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Executive summary

The lessons learned during the assessment and implementation phase of the smart solutions in Rotterdam, Umea and Glasgow were continuously discussed and captured in the Liaison Groups of the RUGGEDISED-project. From the lessons learned, guidelines were developed with the objective to facilitate the implementation of smart solutions and to support (smart) cities with knowledge and processes to maximize the impact of the measures. These lessons learned and guidelines are not only interesting for the RUGGEDISED-project itself but also for other smart city projects. In this deliverable the main outputs of the Liaison Groups are collected and stored for dissemination use to other smart city projects and smart city networks such as the Board of Coordinators and its Replication Group, and the Smart Cities Marketplace.

Three different Liaisons Groups were set up: the Smart Energy and E-mobility Liaison Group, the ICT Liaison Group, and the Innovation and Business modelling Liaison Group. In the beginning of RUGGEDISED the groups convened separately, but after one year the groups were more integrated and discussed together several topics important for the implementation of the smart solutions. For this discussion they made use of best practices available through the network of smart city experts established in Brussels already. Vice versa, the experiences and lessons learned from the Liaison Groups were also brought to the attention of the Board of Coordinators of the Smart Cities projects. The Liaison Groups functioned not only on a practical level but also on a more fundamental level of collaboratively building capacity to deal with complexity and urban innovation processes. In the period from November 2016 until November 2019 the Liaison Groups met nine times and provided the lighthouse cities with a knowledge brokerage service as to secure the coherency of the implementation of smart solutions and to maximize their impacts.

From the lessons learned the following recommendations have been formulated to overcome the obstacles to the implementation of smart solutions:

- Treat complex innovative projects, such as RUGGEDISED, not as standard urban development projects but as innovation programmes;
- Create a joint and binding vision together with the relevant stakeholders to create trust and give guidance;
- Position the innovation programme strategically within the (municipal) organisation;
- Foster cooperation among project partners;
- Foster vertical alignment and cooperation among operational, tactic, and strategic levels within the (municipal) organisation;
- Embed the smart solutions in the existing urban (infrastructure) configuration;
- Build flexibility in the programme itself and in the contracts;
- Think of ways to ensure the success of the programme beyond its life span for a bigger impact.

Moreover, the following guides have been produced and are in this deliverable further summarised for dissemination purposes.

- D1.5 – Prototype Smart Energy District planner
- D1.6 – Guidance on Smart City Design and Decision Platform
- D1.8 – Guide on RUGGEDISED implementation and innovation of smart solutions

This report, deliverable D8.2, is aimed at enhancing the implementation and replication potential of the RUGGEDISED project, and will be used to produce a communication product that easily can be taken up by other smart cities.

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1 Introduction

Cities are complex systems. City developments, such as new housing and infrastructure schemes, influence these systems. They connect and shape places and change daily patterns between various functions of the city. Planning, designing and implementing such city developments have always been difficult. Predicting the impact of city developments on the functioning of the city ecosystem is challenging. Moreover, embeddedness in and connection to the existing urban configuration is crucial for new urban development projects to function well. In this regard, implementing smart solutions may be even more challenging than traditional urban developments, since smart city measures by nature have a networked and connected character. This is why successful implementation of smart solutions more than ever relies on embeddedness in the complexity of the existing urban innovation (eco)system.

This report presents the main lesson learned from the Liaison groups and the developed guidelines with the objective of guiding, coordinating and facilitating the implementation of smart solutions and supporting cities with knowledge and processes to maximize the impact of the measures. Regular Liaison Group meetings were organised to achieve this objective. Three different Liaisons Groups were set up.

The Smart Energy and E-mobility Liaison Group focused on discussing:
- the implementation and impacts of the smart energy measures, including e-mobility;
- the monitoring results on energy and e-mobility;
- the integration of the smart energy and e-mobility solutions into the local energy system and the choices related to that;
- possible barriers and solutions for the design, implementation, and upscale of these solutions.

The ICT Liaison Group focused on discussing:
- the monitoring results on ICT-solutions;
- data protocols, interoperability of the Smart City Design and Decision Platform, and privacy issues;
- issues related to data upscaling from building to district, and GIS-level;
- openness versus partly closedness of the Platform related to privacy issues and the level of detail of the open data related to privacy issues;
- the progress on the Smart City Design and Decision Platform, barriers, and solutions.

The Innovation and Business modelling Liaison Group focused on discussing:
- the progress of the Local Innovation Platforms in the Lighthouse Cities and issues raised there;
- multi-actor financial arrangements;
- new innovative business models and monitoring their results;
- opportunities for local entrepreneurs and new jobs.

