manage such complexity, it is necessary to actively involve a variety of stakeholders and end-users in urban transformations as well as in the development of technological, social and policy solutions (Tran Thi Hoang et al., 2019). This contributes to incorporate their needs and leverage different knowledge in the design, development and operation of smart services.

Smart city solutions are designed, developed, managed and financed with the contribution and involvement of a variety of public and private stakeholders, as highlighted in the previous sections. Which innovative strategies and mechanisms can be adopted by city authorities to achieve an active participation by stakeholders in these processes? How does participation take place in the different stages and dimensions of a smart city action?

Firstly, an overview of participatory approaches in smart city planning processes in provided. Next, the smart city action bundle level is considered. In this report we focus on three main dimensions of smart city action bundles and their business models: Design, Governance and Funding & Financing.



This chapter aims to provide some examples of mechanisms that can be used to involve stakeholders across these three dimensions of smart city actions. These dimensions are deeply interlinked with each other and can overlap. Furthermore, mechanisms can regard more than one dimension. However, for classification purposes the dimensions are described in three different chapters and each mechanism has been assigned to one main dimension.

These mechanisms have been identified from several sources of information, including the stakeholder questionnaire results, the workshop results, relevant literature, and from

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overall MAtchUP experience. Some of these mechanisms have already been implemented in the MAtchUP project. Others could be leveraged by partners in their replication and upscaling activities that will further implement smart city solutions in their territories. They could also provide inspiration for other cities that are willing to implement smart city projects. For these reasons, the main features of each mechanisms and their application to smart city projects are described.

6.1 Smart city planning

Due to an increased demand for sustainability and attention to resource efficiency in cities, the approaches for urban planning and for the development of urban services are changing (Axelsson and Granath, 2018). There is an increasing focus on stakeholder engagement in planning and decision-making processes and on bottom-up approaches, which aim to incorporate and balance the visions, perspectives and goals of different stakeholders (Angelidou, 2017). Smart city planning requires the involvement of several stakeholders, that can have different and sometimes misaligned goals, values and priorities and can contribute to the process and its outcomes in different ways (Axelsson and Granath, 2018; Tran Thi Hoang et al., 2019).

Stakeholders' participation is defined as the process through which stakeholders are involved and represented in decision-making. Stakeholder participation can take place in different phases of urban transformation projects. The International Association for Public Participation has defined five modes of participation, that represent increasing levels of public influence over decision-making.

Figure 3: Spectrum of public participation (based on: IAP2)

- **Inform**: it aims to provide stakeholders with information about the project.
- **Consult**: it aims to obtain from stakeholders feedback about the project.
- **Involve**: it foresees a work with stakeholders in order to consider their needs into the project and into the alternatives developed.
- **Collaborate**: stakeholders become partners in each aspect of the project, including the development of alternatives.
- **Empower**: it implies that stakeholders will make the final decision about the project.

There are many types of public participation tools for urban transformation that have different purposes and targets and are adopted in different stages of the planning

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process. Some tools can be applied at initial stages of urban transformation processes to map and identify the most relevant stakeholders and establish the most suitable participatory processes; others are applicable during the process to collect stakeholders' feedback and involve them directly in the design; monitoring and evaluation tools enable to assess the outcomes and effectiveness of the participatory process. The following table provides a classification of public participation tools for urban transformation according to their purpose:

Purpose	Technique
Preliminary understanding of situation	Key-person interviews Stakeholder analysis survey
Opinion survey	Questionnaire survey Group interview Focus group survey
Promoting participation	Event (symposium, onsite observation meeting, fair) Mailing list Corporate identity formulation
Dialogue	Briefing Open hearing Open house Workshop/charrettes Task force
Dissemination, understanding of opinions	Public relations documents (brochures, fact sheets, public relations papers) Hotlines, comment cards Website Media Information center

Figure 4: Public participation tools (Source: Horita, M., and H. Koizumi, 2009)

Participatory activities in MAtchUP

In MAtchUP lighthouse cities, participatory processes involving citizens have been conducted throughout the project activities, with specific focus on the districts with the demonstration projects.

For example in Valencia, participatory processes have been implemented to define the regeneration process of the Cabanyal District. A contest was launched to select the best option for the regeneration plan. Dissemination events have been organized in the district, during which the local partners of MAtchUP explained the smart metering devices and the installations promoted by the project.

An analysis of stakeholders involved and a description of such activities are included in the following deliverables:

Valencia:

https://www.matchup-project.eu/wp-content/uploads/2021/10/MAtchUP_D2.27-New-citizens-engagement-strategies_Final.pdf

Dresden:

https://www.matchup-project.eu/wp-content/uploads/2021/10/MAtchUP_D3.27_New-citizens-engagement-strategies-in-Dresden-Final.pdf

Antalya:

https://www.matchup-project.eu/wp-content/uploads/2021/10/MAtchUP_D4.27-New-citizens-engagement-strategies-in-Antalya_Final.pdf

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ICT technologies can be used in participatory processes and can support the involvement of specific groups like younger citizens, who find it easier to provide their views and feedbacks through online instruments (OECD, 2019). During the pandemic, ICT technologies played a key role in ensuring participation and engagement of stakeholders in cities' initiatives.

Axelsson and Granath (2018) describe an example of smart-oriented urban development project where digital platforms have been used, together with a variety of other tools, to gather ideas from different stakeholders.

6.2 Design

In addition to urban planning and wider transformation processes or district planning, participation can also be implemented to develop, design and create specific smart city solutions, with a **co-creation** approach involving end-users.

As highlighted by Davis and Andrew (2017) and Paskaleva et al (2015), there are many labels for end-user involvement in design processes, that include "user-centred design, human-centred design, collaborative-design, participatory design, co-design, co-production, and co-creation" (ibid). These terms have different focuses, but they all have in common that design foresees a collaboration between different actors – end-users, industry and researchers – across different stages and through an iterative process.

Among the available co-creation approaches and tools, we focus on three that can be applied to smart city solutions: **participatory budgeting; Living Labs and hackathons**.

6.2.1 Participatory budgeting

By electing their representatives for local government, citizens indirectly contribute to the decisions about the allocation of public resources among different services and projects. However, non-elected citizens can also directly participate in the allocation of city's financial resources by taking part in specific processes like participatory budgeting (Bednarska-Olejniczak and Olejniczak, 2016).

Participatory budgeting is a tool that "[…] gives citizens the opportunity to suggest, develop, design, and vote on projects and services in their community" (Williams, 2022). It involves a discussion and negotiation over the distribution and use of specific public resources for particular projects, where citizens participate through dedicated formats. It can take place both through face-to-face meetings or online through virtual tools. Even when it is conducted in person and when it does not involve the use of ICT technologies for carrying out the process, participatory budgeting is considered as a relevant tool for smart city governance, as it factors in and engages different views and users in decision-making.

The concept was firstly ideated and applied in Latin America in the late '80s to reduce corruption and increase transparency of municipal budget allocations, with the first experiments of public participation in budgetary matters, and it is now diffused in all Latin

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American countries and globally. In Europe, participatory budgeting has experienced a relevant increase from 2005 to 2012, from 55 to over 1.300 cases (EPRS, 2016).

In participatory budgeting, citizens usually can suggest their project ideas, express their views on them and vote for the preferred ones, indicating those projects that they would like to be allocated the resources to. The most voted project is implemented and typically, the process can start again (e.g. the following year). Figure 5 represents the key steps of this process.

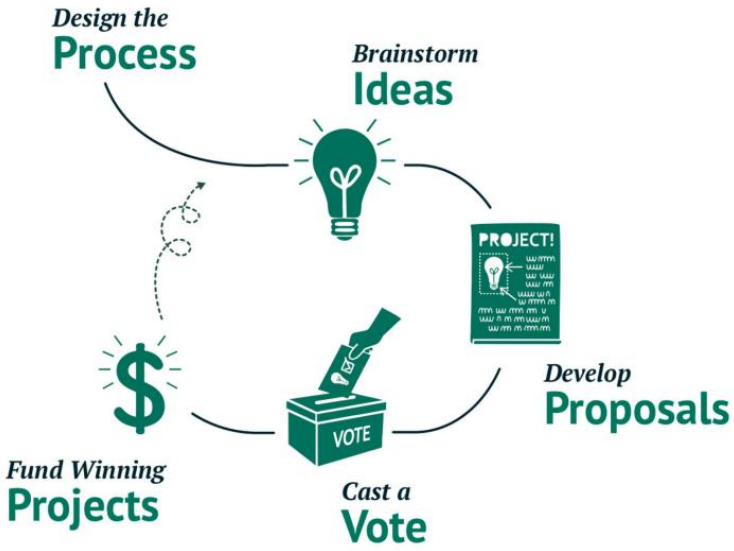

Figure 5: Key steps of a cyclical participatory budgeting process (Source: ParticipatoryBudgeting.org)

Participatory budgeting can be implemented in many ways, but it relies on a set of key founding criteria, which also distinguish it from other participation processes (EPRS, 2016):

- **Focus on financial/budgetary matters**: the tool should be focused on how a limited amount of budget is to be spent
- **Involvement of the whole population**: all citizens interested in the budgetary measured should be involved
- **Repetition of the process**: it is usually repeated over time and is not a unique exercise
- **Public deliberation**: citizens should be able not only to debate the projects but also decide on them
- **Accountability**: feedback to participants is needed, in order to inform them about the implementation of voted projects and the results of the process.

