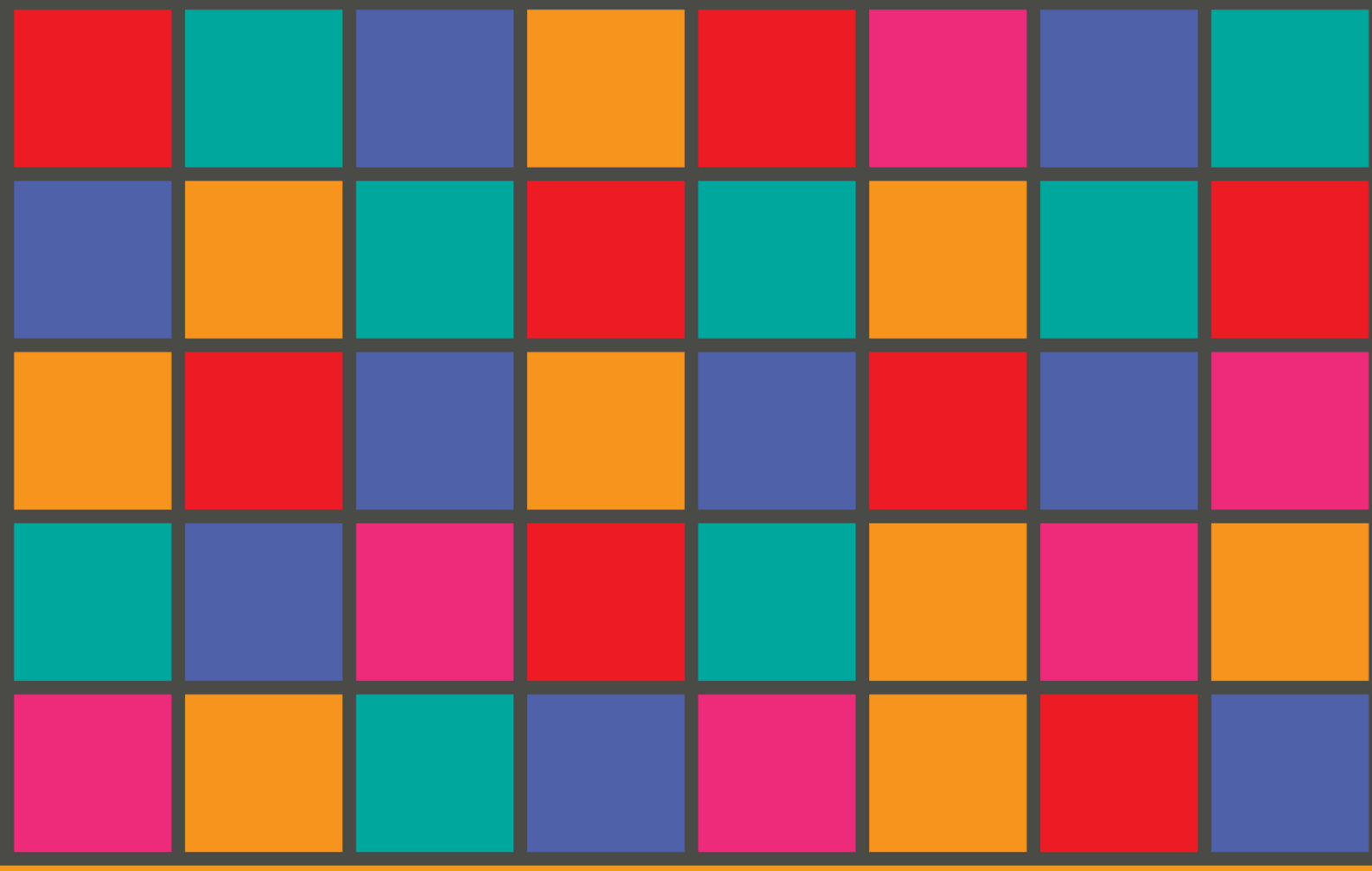

Systemic Changes in Governance

Equipping local governments for realising climate-neutral and smart cities

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1. What & Why

This governance solution booklet brings together the wealth of experiences of all cities that take or took part in the Horizon 2020 Smart City Lighthouse (SCC-01) projects between 2014 and 2022. These lighthouses are deep demonstrators of energy-efficient and smart buildings, clean mobility and logistics, and smart use of urban data in advanced IT infrastructures. They could not have been achieved without intensive engagement of and co-creation with citizens, businesses and other stakeholders, without bold city visions and political leadership, without innovative ways of finding finance and business opportunities, without working across domains and experimenting with new processes, roles and organisation chart within city administrations, and without in-depth peer-to-peer learning.

Currently, this community counts 42 of such 'Lighthouse cities', and 78 'Fellow cities' eager to implement adjusted versions of these demonstrations in their own areas. Together these 120 cities and their partners are sitting on vast body of knowledge and experiences that is highly relevant for any city administration looking for good examples that help to create climate-neutral and smart cities, including those that: are member of the Covenant of Mayors and want to implement Sustainable Energy and Climate Action Plans (SECAPs); signed up to Sustainable Urban Mobility Plans (SUMPs); are working on digitalisation to achieve the goals of the Green Deal; are working on climate-neutral city contracts as part of the Mission on Climate-neutral and Smart Cities; and also those that want to achieve their local or national targets in a sound manner.