In the period from November 2016 until November 2019 the Liaison Groups met nine times and provided the lighthouse cities with a knowledge brokerage service. In the beginning of RUGGEDISED the groups convened separately, but after one year the groups were more integrated and discussed together several topics important for the implementation of the smart solutions. The groups made use of best practices available through the network of smart city experts established in Brussels. The experiences and lessons learned from the Liaison Groups were also brought to the attention of the Board of Coordinators of the Smart Cities projects.

During the sessions of the Liaison Group the following recommendations have been formulated to overcome the obstacles to the implementation of smart solutions:
- Treat complex innovative projects, such as RUGGEDISED, not as standard urban development projects but as innovation programmes;
- Create a joint and binding vision together with the relevant stakeholders to create trust and give guidance;
- Position the innovation programme strategically within the (municipal) organisation;
- Foster cooperation among project partners;
- Foster vertical alignment and cooperation among operational, tactic, and strategic levels within the (municipal) organisation;
- Embed the smart solutions in the existing urban (infrastructure) configuration;

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Moreover, the following guides have been produced and are in this deliverable further summarised for dissemination purposes.

- D1.5 – Prototype Smart Energy District planner
- D1.6 – Guidance on Smart City Design and Decision Platform
- D1.8 – Guide on RUGGEDISED implementation and innovation of smart solutions

This deliverable is aimed at enhancing the implementation and replication potential of the RUGGEDISED project and bring the main lessons learned to the attention of other smart city projects and smart city networks such as the Board of Coordinators and its Replication Group, and the Smart Cities Marketplace

Chapter 2 presents a short overview of the Innovation and Implementation Framework. This is a theoretical framework designed within RUGGEDISED to support the operationalisation of smart cities. More details on the Innovation and Implementation Framework can be found in deliverable D1.2 (Overarching Innovation and Implementation Framework).

Chapter 3 presents a comprehensive step-by-step approach for European cities to embed their urban innovations into the wider perspective of an urban innovation programme. More details on this guide can be found in deliverable D1.8 (Guide on RUGGEDISED implementation and innovation of smart solutions).

Chapter 4 summarises the main steps for the design of the Smart Energy District Planner, a framework and a set of analytical tools to support the development process of smart energy solutions. More technical details can be found in deliverable D1.5 (Prototype Smart Energy District Planner).

Chapter 5 presents the main steps for the design of the Urban Data Platform, an infrastructure to collect, analyse, and disclose city data. More technical details can be found in deliverable D1.6 (Guidance on Smart City Design and Decision Platform).

2   The overarching Innovation and Implementation Framework

The Innovation and Implementation Framework aims at providing support to cities for the definition and operationalisation of smart solutions. It addresses the main technical and socio-economic challenges and contextual factors that positively or negatively influence local innovation and the implementation of smart solutions.

The framework allows to:
- Identify areas where the lighthouse cities require expert support and/or cross-city knowledge transfer;
- Create a knowledge base to facilitate the implementation of smart city solutions by describing the state-of-the-art and next steps;
- Embed smart city solutions and knowledge development in the city innovation ecosystem;
- Address the topics that are relevant for implementation of smart solutions and that could be monitored during the implementation phase;
- Implement the smart city solutions in such a way that upscaling and replication is facilitated.

The framework can be used by city planners and other actors to prepare the implementation process and to assess what aspects need additional consideration. Such assessments stimulate continuous learning of all partners by exploring obstacles that might appear during the process.

The framework consists of 3 levels of impact and 6 steps for the design, implementation and realisation of a smart city.
- **Impact level 1: Realisation and output of a smart solution**. The first step is realisation of a 'simple' and isolated smart solution in a city. A smart solution produces real output if it is well-embedded in the existing urban context (step 2). Both steps are needed to deliver impact for the smart solution that is depended on the embeddedness in the existing urban context.
- **Impact level 2: Embedded outcomes of multiple smart solutions in a system.** The second level of impact is achieved when multiple smart solutions are implemented in the city and connected with each other in an efficient and working system (step 3).
- **Impact level 3: Upscaling and replication.** Outcome at the city level will be reached if smart solutions go beyond being 'pilot' projects and are successfully scaled up within the same city in a smart urban system (step 4). Real impact of the RUGGEDISED project, in terms of the replication of smart solutions, is reached if smart solutions are successfully replicated in the RUGGEDISED follower cities (step 5). The spin-off of RUGGEDISED is realised when other EU-cities take up the lessons learned and smart solutions (step 6).