According to how the process and its phases are conceived and implemented, the innovation potential and the opportunity to realize co-creation can vary. If citizens are involved and can contribute at each step, the process can be defined as actual co-creation; when participation is limited only to some phases, the collaboration

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opportunities are reduced and innovation potential appears more limited. Williams (2022) provides a definition for co-creation at each step of participatory budgeting (Figure 6).

Figure 6: Stakeholders involvement at different phases of participatory budgeting (Source: based on Williams, 2022)

The outcomes and results of this tool deeply depend on how it is implemented, and its application is not without criticism. Among the main reasons for critics, there are the risks of underrepresentation of the overall population within the process (EPRS, 2016).

Currently, there are few applications of participatory budgeting to smart cities' policies (AC Citizen Focus, 2017). Some studies analyse the results of participatory budgeting processes in specific cities, in order to identify the relation between the most voted projects and the city's smart city strategy and vision. For example, Lewandowska and Chodkowska-Miszczuk (2022) analyse the case of the Polish city of Bydgoszcz, a post-industrial medium sized city, which has been employing this tool for a decade. In the Bydgoszcz case, the projects selected by inhabitants respond mainly to infrastructural needs, in particular regarding transport and security, which can be explained by the city-features and the socio-economic and spatial development of the city, which has determined a lack of some infrastructures. The authors suggest that in order for participatory budgeting to be a tool for smart city implementation, the selected projects should regard a wider variety of topics and smart city dimensions (ibid). Securing some budget for underrepresented topics and promoting cross-district projects are suggested as possible ways to strengthen the process and increase its contribution to smart and sustainability goals in the city.

6.2.2 Living labs

The Living Lab (LL) concept was firstly developed in USA at the beginning of 2000s, to describe a research facility implemented as a real home where individuals could be observed (Spagnoli et al., 2019). It has later evolved into a label for those settings where multiple stakeholders can collaborate to "create, validate, test new technologies and systems in real-life context" (Alba et al. 2016) and "to achieve common aims through resource integration, new technologies, and continuous relationships" (Bifulco, Tregua and Amitrano, 2014). With the Living Lab concept, cities have become real-world testbeds for new technologies and solutions (Cosgrave et al., 2013). The concept is deeply intertwined with open innovation, as shown also in the definition by the European Commission: Living Labs are "open innovation environments in real-life settings, in which user-driven innovation is integrated within the co-creation process of new services, products, and infrastructures" (European Commission, 2009). In Living Labs, all the

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actors have a role and can contribute to the innovation and creation process by bringing their different knowledge, skills, experiences, roles, points of view and needs (European Commission, 2014). Living Labs can serve for joint value-creation, prototyping activities or validation of specific solutions in order to scale them up (U4IOT, 2019). They can be implemented in several domains, including health, culture, energy and mobility, smart cities and circular economy (ibid).

Figure 7 synthetizes the main elements that characterize Living Labs:

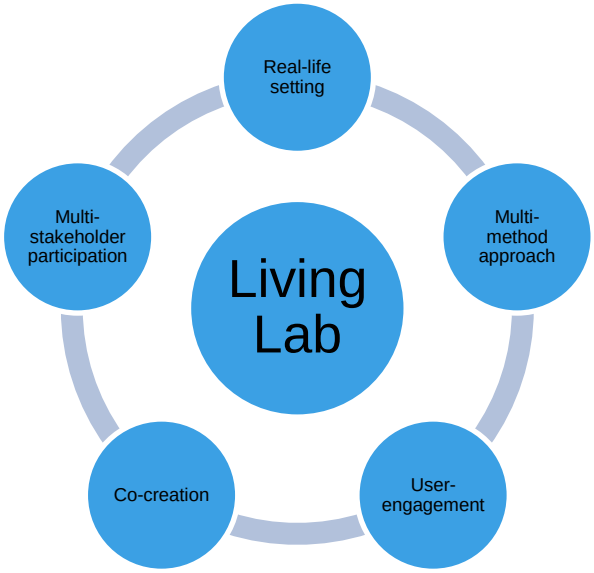

Figure 7: Key elements of Living Labs (Source: based on U4IOT, 2019)

Given their innovation and stakeholder engagement potential, Living Labs have emerged as relevant instruments for implementing smart cities and have been used by several European cities to develop new applications and services for citizens, like Copenhagen, Amsterdam, Vienna, Barcelona, London, Hamburg, Oslo, Brussels and Frankfurt (Paskaleva et al., 2015). In Europe, the European Network of Living Labs (ENOLL) was founded in 2006 to support the implementation of LLs, facilitate knowledge exchange and partnerships and has more than 480 members.

Living Lab projects are led by local governments or private firms and can be supported financially by different sources, from governmental ones to companies (Cosgrave et al., 2013). Typical stakeholders involved are local authorities, private companies, universities and research centres, associations and citizens.

There is not a unique methodology to implement LLs, but rather a series of approaches that can be adopted. However, three main building blocks can be identified in the innovation development phase: exploration, experimentation and evaluation (U4IOT, 2019):

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Figure 8: Main building blocks in the innovation development within a Living Lab (based on (U4IOT, 2019)

- **Exploration**: understanding the users and the context (present state), including their habits, the products/services they currently use, as well as exploring their needs, in order to define the possible "future states" and co-create the concrete concepts that could respond to such needs. This phase also implies to perform a sort of "pre-measurement" that can set a baseline for measuring the actual results of the experimentation phase later on.
- **Experimentation**: it involves the development of a prototype, based on the results of the exploration phase, and its experimentation in the real-life context (as much as possible), in order to check how users respond to the new solution and develop new habits. Depending on the maturity of the prototype, this phase can be a proxy-technology assessment, a user experience testing or a field trial. The results of the experimentation define if it is necessary to return to exploration and develop new solutions, or if the next phase can be implemented.
- **Evaluation**: this phase implies comparing the pre-measurement with the post-measurement results obtained by the experimentation, showing the impact and the additional benefits of the developed solutions. The results of the evaluation can support the development and the "quantification" of the value proposition of the product/service. Furthermore, evaluation can be implemented also after wider adoption of the solution, in order to further improve it and add new functionalities.

ICT technologies can have an important role in LLs, as they enable data collection, data and information exchange and monitoring (Bifulco et al., 2017). Living labs related to smart cities can foresee the adoption of technical infrastructures like sensors, wireless networks and software for data management.

Paskaleva et al. (2015) identify several "success factors" for Living Labs that should be taken into account when implementing this concept. It is important to engage users from the beginning of the process, so that they can participate as co-designers and co-developers. Appropriate tools and techniques should be adopted in order for stakeholders to work collaboratively. Furthermore, intermediaries and mediators like universities and businesses play a relevant role in engaging the other stakeholders and mediate among the participants, which have different interests, knowledge and visions.

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6.2.3 Hackathons

Hackathons are events taking place over short time span (1-3 days), in person, remotely or in hybrid mode, aimed to stimulate the creativity and skills of a range of actors for the development of innovative prototypes to address key challenges, which can regard technological, urban or industrial topics (Perng et al., 2018). Typical hackathon participants are coders, makers, experts, entrepreneurs, business experts and other stakeholders that set up collaborative multidisciplinary teams and join the development of the prototypes, in response to the defined challenges. Hackathon participants can either already be organized in pre-existing teams or join the event individually, and form the teams directly for the event; in these cases, they have to develop effective collaboration and management practices on the spot (Perng et al., 2018).

These events can be promoted and supported by a variety of subjects, including city governments, government agencies, ICT companies, start-ups and others. A specific type are civic hackathons, that aim to involve citizens in the development of innovative solutions using government's open data (Alba et al., 2016).

In these events, a committee usually performs an evaluation of proposed prototypes and identifies the winning one based on some criteria, including i.a. the capability to address the challenge and the marketability of the developed solutions. The solutions and outcomes for smart cities generated at these events can include applications, creation of datasets, APIs, hardware, wearables and sensors (Alba et al., 2016).

Benefits for participants, and possible drivers for participation, include networking opportunities, developing more skills, as well as the possibility to acquire information and knowledge about future markets (Perng et al., 2018). For the event organisers and sponsors, hackathons are ways to harvest and collect innovative ideas leveraging the creativity of participants.

It has been highlighted that the development of the prototype after the hackathon ends is a critical part of the process, as the developers often lack time and opportunities to secure funding beyond the cash awards obtained (Perng et al., 2018). The availability and implementation of coaching and mentoring opportunities to hackathons winners can be relevant in overcoming some barriers and building on the results of the event. Alba et al. (2016) propose a model where smart city hackathons are matched and organized in relation with a living lab. The lab provides a testing environment with real users where smart city solutions can be improved, mature and be scaled before being adopted in the city.