Through distinguishing different levels of impact we can structure the factors that influence the implementation of smart solutions and their success on these levels. Some factors primarily affect the level of implementation and some specifically enhance or suppress that several solutions together produce collaborative smart outcomes. Others are in particular relevant to improve upscaling and replication. The factors that influence the different levels of impact are elaborated in the Overarching Innovation and Implementation Framework - report (D1.2). The factors are summarized in Figure 1.

To realise an embedded solution (Impact Level 1) it is necessary to do a technology assessment, a pre-deployment assessment and take several aspects of the solution into account such as privacy, security, user interfaces, the connection to the smart grid, the impact on the energy grid, and the involved stakeholders.
To realise that multiple smart solutions are connected with each other in an efficient and working system (Impact Level 2), it is necessary look at, amongst others, interoperability, data management and processing, data ownership, business models, wider stakeholder management, an innovation platform, and governance.
For upscaling and replication (Impact Level 3) it is necessary to look at, amongst others, regulations and standards, integrated planning, smart finance, smart governance and a joint integrated vision on the smart city should be ready. Real impact during upscaling and replication is achieved if the factors influencing upscaling and replication are taken into account early in the process.
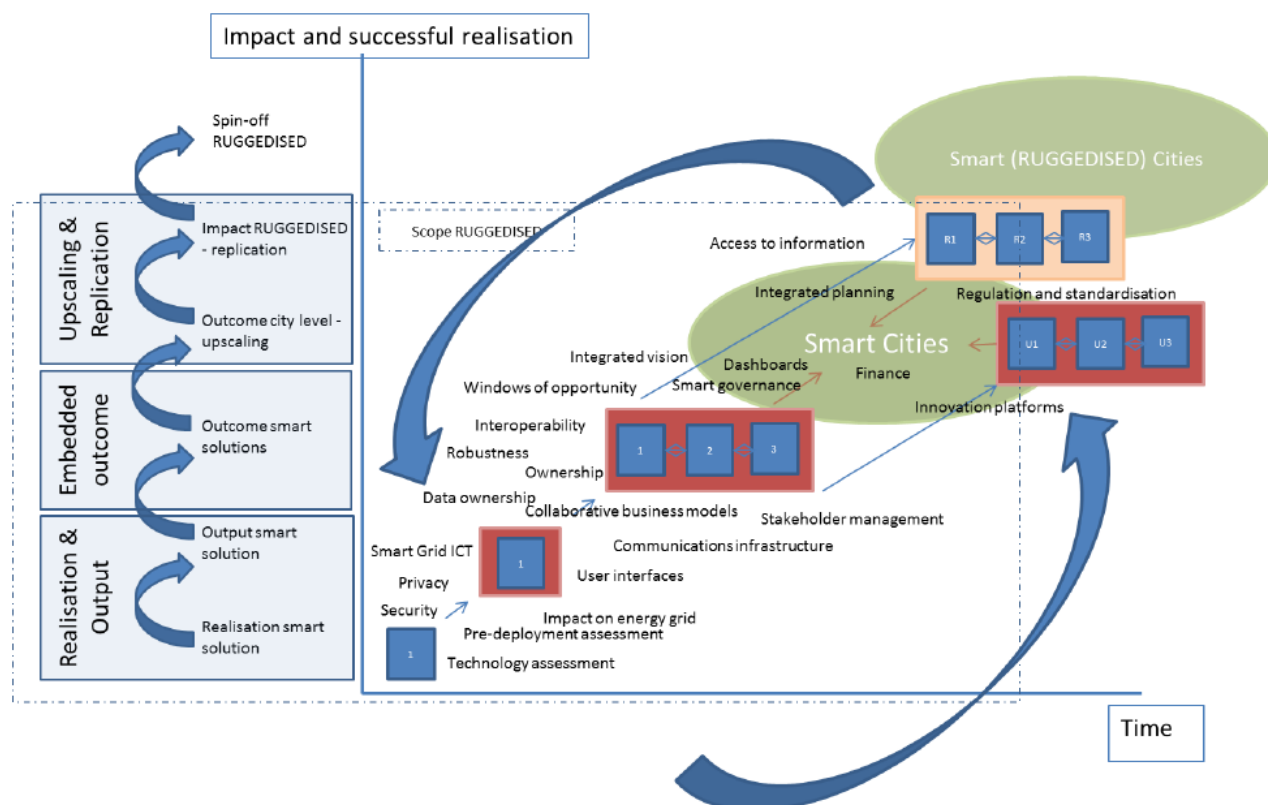
Figure 1 Innovation and Implementation Framework

3   The implementation and innovation of smart solutions

The guide on the implementation and innovation of smart solutions developed in RUGGEDISED presents a step-by-step approach for cities to embed their urban innovations into the wider perspective of an urban innovation programme and support them capturing the lessons that these innovations provide. When setting up an innovation programme, it is important to pay attention to the following aspects that can determine the success or failure of the programme.

Cooperation in innovation partnerships

By implementing smart solutions, cities are intervening in existing urban (physical) infrastructures and services. Key to have impact at this systemic level is to understand the interconnections and interdependencies among the different parts of the system. However, in-depth knowledge on these interconnections is inherently scattered among urban (public and private) partners. For this reason it is fundamental to map the stakeholders and make sure that all relevant ones are at the discussion table, also the ones who might raise objections.

Furthermore, it is important to:

- Create a shared vision at the start of the urban innovation programme, based on the values that each partner would like to pursue and the goals that each partner would like to achieve. Search for collective values and goals, but also appreciate differences, and openly discuss conflicting interests.
- Make a complete overview of running contracts and the status (and capacity) of existing (energy) infrastructure(s) at the start of an innovation programme. In particular, look at how smart innovations can be embedded in the existing urban configuration.
- Collaboratively map and discuss the information requirements and knowledge gaps. Knowledge on particular areas and urban systems might be scattered among partners who do not necessarily agree on each other's knowledge base. Therefore, it is important to articulate contradictions and information asymmetries.
- Try to build a self-sustaining Innovation Partnership. Cooperating partners can collaboratively define services and products that they can offer to upscale and replicate successful smart solutions in the region.

The changing role of government in society

The role of government in society – and with that the scope and mandate of policy instruments – fundamentally differs between counties. Decarbonisation challenges demand cities to reconsider whether they are up to the tasks they face. (Technological) Innovations change the – what are already fuzzy – boundaries between public and private interests. Successful urban innovation asks for a strong orchestrating role of local government. For this reason it is important to:

- Reflect on the (implicit) role-taking of the local government together with the partners. How do other partners see the role of local government? What do they need from the local government? What role do they envisage for the local government, and also for themselves?
- Determine the 'public interest' of an urban innovation programme and of each part of it (smart solutions) in order to legitimate the action and to ensure political back-up.
- Continuously reflect on how connections and interdependencies between smart solutions may require active public intervention and role-taking, also in those cases that individual smart solutions may be in the private domain.
- Continuously reflect on the impact of technical innovations on the division between public and private interests. Innovations may cause a shift in the demarcation of the public interest and require a shift of public role-taking accordingly.

The structure and organisation of public administration

The strategic positioning of the team working on the urban innovation programme, within the city government is crucial. It determines whether the team is allowed to shift the perspective from mere project implementation towards a wider learning and innovation programme management. Strategic positioning of the innovation teams also stimulates to improve the capacity to connect the various levels (strategic, tactical and operational) and the different domains (energy, mobility, housing, urban planning) within the organizations. As knowledge on the urban system level is inherently scattered among urban (public and private) partners, increasing the agility to connect is an important factor for successful urban innovation. In this context it is important that:

- The innovation programme team includes members from operational, tactical and strategic levels, as to align different knowledge bases and create a system perspective on the areas that are subject to the urban innovation programme.
- The innovation programme team includes (or closely align with) members from relevant domains (energy, mobility, housing, digitalization, etc) so that the urban innovation programme resonates with domain-specific policy/investment initiatives.
- The innovation programme and its team have sufficient political and administrative back-up.

Spanning judicial boundaries

By implementing smart solutions, cities face legal challenges. Existing contracts, ownership structures, operating responsibilities and divisions of risk are put under pressure. Legal issues at the tactical and operation levels often turn out to be significant obstacles for implementation. The early involvement of – and intensive cooperation with – the legal team allows to innovate together and to prevent complex negotiations and delays at an early stage. Therefore, it is important to:

- Explore, well in advance, what stakeholders are active in the innovation area, what their interests are, and what agreements may exist (and what needs to be renegotiated) between them.
- Gain experience with new roles and shared risks through intensive piloting and learning. Building up experience through pilots will allow parties to better understand the risks and benefits of urban innovation.
- Try to develop contracts that are flexible and can support new roles and partnerships for the implementation of novel technologies.
- Perform a Data Protection Impact Assessment (DPIA) to get a clear overview of what data can be gathered, used and disclosed. This DPIA is mandatory if processing of data can likely result in high risk to the right and freedoms of natural persons. In case it is not mandatory, a DPIA can still help to build compliance.