Open Data Camp - City of Dresden

In November 2019, the Office for Economic Development of the state capital Dresden organized in the context of MAtchUP the so-called "Open Data Camp", together with the GDI Sachsen e.V. (GDI SN). Various institutions made available their data for the initiative, including the municipal statistics office and the office for geodata and cadastre of the city of Dresden, the state company 'Geobasisinformation und Vermessung' (GeoSN), the 'LISt Gesellschaft für Verkehrswesen und ingenieurtechnische Dienstleistungen' (LISt GmbH) as well as DVB (Public transport company) and VVO (Transport Company for the region).

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The event relied on the technical support by a university (team of the Chair of Geoinformatics at TU Dresden) and the Design Thinking Team of T-Systems MMS. The hackathon was based on the freely accessible data sets with the aim of developing exciting and innovative solutions individually or in project teams.

The winners of the Open Data Hackathon developed a mock up for an application for a Dresden tour based on dynamic route guidance and the "VV Wo?" project, which uses voice recognition to provide information on public transport connections in Dresden.

Source: https://www.matchup-project.eu/news/open-data-hackathon-delivers-new-digital-applications-for-dresden/

6.3 Governance

The concept of governance refers to how society, or groups within it, organize themselves to make and implement decisions. It often involves a continuous process of negotiation over the allocation of power and resources. In the smart cities' domain, smart governance is often considered one of the key dimensions to define a city's smartness (Vasco Lopes, 2017). Smart Governance is a broad concept that includes "citizens' participation in urban decision-making processes, the co-creation of new services for an improved quality of life, and the implementation of different instruments for collaboration, service integration, and data exchange" (Bifulco et al., 2016). This term is often used in relation with "smart city government", which implies leveraging ICTs and actively collaborating with stakeholders in implementing policies that can contribute to reach smart city goals like quality of life, global competitiveness and attractiveness, security, safety, economic and environmental sustainability (Scholl et al, 2014). This shows some overlaps between the terms. Smart government is also used in relation to e-government practices and tools.

Governance - with its decision-making and coordination mechanisms between different actors - is a key element for any smart city project or initiative (Vasco Lopes, 2017). Governance models for smart city projects can be analysed and categorized in different ways. Al Awadhi et al. (2016) define a range of governance models that go from bottom-up/network – which are based on participatory principles among the partners of the initiative - to top-down/hierarchical models. They also identify hybrid models that combine these elements together. To categorize the governance models of selected city case studies, they consider different elements including the roles and responsibilities of actors and the mechanisms to prioritize decisions, for information sharing and for conflict resolution among the partners of the initiative. Despite the differences in the governance models adopted in the analysed cities, they find that recurring elements present in all the models were: stakeholder participation, consensus seeking mechanisms, conflict avoidance and resolution mechanisms, transparency, tight project monitoring, and risk control (Al Awadhi et al. 2016).

By using another categorization approach, Landsbergen et al. (2022) distinguish between public and private models. In public ones, the funding and governance of the project remain within the government. They highlight three main approaches that are used in the US for smart city projects:

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- **Municipal**: conventional public service mode of public provision characterized by a single-jurisdiction government responsible for the design and operation of smart city projects.
- **Regional cooperative**: it expands the municipal model by involving other local governments and partners like universities; it can be structured as a "hub and spoke" system, with a large expert city with resources acting as a leader and many small municipalities joining the cooperative; or they can be clusters of similar governments within the same region; and others;
- **Public Private Partnerships**: intermediate solution where industry participates as partner in the design and operation of smart city projects.

Each approach has some benefits, opportunities and challenges, summarized by Landsbergen et al. (2022) and reported in table 9. Public models suffer from limited financial resources, which can be instead be more available in private and public-private models. At the same time, public models are more likely to respond to public values and take citizens' needs into consideration. Collaboration between different public authorities can lead to economies of scale and more efficiencies, due for example from pooling/sharing resources, but they imply higher coordination efforts and costs. Higher coordination costs also characterize public-private models involving different actors, which can also be characterized by competition among different objectives. However, public-private models can have a more flexible access and management of resources and are characterized by increased innovation and access to talents and skills.

Approach	Features	Advantages	Challenges
Public: Municipal	Single jurisdiction Conventional public service model Contracts w/vendors Funding, governance retained by government	Centralized, single governance authority Likely responsive to citizens, public values	Limited financial resources Limited access to talent, skills Heightened political, legal restrictions Constrained utility as data restricted to single jurisdiction
Public: Regional Cooperative	Multi-jurisdiction, may include public universities Conventional public service model Contracts w/vendors Funding, governance retained by government	Potential for economies of scale, shared services Pooled financial resources Greater utility as data is multi-jurisdiction, regional, and shared Likely responsive to citizens, public values, but may be competing for resources across jurisdictions	Limited financial resources Limited access to talent, skills Heightened political, legal restrictions Requires more resources for coordination Higher transaction costs due to coordinating across different systems
Public-Private Partnership	Cross-sector, may include multi-jurisdictions Collaborative public service model Shared funding, governance, risk among parties	Innovation, access to talent, skills Access to capital, flexible resources Greater emphasis on efficiency Pooled financial resources	Disparate, competing goals Potential for differential service quality based on fee-for-service Requires more resources for coordination Less responsive to citizens, public values

Table 9: Advantages and challenges of different governance models for smart city projects (Source: Landsbergen et al., 2022)

6.3.1 Steering Committees

In order to implement a specific model, governance structures can be set-up and activated within involved organizations. Al Awadhi et al. (2016), in their review of smart city initiatives, differentiate between **temporary governance structures**, which are project-related, and **permanent ones**, which have the potential to change the existing structures.

A typical example of governance structure are **Steering Committees**.

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At city-wide level, a Smart City Steering Committee can be a governance structure that aims to promote the digital development of a city and coordinate all smart city efforts, empowered by the city mayor or another high-ranking civil servant (source: EBRD).

A Smart City Steering Committee can have different forms, for example it can be constituted by all city departments and agencies, or it can be a sub-set of a specific department or a dedicated unit of government incorporating both civil servants and other organizations, including civil society.

The Steering Committee members can include senior leaders from public and private sector organisations, experts, stakeholders and other representatives from the civil society. The diversity of members is a key factor for its success, as it ensures a mix of different viewpoints and expertise, as well as independence and authority to develop and implement decisions (ibid).

This image shows an example of structure of a Smart City Steering Committee in the city of Portland (US):

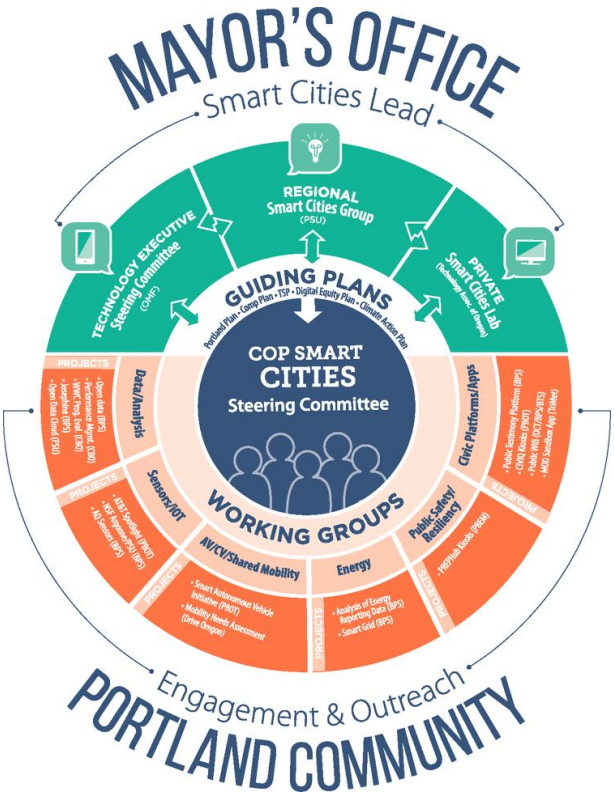

Figure 9: Smart City Steering Committee in the City of Portland (US)[3]

Typical duties of a Steering Committee include:

- Define the strategic direction and set objectives

[3] https://www.smartcitypdx.com/smart-cities-steering-committee

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- Identify key actions and assign them to competent departments/agencies
- Set up communication channels to break silos between different departments
- Involve/engage stakeholders
- Develop and review policies
- Monitor the effectiveness and impact of smart city policies and projects
- Identify funding opportunities and potential partnerships.

The table below illustrates the tasks and competences of Smart City Office of Valencia, one of MAtchUP lighthouse cities.

Smart City office - Valencia

The Smart City Office of Valencia was created in the Local Government Board in session held on February 16, 2018. By decree of the Mayor's Lieutenant, the creation of the Smart City Office was established with the following competences:

1. ADVISE, GUIDE AND INFORM on the Smart City model and the different municipal strategies regarding Smart City and Connectivity
2. COORDINATE AND MANAGE the analysis, design and management of Smart City projects.
3. PROJECT MANAGEMENT technology of the Internet of Things, introduction of ICT in public services and digital transformation.
4. DESIGN, CONTROL AND MAINTENANCE of the technological architecture that ensures connectivity to citizenship
5. MANAGEMENT AND RESPONSIBILITY of the Integrated City Management Platform: VLCi Platform.
6. DIRECT AND COORDINATE INTEGRATION AND FUNCTIONAL COMPATIBILITY between projects and computer systems and Smart City technologies.
7. COOPERATION IN THE MANAGEMENT AND COORDINATION of initiatives and R + D funding programmes in the field of Smart City.
8. DEVELOPMENT OF METHODOLOGIES AND WORK REGULATIONS regarding the introduction of TIC in public services.
9. COORDINATE TECHNICAL STAFF on regard of the launching of projects and their subsequent operation, maintenance and continuity of operation.
10. EDUCATION ON THE USE OF NEW PRODUCTS AND TECHNOLOGIES in its scope of action.