Sustainable financing, collaborative business models and procurement

The systemic and connective nature of smart solutions and urban innovations diverge from the unidimensional and clearly demarcated characteristics of business models and financing incentives. In order to exploit this diversified capacity of urban innovations and optimise their design and deployment at area – or city – level, collaborative business models provide suitable opportunities to overcome split-incentives. Therefore, it is important to:

- Take time, together with the innovation partners, to invent and discuss new financial methods and vehicles.
- Consider the option of applying a public procurement procedure for the design and implementation phases of smart solutions. It is often experienced as a complex procedure, but at the same time has proven to be a valuable tool for local authorities to define what they want to develop/ buy.
- Consider market consultations and tendering pilots to further support the definition of the final contract.
    o Functional tendering can be a way to stimulate innovation. The final contract between the contracting parties, however, should be sufficiently clear, to facilitate that single parts of the agreement can be, if necessary, renegotiated at a later stage.
    o Dividing a tender into different steps can be a great way to add flexibility and reach the still uncertain satisfactory end-goal.
- Consider the possibility to issue Green Municipal Bonds to cover the costs of the projects and/or to form Public-Private Partnerships (PPPs). Private-public partnerships can allow for different business models such as concession, shadow pricing and other combinations.

The role of knowledge in urban policy making

Due to the complex and systemic nature of smart urban infrastructures, in urban innovation programmes actors from different backgrounds and different expertise come together. As no single actor has the capacity to fully understand the entire system with all its complexity, problems and challenges that stem from this complexity and intertwinement are usually not well defined. Therefore, in order to bring suitable knowledge into policymaking and decision-making processes it is important to:

- On a structural basis, together with the innovation partners, take the time to reflect on how everyday practices include beliefs and routines that perhaps do not contribute to the overall aim of learning in innovation programmes.
- Collaboratively map and discuss the information requirements and knowledge gaps.

- On a regular basis, shift mindsets through role-playing games in order to create awareness of the value of the information for all involved cooperation partners.

Create a shared vision at the start of the urban innovation programme, based on the values that each partner would like to pursue and the goals that each partner would like to achieve.

If you want to dive deeper in one of these aspects, more can be read in the *Guide on RUGGEDISED implementation and innovation of smart solutions*, available at the following link:

D1.8_-_Guide_on_RUGGEDISED_implementation_and_innovation_of_smart_solutions.pdf

4 The prototype Smart Energy District Planner

This section contains the "prototype Smart Energy District Planner" (SEDP), a set of analytical tools and a framework for their application to support the decision-making process and design of smart solutions.

The smart energy district planner draws from both formalised design stages and more iterative, tool-assisted design processes. However, it expands the scope of the process description to include the people required to make robust decisions, based on the data emerging from concurrent design and modelling processes.

The real value added from this approach is at the decision points of a design process, i.e. those points where a concept either proceeds to the next stage of development either is rejected or requires revision. Each decision point involves four key elements:

- the **criteria** against which performance is being judged;
- the **people** needed to make a robust decision;
- the modelling **tools** required to support the process;
- the performance **data** required to compare performance against the specific evaluation criteria.

Figure 2 Elements of a decision point

These elements combined help reduce (but does not eliminate) risks, including design time being wasted on a weak or inappropriate design solutions and ultimately of a smart solution performing poorly when physically realised.
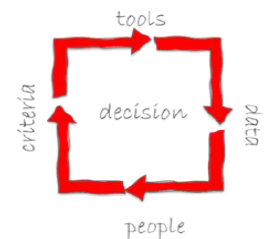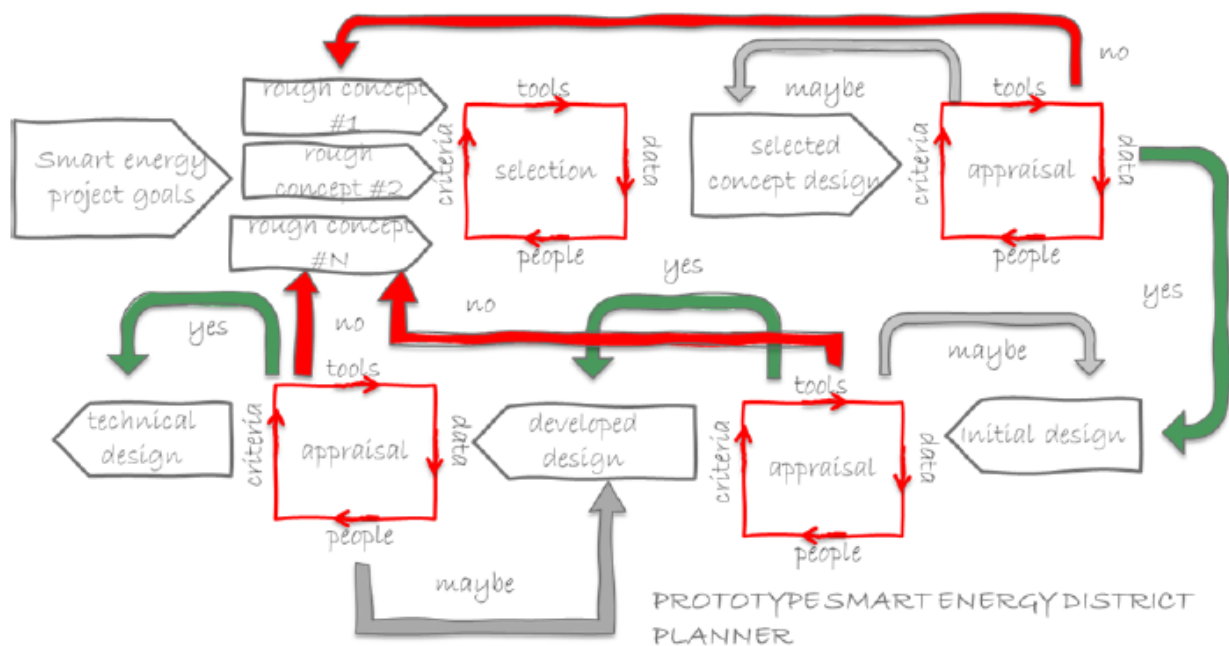
Figure 3 Design process path

Looking in more details at each element of the decision points:

People

The core of stakeholder involvement is to engage with them already in an early stage of the design process. For this reason, it is fundamental to identity who the stakeholders are for a particular innovation programme. Once these are identified it is equally important to have the right stakeholders at the discussion table in each phase of the process. The following questions could further help in identifying the stakeholders and positioning them in the process.

- What will the stakeholders contribute to the process?
- What kind of knowledge do they possess?
- What are the relevant interests and goals of the stakeholders?

- How do the stakeholders interpret the issue at hand?
- How well informed are the stakeholders about the issue?
- What are the (possible) motives for these stakeholders to participate, or not to participate?

Criteria

The design process path and the decision points require a clear definition of evaluation criteria for each stage of the process. Based on the kind of solution and overall goal of the innovation programme, these criteria could be:

- Energy criteria: for example, energy demand reductions from smart building solutions, heat recovery from waste, utilisation of renewable energy, generation of renewable energy.
- Environmental criteria: such as reduction of greenhouse emissions, reduction of air pollutants.
- Economic criteria: total costs, return of investments, payback period.
- Social criteria: acceptance of smart solutions, awareness and perceived impact of the programme.

Tools

These could be for example tools for opportunity mapping, for modelling and evaluation, for impact assessment, for verification and calibration.

Data

Data are crucial as these are needed to feed the tools but also to define the right evaluation criteria. When dealing with data the first step is to make sure which data are for and from modelling. Then it is important to define data requirements and their sources, together with uncertainty factors that must be included.

If you want to dive deeper in one of these aspects, more can be read in the Guide *Prototype smart energy district planner*, available at the following link:

D1.5_-_Prototype_Smart_Energy_District_planner.pdf (ruggedised.eu)

5   Smart City Design and Decision Platform (Urban Data Platform)

Urban Data Platforms (UDPs) are defined as an infrastructure to process, use, and share data (public or private) in the city. These are an essential mean towards smart cities.

One of the main functional aims of UDPs is to derive insights on the current functioning of the city. Those insights are input to support decision making over various domains. These insights could be:

- *Operational insights:* to understand the properties and characteristics of urban objects and activities, and to derive opportunities for improvement of e.g. public real-estate and public services to citizens.
- *Critical insights:* to monitor and derive recommendations for responses to incidents or crises.
- *Analytical insights:* to identify and assess patterns and correlations to subsequently derive forecasts on urban innovation. Additionally, for impact assessment of urban innovation measures and the derivation of evidence on challenges and opportunities in the urban environment.
- *Strategic insights:* to facilitate overarching strategies among goals, plans and decisions in the urban environment

In order to ensure the proper uptake and impact of UDPs it is important that the UDPs are embedded in the entire local government. This means that the local government should define a wide strategy on producing, processing and using city data. Data management challenges, e.g. availability, quality, interoperability, ownership/governance, privacy, valuation and monetization are essential elements of a city data strategy and influence the design of the UDP.