Source: https://smartcity.valencia.es/smart-city-office/#what-is-a-smart-city

Key elements for an effective functioning of a Steering Committee are the level of expertise of its members; the leadership of the Committee, which needs to balance different interests and visions, as well as the leadership and commitment of the Mayor (Source: EBRD).

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6.3.2 Public-private cooperation agreements

Some cities prefer to involve the private sector more deeply into the decision-making process concerning smart city projects, for example through public-private cooperation agreements. These agreements fall within the scope of public-private partnerships (PPP), which are “long-term contractual agreements between the public and private sector for the provision of public infrastructure and services using the resources and expertise of the private sector” (Iossa and Saussier, 2018).

EBRD describes the case of the city of Berlin, where through a public-private partnership the Berlin Partner for Business and Technology has been appointed as the city’s main business promotion partner in the field of smart city projects, and endowed with responsibilities related to funding, policy development, ecosystem formation and experimentation (ibid).

PPP model for the development of the smart district - Antalya

The first “smart district” targeted by Antalya Metropolitan Municipality within the scope of urban transformation is the New Kepez Santral District. Through MAtchUP, the district will create a 2 Billion euros economy for Antalya and will be the first of its kind where a smart city is being created from scratch using several smart city initiatives. The first stage of development includes the high performance district targeted by the demo site. “Best practices” on smart, energy efficient built environments will be presented to the rest of the New Kepez Development.

The smart district development was implemented through a PPP model, that includes Antalya Metropolitan Municipality (AMM), ANTEPE (subsidiary of AMM), and SURYAPI (private construction company). Within the model, the municipality invests in public amenities & facilities and the private investor in the buildings development.

Source: https://www.matchup-project.eu/cities/antalya/

6.3.3 Project management board

From the analysis of MAtchUP case studies of stakeholder engagement in action bundles’ business models (chapter 7), a further management model can be identified at project level, which has been used in several action bundles to manage the decision-making processes within the Smart City project. This refers to the creation of a multi-organization project management board, involving all the partners of the action bundle. These boards serve as venues for discussing the project implementation and take relevant decisions about it. An example of such boards is provided by the case study of Dresden Intermodal Mobility Hubs.

6.4 Funding/Financing

The implementation of smart city solutions requires the mobilisation of financial resources that are not always available in local public authorities. Public budget constraints can limit city governments’ investments in smart city projects, and grants from the European, national and regional level often play a major role in supporting cities in

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the deployment of these projects. However, cities are increasingly considering a variety of innovative and alternative financial instruments to support their smart city projects. Such instruments often foresee an active role of a variety of stakeholders in the financing model, proving capital, sharing the revenues or the risks of the project.

This chapter aims to analyse how different stakeholders like private companies, utilities, energy service companies, NGOs and citizens can participate in the financial model of smart city solutions and describe a selection of mechanisms that can be used to this purpose. The role of different partners in alternative financing models is envisaged also in the definition of innovative financing schemes provided in (PROSPECT project, 2020): "*non-traditional ways of raising funds and facilitating sustainable energy and climate investments for cities and regions by mixing different sources (own fund, public and private funds) or engaging different partners (e.g. citizens, private sector) aside from established financial institutions (e.g. banks)*".

6.4.1 Crowdfunding

Crowdfunding can be defined as "a collective effort of many individuals who network and pool their resources to support efforts initiated by other people or organizations" (De Buysere et al., 2012). In practice, crowdfunding consists in raising funds for a project through the donation of small amounts from a large number of individuals, or in exchange for some form of reward and/or voting rights. The gathering of funds takes place through a platform, which is often internet-based.

The main phases of crowdfunding include (Nesta, 2013):

- **Pitch**: the project proposer pitches the project idea to the crowdfunding platform, defining the funding target, the return for funders, funding deadline, etc.
- **Screening**: the platform checks that the pitch meets its criteria. If it's approved, it goes live on the website.
- **Pledge**: people pledge to the project within the funding deadline.
- **Deadline**: if the funding target is not met within the deadline, there can be two options, depending on the platform: with the 'all or nothing' option, the project only gets the money pledged if they reach their target on time. The 'keep it all' model lets the project keep any money pledged by the deadline, even if the target is not reached.
- **Delivery**: if the funding target is met, the project has to be delivered.

Different models of crowdfunding can be identified, according to the form of contribution provided by the funders, which can vary from donation, loan to investment; the form of return that funders obtain, which can range from intangible benefits, to rewards, to loan repayments or returns on investments; and the main motivation for funders to participate in the crowdfunding, which can combine intrinsic, social and financial motivations. Nesta (2013) has summarized the main features of these models in the following table:

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	Form of contribution	Form of return	Motivation of funder
Donation Crowdfunding	Donation	Intangible benefits	Intrinsic and social motivation.
Reward Crowdfunding	Donation/ Pre-purchase	Rewards but also intangible benefits.	Combination of intrinsic and social motivation and desire for reward.
Crowdfunded Lending	Loan	Repayment of loan with interest. Some socially motivated lending is interest free.	Combination of intrinsic, social and financial motivation.
Equity Crowdfunding	Investment	Return on investment in time if the business does well. Rewards also offered sometimes. Intangible benefits another factor for many investors.	Combination of intrinsic, social and financial motivation.

Table 10: Main features of different crowdfunding models (Source: Nesta, 2013)

Throughout the world, civic crowdfunding platforms have emerged to support city projects and address local challenges (Muñoz and Cohen, 2016). Crowdfunding can be applied to projects in different sectors and with different sizes (Caré et al., 2018). While some projects are proposed and funded completely from citizens, other approaches also exist. For example, some city governments have used crowdfunding combined with 'match funding' schemes. This approach implies that the city funds a project if a crowdfunding target is reached. Nesta (2015) describes the case of London and the Pocket Park project, where the city provided £5,000 of match funding for small park projects if citizens could raise the first £5,000. Other projects start with funding from the city government, that afterwards asks citizens to complement the funding with crowdfunding. If the crowdfunding target is reached, this implies a validation of the project from the citizens.

Caré et al. (2018) analyse a set of smart city projects initiated either by public institutions or private actors, that have been funded through a crowdfunding approach and find that both the donation-based and the reward-based models are suitable for the development of smart city projects. Furthermore, they find that the absence of public funding support is not a limiting factor in the success of the crowdfunding model.

Crowdfunding can take place in combination with the establishment of energy cooperatives, which are business models based on shared ownership and democratic decision-making procedures (CoM, 2016).

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Civic Crowdfunding – Bergamo Smart City (Italy)

INSIEME ("together") is a civic crowdfunding initiative promoted by Bergamo Smart City, a no-profit association involving the Municipality and the main stakeholders of Bergamo involved in innovation activities, with the purpose to implement projects that can improve the quality of life in the city. The initiative relies on strategic and financial contributions from several stakeholders, including the Municipality of Bergamo, associations, bank foundations, others. The civic crowdfunding aims to promote social innovation projects in the fields of accessibility, culture, vulnerable population, connectivity, technological innovation. Projects are proposed by private actors, who pitch their ideas to the local communities to obtain their support. For the most appreciated ideas, the Smart City association complements the 40% of the funding in order to have a multiplier effect. The available starting funds are 45.000€. In this way, the city aims to act as enabler of innovative project ideas responding to civic challenges proposed by private subjects who have a link with the local communities.

Source: https://www.bergamosmartcity.com/presentazione-crowdfunding/

6.4.2 Energy communities

The energy sector is undergoing a deep transition, driven by climate and energy policies and targets and technological innovation, shifting production and consumption models from centralization towards decentralization with distributed generation (Corsini et al., 2019).

An increasing number of approaches is involving citizens and communities in energy generation and distribution, changing their role from consumers to "prosumers" (EC, JRC, 2020). The term "energy communities" and "community energy" can be referred to a broad range of approaches that see an active role of citizens in local renewable energy generation, community building renovations, behaviour change programmes, energy purchase, and others. These initiatives foresee different degrees of community involvement in decision-making and benefits sharing (Walker and Devine-Wright, 2008 in JRC).

Energy communities are considered to provide several benefits to energy systems, including (Corsini et al., 2019):

- contribution to decarbonisation
- structural benefits reducing peak demands during the day and performing load shifting in the electric system
- promoting new energy management models and social innovation

The EU legislative framework through the "Clean energy for all Europeans" package, adopted in 2019, formally acknowledges and defines specific types of community energy: "renewable energy communities" (included in the revised Renewable Energy Directive (EU) 2018/2001) and "citizen energy communities" (included in the revised Internal Electricity Market Directive (EU) 2019/944). According to the definitions provided in the EU directives, primary purpose of such communities is to provide environmental, economic or social community benefits rather than prioritise financial profits. Both

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directives allow for different organisational forms of energy communities (association, cooperative and others) through a legal entity.

The two types of communities have some common features and differences, synthetized in the following table:

Criteria	Renewable Energy Communities (RECs) Pursuant to Arts. 2 (16), 22 RED II	Citizen Energy Communities (CECs) as Defined in Arts. 2 (11), 16 IEMD
Eligibility	• Natural persons • Small and medium sized enterprises • Local authorities, municipalities	• Open to all types of entities
Primary Purpose	*"environmental, economic or social community benefits for its shareholders / members or for local areas where it operates, rather than financial profits"*	
Membership	Voluntary participation open to all potential local members	Voluntary participation open to all potential members
Ownership and control	• Effectively controlled by shareholders or members that are located in the proximity of the RE project; • Is autonomous (no individual shareholder may own more than 33% of the stock).	• Effectively controlled by shareholders or members of the project; • Shareholders engaged in large scale commercial activity and for which energy constitutes primary area of activity excluded from control.

Table 11: Main features of Renewable Energy Communities and Citizen Energy Communities (Source: RSE, 2021)

In particular, regarding the potential participants, citizen energy communities have a broader membership as any type of entity can participate, provided that members engaged in commercial activity and that primarily operate in the energy sector do not detain decision making powers. Renewable energy communities instead have a narrower membership potential and only certain type of entities can participate (EU, JRC, 2020). Member States must ensure participation in renewable energy communities for consumers in low-income or vulnerable households.

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7 Case studies: stakeholder involvement in smart city actions and their business models in MAtchUP cities

This chapter provides a detailed description of 7 case studies from MAtchUP lighthouse and follower cities. They regard different phases of smart city action bundle development and different mechanisms to involve stakeholders in the planning, governance and funding/financing aspects of smart actions.

Table 12 presents an overview of the case studies and the main stakeholders involved in each of them:

Case study	City	Key stakeholders
Socialized solar plant	Valencia	• innovation agency • consultancy • citizens
Pilots Community Energy Projects	Valencia	• energy office • citizens
Smart tenant model (existing and new building)	Dresden	• energy utility provider • energy systems specialized company • housing company • tenants
Intermodal mobility hub	Dresden	• public transport company • City authority • energy utility provider • sharing mobility services providers • public transport software provider • citizens and city users
Photovoltaic Solar Power Plant installation to support agricultural irrigation	Antalya	• Metropolitan municipality • Regional development agency • farmers
Group purchases	Ostend	• energy advice desk • energy utility suppliers/insulation suppliers • citizens
Alliance contracting model	Kerava	• City authority • technical building systems design company • consulting (energy efficiency consulting) • technical building systems implementation company • structural design company

Table 12: Overview of MAtchUP case studies of stakeholder involvement in smart city action bundles and business models

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7.1.1 Socialized photovoltaic plant “Las Naves Brillen” (Valencia)

Description of the model & process

“Las Naves Brillen” is a pilot project that aims to demonstrate a public-private financing model to promote the installation of photovoltaic plants. A 100 KW PV plant financed through a collective financing campaign involving citizens will be installed on the roof of Las Naves Foundation (the innovation agency of Valencia Municipality). The project has been developed in two phases. The first phase had the objective of making energy efficiency improvements in the public building, reducing consumption as much as possible. Thus, during 2019 and 2020, several actions were deployed, such as energy efficiency workshops targeting Las Naves employees to raise awareness on energy efficient and saving behaviours; an energy audit was conducted and consumption was monitored; a billboard was put up to the entire building with information and energy saving tips, among others. Once the minimum consumption was reached, the second phase was launched, which consisted of the development of the “socialized” plant and the collective financing campaign. The business model, its underlying conditions, main elements and performance were studied and defined, and then the financing campaign was launched. The project was presented and advertised through several means (e.g. street and buses advertisement; website and video; promotional materials; presentations).

The cost of the PV plant is €100.000. 20% is covered by Las Naves and 80% by citizen participation. Any citizen can participate in the collective financing by investing a sum from 100€ to 2.000€ and receiving a financial return. The profitability of the investment is ensured by the stable profits that the PV plant obtains: the economic savings of Las Naves due to the self-consumption of energy and the sale of excess energy to the grid. The payback is around 5 years. The rest of the twenty-five years that the project lasts, the citizens are receiving a benefit with a guaranteed IRR of at least 1.5% and potentially higher. Payments will be made after the commissioning of the photovoltaic plant. Profits that will be earned by Las Naves will be directed to energy poverty projects, as by law a public entity cannot perform a business activity or earn from this type of projects.

The project combines economic/financial objectives (giving citizens the option of receiving financial returns thanks to the investment in this project) with social and environmental ones (contributing to the energy transition). The project seeks to demonstrate that public-citizen collaborations are possible and promotes a greater involvement of citizens in these types of projects.

Figure 10: PV plant on Las Naves building

Stakeholders involved in the business model:

- Las Naves Foundation, as manager of the collective financing campaign and of the photovoltaic plant
- ECOOO consultancy, that conducted a feasibility study for the installation of the PV plant and analysed the conditions of the collective financial model
- Citizens that decided to participate in the collective financing of the PV plant.

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Results:

The campaign was launched in November 2021 and aimed to raise 80,000 euros to finance the construction of the PV installation. It managed to raise 100% of the financing through the investments of more than 100 people.

The installation will generate a total of 138,880 kWh of electricity annually (equivalent to the electricity consumption of 37 homes), which will be used for self-consumption by the Las Naves Foundation building itself, as well as the recharging point for electric vehicle located in its facilities. In total, it is estimated that this installation will generate annual savings in greenhouse gas emissions of 54,700 kg of CO2eq.

Critical aspects:

The internal procedures to prepare the project were quite long, due to bureaucracy (e.g. for roof lending). Furthermore, the administrative and bureaucratic management is somewhat complex, in particular if many participants are involved in the financing.

Despite this, the project has a relevant replication potential in particular in public administration buildings, as photovoltaic energy is not expensive and the investment is easily recoverable. Project participants intend to open all the information and learning generated by this pilot to the population and to other public administrations (methodology, legal framework, etc.), to promote the diffusion of this model.

Mechanisms to involve stakeholders:

The project itself is a mechanism to involve citizens through their direct participation in the collective financing of a PV plant. A quarterly report will be sent from to the plant financers, including information on how much the plant is producing, consumption data, educational information on energy and the benefits of the plant.

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7.1.2 Pilot Community Energy Projects (Valencia)

Description of the model & process

Energy communities are an innovative governance and financing model for renewable energy projects, and they represent an opportunity to speed up energy transition at the local level. Local authorities can contribute to support their implementation and diffusion through several initiatives.

The City of Valencia has decided to support the first two energy communities in its territory, as lever to promote other private initiatives and to upscale this model. The pilot energy communities are being developed in the city through a participatory approach, with the support and facilitation of the Energy Office of Valencia City Council. Groups of citizens are being accompanied in the process of designing, purchasing and installing a community photovoltaic plant. According to current legislation, any neighbor or organization that is around the point of the photovoltaic installation, up to 500 meters away, can participate in the community.

One pilot project regards the installation of a PV plant of about 20-30 KWp on private roofs in the Ayora neighbourhood. The project involves about 20-30 households and a local store. As current steps, an administrative process for creating an association is ongoing, together with the identification of the roof and elaboration of the technical project.

Another community project regards a public roof on the Local Civic Centre of Castellar-l'Oliveral. The plant size is about 48 KW and the community involves about 50 households. Initial investment costs amounted to 58.000 €. 53% is covered by a grant and each family invests 590€. Annual estimated savings amount to 130 €/household. The average return period estimated is 4-6 years.

Stakeholders involved in the business model

- Energy Office of Valencia, as leader and facilitator of the project. The office acts as one stop-shop for Energy Transition, providing assistance to citizens on technical and economic aspects. The office takes care of all the necessary procedures to carry out the installation and launched a contest to select the installation company
- Citizens participating in the energy communities

Results

These types of projects aim to enable people to supply collectively their own energy, to support clean energy transition and energy security. Furthermore, these projects generate a community where citizens are engaged and take decision together, experimenting new governance models.

Critical aspects

The change in the legal framework on energy communities in Spain was a key element to determine the feasibility of this model. Another critical element for success was the political leadership, as there was a strong commitment from the Mayor in the project.

Preparatory activities performed by the Energy Office, like deepening the legal aspects involved in a collective self-consumption installation as well as the design of the participatory process, were important means to overcome some of the barriers faced in the project.

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Mechanisms used to involve stakeholders

As mentioned, the pilot projects rely on a participatory process, which helped to identify which people, families and businesses in the neighborhood were interested in participating. Several issues were discussed and defined within the process, like the type of installation, the self-consumption modality, the distribution of generated energy, the way to finance the installation.

The process was also complemented by a communication campaign.