While the UDP requires the central role of the local government, it is important not to forget about the other relevant stakeholders involved not only in the design and implementation of the UDP but also in its use. In fact, stakeholders should have sufficient trust in the UDP for sharing data and using the UDP to create new use cases. Therefore, creating an environment in which involved stakeholders have trust in each other and in the UDP software, hardware and governance, is of utmost importance.

In general, UDPs should be developed in a demand-driven manner, based on a user-centred business model. However, it is recommended to incorporate sufficient room in the platform design to cater for the unknown or future demands. In addition to economic aspects, the business model should also account for the environmental and social aspects. In order to have a city-wide impact, the UDP should address needs of the politicians, planners, businesses and citizens. Already in the development process, clear value cases should be defined together with the potential users. UDPs could go beyond data sharing and further support the decision-making of the local governments and, to a varying extent, of citizens and businesses in the city. Moreover, the UDPs enable the co-creation of digital products and services by the various stakeholders. The added value of the UDP should be evidenced by means of functional prototypes to convince the potential users and data providers of its added value.

In line with a demand-driven strategy, the UDP should be visually appealing and convenient to use by the target groups. This entails convenient APIs, user friendly interface, open source development, cost efficient, and innovative visualization (3D, VR/AR).

Depending on resources and expertise available, the municipality needs to make an important decision whether or not to develop, host and maintain the UDP in-house, or partly or completely outsource the development, hosting or maintenance of the UDP. This process is critical for the success of the UDP and needs to be done at all times with an agile and user-centric philosophy with room for innovation (due to the rapidly evolving technological change in this field), while preventing vendor lock-ins.

All these factors are captured in an UDP development process consisting of 5 main phases. The depicted development process provides guidance for cities that want to start with development of a UDP, leads them through the different phases, and provides an overview of the aspects to consider in each phase.

Ecosystem readiness assessment	Assess the city's readiness for smart initiatives and its city data ecosystem.
City Data Vision and Strategy definition	Establish a clear and supported vision and strategy on city data and the role of the UDP and operationalise it in policies and plans.
Making the case	Develop the purpose, functionalities and business case of the UDP. Design the governance framework to ensure that the UDP will fit the requirements regarding data access, supply, privacy and ownership.
Building the UDP	Development of the UDP and translation of the governance framework and UDP design into governance agreements.
Making the case	Exploitation and utilization of the UDP.

Figure 4 Five steps to develop Urban Data Platforms

If you want to dive deeper in one of these aspects, more can be read in the Guide *Guidance on Smart City Design and Decision Platform*, available at the following link:

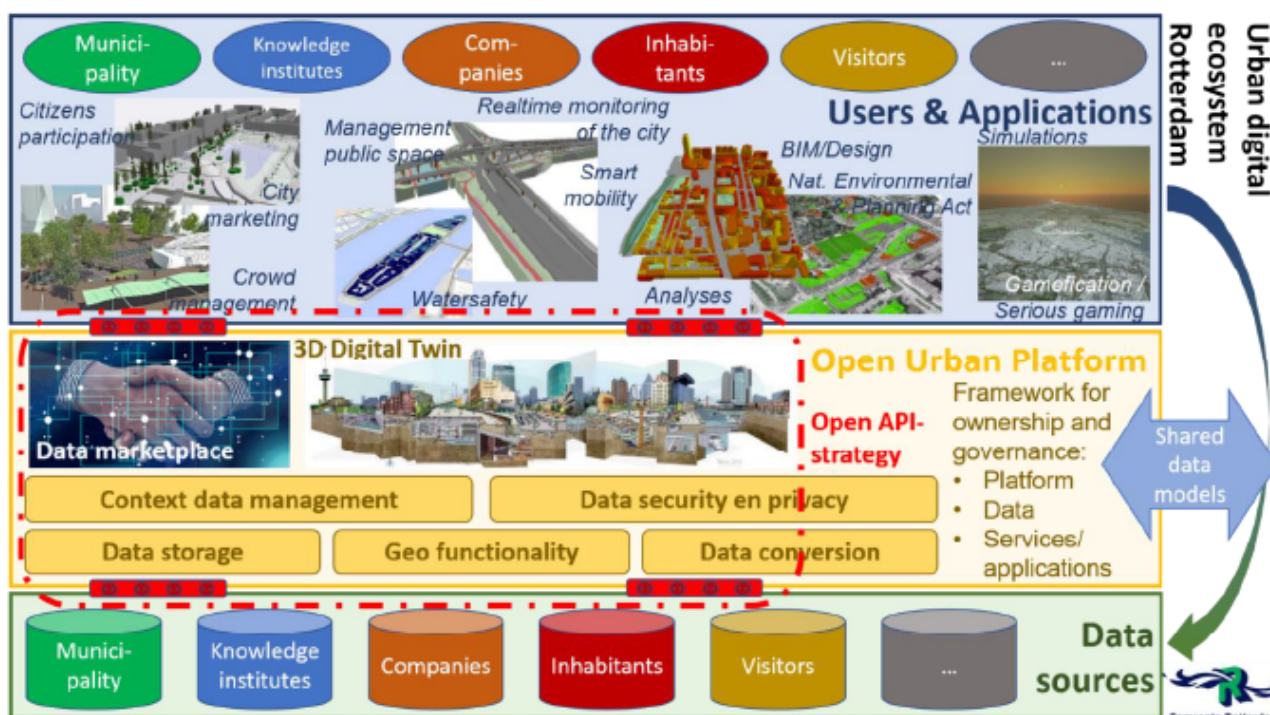D1.6_-_Guidance_on_Smart_City_Design_and_Decision_Platform.pdf (ruggedised.eu)