Figure 11: Communication materials for the pilot energy community projects

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7.1.3 Tenant electricity model (Dresden)

A “Tenant Electricity Model” (TEM) enables the consumption of locally generated energy from a photovoltaic (PV) system by tenants of an apartment building, so less energy must be obtained from the grid. The model applies the principle of shared consumption to the supply of green electricity. By participating in the TEM, the tenants get a fixed discount on their electricity price. Additionally, the green electricity coming from the PV system is discounted in three phases of time, weather and surplus feed-in (load-variable tariffs)[4], which encourages the tenants to schedule electricity consumption at specifically low-price times and high availability of RES.

The model helps to reduce the consumption of energy coming from the grid and the feed-in of PV power into the grid, what contributes to grid relief. For a better ratio of locally generated power within the electric consumption, the technical system is equipped with a battery storage which increases the self-consumption rate and the autonomy of the system.

The following figure illustrates the approach:

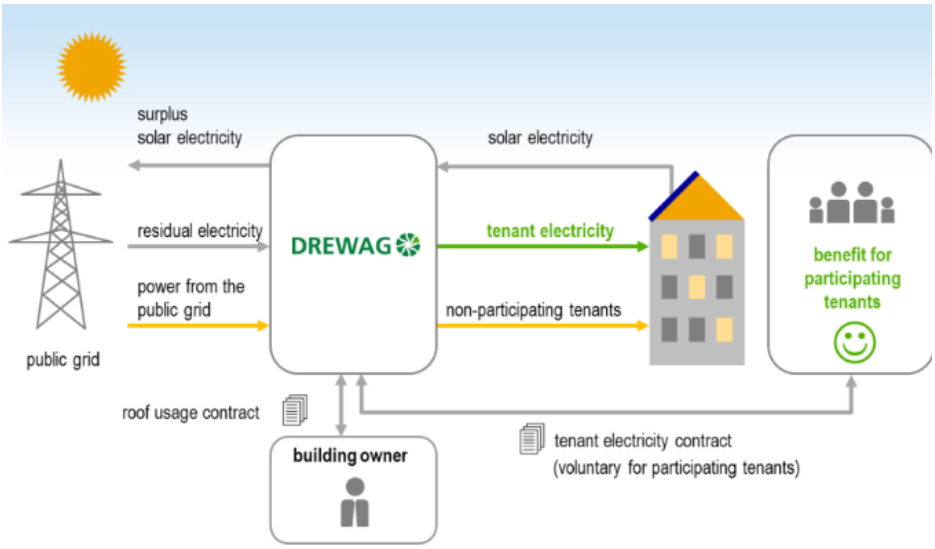

Figure 12: Functional scheme of the TEM

By introducing the TEM, tenants can participate in the urban energy market and contribute to the Energy Transition. At the same time, they obtain a financial benefit. The model is specifically tailored to the customers and must be adapted for new apartment buildings considering roof size, orientation and statics, shading and the number of potential users.

Within the MAtchUP project, the model was implemented within an existing building and within the newly constructed “District Future House” building.

Stakeholders involved in the business model:

- DWG/SNE (energy utility provider) was responsible for the design and approval planning of the energetic components (PV system with storage), construction supervision of the PV system, as well as calculation of the TEM and acquisition of the participating tenants

[4] *Offered products from DREWAG/SachsenEnergie AG for tenant electricity model (07.07.2022): https://www.drewag.de/wps/portal/drewag/cms/menu_main/privatkunden/produkte/energievielfalt/vermieter/stromloesungen*

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- EASD (EA Systems Dresden, company specialized in planning, optimizations and evaluations of energy systems) developed simulation model to evaluate the system layout and to test suitable smart tariffs in advance
- VONOVIA (housing company) and WGJ (housing cooperative) provided roof areas, for the existing building and the new building "District Future House" respectively; a roof usage contract was put in place between the building owner and the energy utility to implement this model
- Tenants as users and volunteers of the model

Main results

The tariff „Mein Mieterstrom smart" (My smart tenant electricity) was tested comprehensively in the „District Future House" to expand the knowledge and develop tools for the implementation of the tenant electricity model. The billing system has been designed and its limits have been identified. The model is now fully implemented and is working properly, offering two price discount rates.

A high percentage of the tenants in the test buildings are participating and benefit from the price discount. The majority of the users use electrical consumers specifically during the time slots of price discounts, as emerged from a survey about the model performance. The TEM led to more efficient energy consumption, as the users have access to real-time information on their energy consumption and automated billing.

Savings for the tenants result as the electricity for the tenants is generated locally from RES and does not have to be purchased from the stock exchange by the energy provider. The grid transmission with its associated fees can be saved and these savings are passed on to customers as the mentioned price discounts.

The main reasons to participate in the TEM are the lower price compared to the normal tariff, the innovative usage of RES in the own energy consumption and the regionality.

Critical aspects

The economic and business case varies from case to case. The ratio of the roof area to the number of tenants must be advantageous. If too many tenants live in an apartment building with a small roof size, the partial price discount for each tenant is reduced and the attractiveness of the model is affected. However, economic feasibility is given when ratio between is favourable.

Mechanisms used to involve stakeholders

Tenants have been informed of the initiative by means of letters and informative materials, which explained the functioning of the model and the benefits for them and for the environment (e.g. CO2 emission reductions). Clarification talks with tenants were also carried out when needed. A survey enabled to evaluate the electricity usage of tenants during the different time slots. Overall, tenants participated in the model by selecting and joining the smart tenant contract in alternative to conventional contracts.

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7.1.4 MOBI Multimodal mobility hubs (Dresden)

Description of the model & process

Since 2018, the public transport company DVB has been implementing in collaboration with the city of Dresden and several partners an integrated concept for multimodality, which consists of a network of physical multimodal hubs named “MOBIpunkte”, a multimodal app, as well as a dedicated design, branding and communication strategy. The integrated concept aims to enable a seamless multimodality by better connecting public transport with sharing mobility and other mobility services (car sharing, bike sharing, public e-cars and e-bikes charging stations), easing access to and use of mobility services, with the long-term goal to promote sustainable mobility, change the modal split, and reduce private car ownership in the city.

The multimodal hubs are located near public transport stops, they bundle several mobility services in a single place, making them more visible and improving their accessibility. A corporate design was developed to facilitate the identification of the mobility hubs and their services by citizens and city-users. The location of the mobility hubs is based on a City Council resolution of 2017. 50 hubs have been realized since 2018, with the goal to implement 76 by 2023.

Regarding the services provided, a new tariff product for car sharing (MOBIcar tariff) was set up by DVB in cooperation with the local partner teilAuto, which foresees discounts for DVB subscription customers, access to 300 cars and over 200 stations in Dresden, and to 1.200 vehicles in central Germany. A new public bicycle rental system “MOBIbike” was launched since August 2020, with 1.000 bikes available and discounts for DVB subscription customers. The public charging infrastructure is being expanded by the municipal energy supplier. The goal by 2022 is 400 charging points in the city, most of them at mobility hubs. Furthermore, a mobility-on-demand service (MOBIshuttle) is being tested, which aims to fill the gaps of existing public transportation in particular for first and last-mile mobility, and reach new target users.

Figure 13: structure of a MOBI multimodal mobility hub and services included (Source: DVB)

Since intermodal services are offered by various operators with different access conditions, an integrated application for all services is currently being developed in order to ease the booking and billing process for users.

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Stakeholders involved in the business model:

- DVB (public transport company of the city of Dresden) is the operator of the multimodal mobility hubs
- the City of Dresden is the owner of the land required to implement the mobility hubs; together with the local distribution system operator and relevant city departments, it was responsible for the identification of suitable locations for the hubs
- DWG (energy utility provider) is the electricity provider within the e-charging stations
- teilAuto and Nextbike are the providers of sharing mobility services (car sharing and bike sharing respectively)
- MENTZ (public transport software provider) is developing a new mobility platform that will bundle all MOBI sharing and mobility services
- Residents and city users, as users of the multimodal hubs and related mobility services

Results:

The usage numbers of MOBI services show that the multimodal concept is appreciated, for example in 2021 MOBIbike had 780.000 rentals and 63.000 active customers (23.000 linked with DVB subscription card); MOBIcar had 122.000 rentals, of which 39.000 at a MOBIhub and 15.000 active customers, with 1.000 in the MOBIcar-tariff. 69.000 charging operations were done in the first half of 2021.

The implementation of mobility hubs has enabled beneficial effects reducing the number of cars and freeing up parking space, and reduced externalities (noise, emissions of CO2, emissions of nitrous gases and fine particulates, congestion). The benefits are currently under evaluation by DVB.

Critical aspects:

Bundling together several services of different partners poses some challenges which need to be addressed with appropriate tools, for example aspects related to customer ownership and data protection.

Long bureaucracy was an issue that was addressed by defining a clear and transparent decision-making process (see also the description of mechanisms to coordinate stakeholders in the next section).

Regarding communication, it was important to have a common communication plan to coordinate multiple advertising and communication channels among partners. Having a dedicated design, aligned with corporate values, was key in the project communication.

Overall, the model saw an active public-private collaboration, which enabled to share the financial risks related to the project among different partners.

Mechanisms to involve stakeholders:

An important element for starting the overall process was the definition of the political framework, which took place through the commitment of all the public entities involved in the initiative (i.e. the City of Dresden, its relevant departments, DVB). The city council resolution of 2017 functioned as a contract with DVB and the mobility hubs were included in the public service contract.

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Another key mechanism for the overall coordination of partners of this initiative has been the establishment of a taskforce with representatives of DVB and the relevant departments of the city of Dresden. This taskforce enabled to discuss issues and take decisions in a quick way.

Finally, market research and evaluation enabled to factor in customers' needs and expectations. DVB has an in-house market research department, which performed analysis and surveys to understand the services that customers wanted and their willingness to pay, as well as evaluated the appreciation of the service after it was put in place.

7.1.5 Photovoltaic Solar Power Plant installation to support agricultural irrigation (Antalya)

Description of the model & process

Agriculture is a key sector for Antalya's economy. The land assets of Antalya province are 2 million 18 thousand hectares, the agricultural area is 360,245 hectares. 42% of Turkey's greenhouse agricultural areas are in Antalya province. In this context, agricultural irrigation in the region suffers from some operational problems. Mass irrigation facilities are built and put into service by public institutions (DSI (State Hydraulic Works) or Metropolitan Municipality. However, in order for the facilities to be operated in accordance with their purpose, the facilities belonging to DSI are transferred to the Irrigation Unions, Irrigation Cooperatives or local Municipalities, and the facilities belonging to the Metropolitan Municipality are transferred to the Irrigation Cooperatives with mutual protocols for the provision of operation services. If both institutions cannot find a legal entity to take over, they also operate the facility they have built themselves. However, it is more economical and realistic if the business service is carried out from the site and by the user farmers. Despite this, both public institutions are either unable to find operators or the existing operators are insufficient to operate the facility in accordance with its purpose, and as a result, either the facilities become idle or farmer complaints arise.

One of the problems faced by the operators of Irrigation Facilities is high operating costs. The necessity of allocating sufficient budget to cover these expenses arises, which is ultimately billed to the farmers, as users of irrigation facilities. Therefore, under free market conditions, this mechanism increases the costs of farmers who already have low competitive power, and as a result, production is often abandoned and facilities become idle.

Antalya Metropolitan Municipality is entitled to provide energy support to agricultural activities in accordance with the "Antalya Metropolitan Municipality Agricultural Support Regulation". Based on this regulation, Antalya Metropolitan Municipality has decided to invest in a project on Solar Photovoltaic Plants in order to supply free renewable energy for the operation of mass irrigation facilities and benefit local farmers, contributing at the same time to several objectives:

- accelerate the rural development process, agricultural production and agricultural employment in the Antalya region
- increase the agricultural competitiveness of Antalya farmers and their quality of life
- set an example for farmers and other relevant institutions on the use of renewable energy in agriculture
- contribute to reduce foreign energy dependency of the country by using local and continuous energy resources
- contribute positively to the reduction of greenhouse gases and to the fight against drought

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- meet energy needs in agricultural irrigation and save at least 40% of irrigation water by encouraging the use of modern and pressurized batch drip-sprinkler irrigation systems, instead of using primitive or surface irrigation methods
- demonstrate the profitability of meeting renewable energy in agriculture with collective facilities instead of individual and private facilities, in terms of operation and feasibility, and ease in terms of connectivity to the national electricity distribution system
- show that less resources and land are used for the production of renewable energy in agriculture with collective facilities compared to production with individual facilities.

The project therefore aims to demonstrate an environmentally sustainable, economical and exemplary energy production model in agriculture.

Stakeholders involved in the business model:

- Antalya Metropolitan Municipality is the project owner and coordinator
- BAKA (Western Mediterranean Development Agency) provided grant support to Antalya Metropolitan Municipality and played an integrative role by ensuring the cooperation of public institutions, private institutions and non-governmental organizations in the execution of the project. Development Agencies were established in certain regions of Turkey under the Ministry of Industry and Technology of the Republic of Turkey, with the purpose of accelerating regional development, ensuring its sustainability, and reducing inter-regional and intra-regional development disparities by improving cooperation between public sector, private sector and non-governmental organizations.
- About 15.000 farmer families, members of 42 irrigation cooperatives operating in the province of Antalya, that are benefiting from the collective irrigation facilities operated by the Antalya Metropolitan Municipality.

Results:

The Solar Power Plant, which consists of seven parts, has a total installed power of 4.89 MW. The cost of electricity consumed by the farmer families is paid by the Antalya Metropolitan Municipality, by settling with the authorized electricity distribution company, without demanding a fee from the farmers. Agricultural irrigation costs of Antalya farmers have therefore been reduced and their competitiveness has been increased, with also improvements in the irrigation rates and in sustainable agricultural employment. Through this project, Antalya Metropolitan Municipality has increased its energy support by 75%, according to 2022 data.

Critical aspects:

Given the scope of agricultural activities, the producers in the region are in great need of investments and social services in the field of agriculture. For this reason, both the actors in the sector and the project stakeholders always support the operation and continuation of such projects. In addition, since this project, which supports economic development, did not create a competitive environment, there was no difficulty in the coordination of the stakeholders.

However, the project could not have been realized with the Municipality's budget alone if the Development Agency had not funded it. The budget allocated to Antalya Metropolitan Municipality, which is subject to the Public Financial Management and Control Law No. 5018, could have reduced the scale of the project.

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Mechanisms to involve stakeholders:

BAKA's grant support applications are made according to a guideline. For the projects that are entitled to receive grant support, a grant agreement is signed between the institution receiving the support and the BAKA. All rules to be followed, project activities, and allocated budget are specified in this contract. The project has been carried out in accordance with the articles of this contract.

As a result of the project, protocols were signed between the Agricultural Irrigation Cooperatives to which agricultural producers are subject and our Municipality. Thanks to these protocols, the terms of use of “Photovoltaic Solar Power Plants” by agricultural land owners have been decreed.

Figure 14: View of the Photovoltaic Solar Power Plant installation

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7.1.6 Citizens' group purchases (Ostend)

Description of the model & process

'Energiehuis Oostende' (energy advice office owned by the Municipality) offers two types of group purchases to the inhabitants of Ostend. These group purchases concern roof isolation and green electricity & gas.

Many houses in Ostend have poor or no roof insulation at all. That is why the Energiehuis wants to encourage Ostend residents to insulate their roofs. Through a group purchase of roof insulation inhabitants can have roof insulation installed in their homes without worries and at a lower price. Good roof insulation is indispensable to keep energy consumption low and thus save on the energy bill. Moreover, not only do inhabitants save energy and costs, a well-insulated roof also increases living comfort (also in summer) and reduces CO2 emissions.

With the group purchase, the 'Energiehuis' brings together as many people as possible to buy electricity and/or gas together at a more advantageous rate. On average, households save 200 euros on a yearly basis.

Every energy supplier supplying green electricity and natural gas in Flanders can participate and is given the opportunity to make its best offer during the auction. The suppliers do have to meet a number of predetermined quality requirements, to enable a smooth transition for the participants. A group purchase also has other advantages: by choosing green power, inhabitants do their bit for more sustainable energy consumption!

Stakeholders involved in the business model:

- The 'Energiehuis Oostende' as facilitator for the group purchases
- The suppliers of green energy/gas and suppliers of insulation
- Citizens that decided to participate in the group purchases

Results:

The group purchase for gas and electricity started in 2010. In the last decade, 19.187 inhabitants participated in the group purchase. The initiative is expected to continue in the future.

The group purchase for insulation started in 2015. In total 306 inhabitants participated.

Critical aspects:

The internal procedures are quite long and the investment of time to organize a group purchase is quite big. Especially the communication and procurement part is labor intensive. Recent changes in regulations make it a challenge to convince participants.

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To ease the flow, the Energiehuis choses to work with a digital tool. This imposes an extra challenge for some of the participants.

For the group purchase on gas and electricity, it is not always easy to find a supplier who wants to participate, due to high fluctuations in price.

Mechanisms to involve stakeholders:

Citizens are being engaged in the group purchase itself. They are being update by using different forms of communication (both digital and analogue). Feedback of citizens is used to determine the scope of new group purchases.

Figure 15: Communication campaign for group purchases in Ostend

7.1.7 Alliance contracting model to build Keravanjoki multipurpose building (Kerava)

Description of the model & process

One option in large and complex construction project is to use so called alliance contracting model. In this model the project parties, including the client, are jointly responsible for planning and construction, as well as risks and benefits included in the project. This model can also be used in smaller projects in case the project involves new innovations (e.g., the use of new technologies, construction methods etc.). The alliance contracting model differs from traditional contracting models, where each party operates under its own contract containing separate objectives.

Keravanjoki multipurpose building was recognised in the city already in early phase being challenging project. The goal was to build a school for approximately 1 000 students as well as premises for residents, associations, etc. There exist busy roads causing noise and challenging soil conditions. The city expected the building to meet also demanding environmental, economic, and indoor climate conditions. Alliance contracting model was recognised as a flexible model, where all partners carried the possible risk, as well as got an opportunity to suggest optimal solutions for the whole life cycle of the building.

When the alliance model was chosen and strategy and tendering phases finalised, the contract was signed for project development and implementation. Alliance partners, in addition to the City

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of Kerava (client), were Lukkaroinen Architects, Granlund (technical building systems design), Granlund Consulting (energy efficiency consulting), Caverion Finland (technical building systems implementation) and WSP Finland Oy (structural design). The alliance management team was established as well.