Figure 5 Example: The UDP embedded in the Rotterdam Ecosystem of stakeholders, data sources and functionality

6   Conclusions

Setting up an innovation programme for the design, implementation and upscale of smart solutions in a city is extremely complex. The Innovation and Implementation Framework aims at providing support to cities for the definition and operationalisation of smart solutions. It addresses the main technical and socio-economic challenges and contextual factors that positively or negatively influence local innovation and the implementation of smart solutions. The framework can be used by city planners and other actors to prepare the implementation process and to assess what aspects need additional consideration. Such assessments stimulate continuous learning of all partners by exploring obstacles that might appear during the process.

From lessons learned on the implementation of smart solutions in RUGGEDISED, the following recommendations to overcome barriers RUGGEDISED are summarized:
- Treat complex innovative projects, such as RUGGEDISED, not as standard urban development projects but as innovation programmes;
- Create a joint and binding vision together with the relevant stakeholders to create trust and give guidance;
- Position the innovation programme strategically within the (municipal) organisation;
- Foster cooperation among project partners;
- Foster vertical alignment and cooperation among operational, tactic, and strategic levels within the (municipal) organisation;
- Embed the smart solutions in the existing urban (infrastructure) configuration;
- Build flexibility in the programme itself and in the contracts;
- Think of ways to ensure the success of the programme beyond its life span for a bigger impact.

Next to this, three other guidelines were defined based on the work done in the Liaison Groups:
- D1.5 – Prototype Smart Energy District planner
- D1.6 – Guidance on Smart City Design and Decision Platform
- D1.8 – Guide on RUGGEDISED implementation and innovation of smart solutions

The "prototype Smart Energy District Planner" (SEDP) is a set of analytical tools and a framework for application to support the decision-making process and design of smart solutions. It guides developers step by step through several decision points that involves four key elements:
- the **criteria** against which performance is being judged;
- the **people** needed to make a robust decision;
- the modelling **tools** required to support the process;
- the performance **data** required to compare performance against the specific evaluation criteria.

These elements combined help reduce (but does not eliminate) risks, including design time being wasted on a weak or inappropriate design solutions and ultimately of a smart solution performing poorly when physically realised.

Urban Data Platforms (UDPs) are defined as an infrastructure to process, use, and share data (public or private) in the city. These are an essential mean towards smart cities. One of the main functional aims of UDPs is to derive insights – such as operational, analytical, critical, strategic – on the current functioning of the city. Those insights are input to support decision making over various domains. UDPs should be well embedded in the entire local government. It should be demand-driven, and it should be design, implemented and upscaled together with the relevant stakeholders.

The guide on the implementation and innovation of smart solutions developed in RUGGEDISED presents a step-by-step approach for cities to embed their urban innovations into the wider perspective of an urban innovation programme and support them capturing the lessons that these innovations provide. When setting up an innovation programme, it is important to pay attention to the following aspects that can determine the success or failure of the programme:
- Cooperation in innovation partnerships
- The changing role of government in society
- The structure and organisation of public administration
- Spanning judicial boundaries

- Sustainable financing, collaborative business models and procurement
- The role of knowledge in urban policy making