The development phase started on 2018 and the building works were finalised on summer 2021 before the school year started.

Stakeholders involved in the business model:

Alliance management team included all alliance partners. Daily operations were run by the project team and project manager. The project organisation related to alliance model needs to be especially based on openness and cooperation supported by relevant contracts.

Main results

At its best alliance model ensures the smooth execution of the project even when unexpected situations arise. Project stakeholders can decide together the best option to progress which results fewer disputes and need for legal actions. Keravanjoki multipurpose building was built on time, its energy class is the highest A class without compromising the indoor climate, and the budget frame 37 M€ was met. The energy system was planned and built by Kerava Energy which also operates the energy system for 20 years period. There are solar panels, ground heating as well as district heating system available to optimise the use of energy.

Critical aspects

Model requires special competences from the client and service provider. Cooperation between parties need to be based on trust, which takes time to be built. Model is not suitable for small and simple projects or ones with very strict budget constraints.

The project overall went well. Because the model was new for the client, it remains to be seen whether all the desired benefits will be realised. User involvement must be invested even more in the future.

Mechanisms tools used to involve stakeholders

Building trust between parties is essential for the success of the project. The use of collaborative operating methods is recommended as well. Some projects benefit also from the use of so called physical “big room”, where project stakeholder can work closely.

There were several meetings for user involvement in the project. More extensive use of different ways of participation is recommended for future projects.

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8 Procurement models for smart city solutions

Public procurement is “the process used by cities and particularly their municipalities and anchor institutions to buy goods, services and works”, and is namely the competitive process used to make decisions about which supplier to use (URBACT, 2019).

Public procurement is a very relevant process as it represents 14% of EU GDP, it can be used to address several economic, social and environmental challenges of European cities and it can be an opportunity to support and involve SMEs.

At the same time, public procurement is hampered by several barriers, including (among others) the complexity and length of procurement processes; high level of bureaucracy; rigidity of procedures, which do not evolve fast enough to cope with technological innovations, in particular in the smart city domain; tendency of public procurement officers to work in silos and do not collaborate with other municipal departments.

A small number of local and regional authorities in the EU have developed Public Procurement Strategies and Action Plans. While there are successful experiences in this regard, a number of implementation challenges emerge in these plans that still need to be addressed (URBACT, 2019).

Public procurement is normed by European, national and local regulations. In particular, the EU Commission updated in 2014 three directives[5] on procurement, highlighting aspects related to efficiency, transparency, flexibility, innovation, as well as the inclusion of social and environmental considerations in procurement. These directives should have been transposed into national laws by April 2016.

There are different types of public procurement procedures. This table provides a short description of each type:

Name	Description
Open procedure	Anyone may submit a full tender. This procedure is used most frequently.
Restricted procedure	Anyone may ask to participate in a restricted procedure, but only those who are pre-selected may submit tenders.
Competitive negotiated procedure	Anyone may ask to participate, but only those who are pre-selected will be invited to submit initial tenders and to negotiate. Procuring entities can only use this procedure when negotiations are necessary due to the specific or complicated nature of the purchase however, the procuring entities in the defence and security, water, energy, transport and postal services sectors may use it as a standard procedure.

[5] https://ec.europa.eu/growth/single-market/public-procurement/legal-rules-and-implementation_en

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Competitive dialogue	This procedure can be used by a contracting authority with the aim of proposing a method of addressing a need defined by the contracting authority.
Innovation partnership	This procedure may be used when there is a need to purchase a good or service that is still unavailable on the market. A number of companies may participate throughout the process.
Design contest	This procedure is used to obtain an idea for a design.

Table 13: Types of public procurement procedures (Source: EU website)

Procurement processes of MAtchUP LH cities are described in deliverables on city policies (Dx.25 - New policies on Valencia/Dresden/Antalya city council).

In this chapter, information and results from the stakeholder survey and from the thematic workshop with LH cities are analysed to provide insights into MAtchUP procurement processes.

Among MAtchUP stakeholders that responded to the questionnaire survey, 29% is involved in the public procurement of solutions deployed in the smart city action bundles.

Interviewed organizations are mostly involved in phases for the preparation of the tender, and to a less extent involved in the contract preparation. Only a few are involved in the supply of solutions. A relevant share of stakeholders is involved in almost all the phases of tender preparation, whereas only a few focus on specific phases.

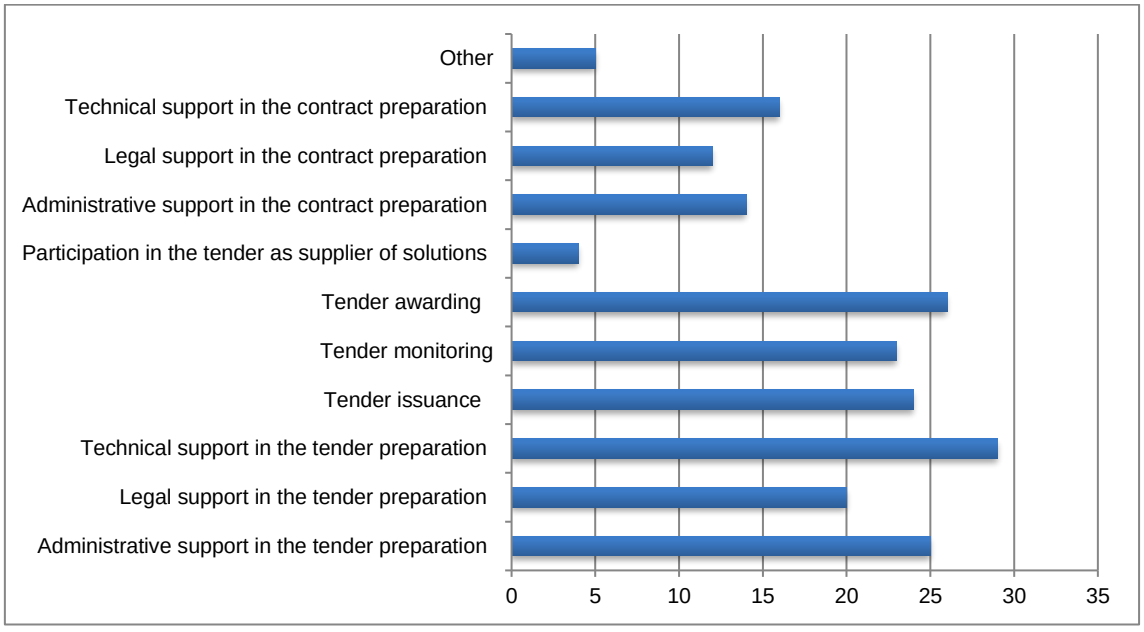

Figure 13: Public procurement steps where interviewed stakeholders took part

Stakeholders and MAtchUP project partners have highlighted a series of risks that they have identified in the procurement process, which have been provided during the questionnaire and during the thematic workshop on procurement. These risks are mostly connected with the slowness and the complexity of the procurement process and the

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difficulties to adapt the existing procurement practices and rules to innovative technologies.

- Slowness of the process
- Complexity of the process
- Excess of requirements can lead to unsuccessful processes or to delays
- Procurement process is not coherent with timelines of EU projects
- Need of personnel effort to coordinate the process
- Need of permits (which require time to be obtained)
- Lack of references/previous experiences as comparison
- Internal resistances within the local administration
- Reluctance of staff to start new processes, preference for already established practices (even though complex and long)
- Administration reluctance towards a technology not previously installed
- Low market maturity for the smart city solution due to the innovative character of technologies
- Prolongation of the procurement process due to Covid-19
- Prolongation of the market research and feasibility study process before the tender
- Prolongation of the procurement process due to testing phase of specific product brands before launching the tender (it requires time)
- Lack of demand for the innovative service (it requires promotion to stimulate the demand)
- Current public procurement rules more suitable for business as usual technologies rather than innovative ones and first-of-its-kind applications
- Fluctuations in the exchange rate in Turkey, which directly affects the purchasing process by public institutions
- Need to import products, which impacts on timing

Table 14: Main risks in the procurement processes identified by stakeholders and MAtchUP partners

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9 Conclusions

The involvement of stakeholders into smart planning and into the design, development, funding and implementation of smart city solutions is a key factor for a successful transition to smart and sustainable cities. Different types of public and private stakeholders, from local authorities to the private companies, from financial institutions to civil society, play a role and can actively contribute to smart city development.

Through the analysis of MAtchUP smart city action bundles, this deliverable provides an overview of the main actors involved, their opinions about the most relevant barriers to effective smart city business models and suggestions about how to overcome them. This overview of barriers highlighted the importance of economic and financial factors as well as institutional and management ones.

Stakeholders suggested several solutions that can be adopted to address and overcome these barriers, which comprise political-institutional levers or mechanisms, project management solutions, communication, dissemination, awareness raising activities, economic and financial instruments, and technological solutions.

These results show the need for alternative financing approaches and wider public-private collaborations, also involving citizens. It also shows the need for new management and coordination approaches that can boost collaboration among stakeholders internal to city authorities and external ones.

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