In this booklet, we have harvested the main recommendations flowing from the collective intelligence from the 120 cities participating in Smart City Lighthouse projects, exemplified by best and good practices. We hope it provides not only inspiration for adjusting these solutions to your own local situation, but also helps to build the tenacity needed for these trajectories, and to consolidate its learnings in an accessible way.

1.1. What is meant by changes in governance?

This section explores what is meant by changes in governance and governance structures for municipalities and local innovation ecosystems.

The solutions presented in this booklet, are based on profound changes in governance introduced by local governments during or as a result of their Smart City Lighthouse projects, which go far beyond business as usual. While these changes might or might not yet be formalised in specific governance structures, they provide inspiration and best practices to a wide audience.

The Task Group Replication and City Coordinators Group of the SCC-01 project community consider governance structures as "the framework of rules, procedures, roles and responsibilities that constitute decision-making processes and project management". Such structures are about the

formal organisation of the work to realise climate-neutral and smart cities, both at the level of individual projects and programmes and at the level of the municipal organisation. This solution booklet looks at the most important changes in governance that have been experienced as useful and helpful in furthering climate-neutral and smart cities, irrespective of whether they have been formalised or not.

It is clear that governance for creating climate-neutral and smart cities covers many different domains and topics. For this solution booklet, these have been summarised in the **six broad categories** of relevant aspects of governance described below. The categories broadly reflect the internal and external organisation and collaboration processes of local governments, which are taking place within the wider context of regulatory frameworks and a specific learning environment:

City vision and long-term transformation plans

This is about the presence and quality of city visions as backbones of urban change, and how this vision is translated into long-term territorial transformation plans. Political approval, ownership and leadership are important elements to guarantee the implementation of long-term plans, but these are vulnerable to election cycles which might lead to changes in priorities detrimental to the execution of those long-term plans. Apart from this, the implementation of long-term transformation plans can hugely benefit from agile piloting and experimenting, as these can help to feed novel and innovative yet validated experiences and knowledge into the plans. Section 4.2 will discuss this topic in more detail.

Transforming the internal organisation within the city administration

This is about how working across silos within local governments can be facilitated by making changes in the organisational structure and/or responsibilities of municipal employees, and by sharing urban data. It also deals with how better collaboration can be established with other levels of government and with other local authorities as utilities and government-owned energy companies. Section 4.3 summarises several good practices for better internal municipal collaboration.

Participation strategies and co-creation

Participation strategies are an important element of governance, because cities are legally obliged to consult and engage with citizens, local businesses and other stakeholders, and the viability of plans is much higher when their support is secured through co-creation. What is more, good participation strategies are also a vehicle for harvesting good ideas of citizens and local businesses, and for making use of their excellent knowledge of the local situation. How stakeholders are identified, contacted and involved, how communication and collaboration are taking place in reality, and how successful co-creation and possibly also co-production are set up, is key to any climate-neutrality plan. The local media can play a significant role in reaching out to citizens and other stakeholders. More details can be found in section 4.4.

Public-private collaboration, business models, financing and procurement

City administrations cannot achieve their goals on climate-neutral and smart cities, without collaboration with the private sector. While the previous category of governance aspects focuses on collaboration with citizens, this category focuses more explicitly on collaboration with businesses as solution providers and investors. Several cities have experimented with different approaches to and vehicles for collaboration with the private sector to promote sustainable, climate-neutral and smart cities. Often it has worked well and deserves wider adoption. Collaboration can be informal and loose, or more formalised in the form of a public-private partnership. Closely linked to this public-private partnership is how the transition to climate-neutrality is financed, often by a combination of public and private means. Having sustainable procurement processes in place can play an important role as it can be a key tool for ensuring other arguments than economic ones are considered when contracts are selected, such as reduced air pollution or prevention of energy poverty. In section 4.5, current issues are explored, and examples of innovative solutions given.

Regulatory frameworks

Many cities experience regulatory difficulties when preparing and implementing climate-neutrality project portfolios and programmes. Quite often, these difficulties result from national legislation that is lagging behind with respect to introduction of new technologies or does not allow selling excess renewably produced energy back to the power grid. European and national competition rules might limit sustainable procurement, while local or regional rules on preservation of heritage and cultural landscape might hamper possibilities for renewable energy through permission granting. A city's journey towards climate-neutrality may be constrained by these regulatory frameworks, which might need adjustment or require derogations. Chapter 3 sketches the average regulatory landscape for climate-neutrality in cities across Europe.

Learning within and between cities

Smart City Lighthouse projects, living labs, pilots and the like have demonstrably been key to building up local knowledge and experience, thus facilitating wider application of successful solutions within cities' own jurisdictions, and to Fellow cities, often after making some adjustments and amendments for other contexts. Collaboration within SCC-01 projects between different European cities and within the SCC-01 community in specific task forces, complements this local knowledge and experience with more information from regional and international networks. It has provided and still provides a learning environment, also for new national and European initiatives, for instance the Mission on Climate-neutral and Smart Cities. Chapter 5 provides advice and best practices on how

to facilitate learning within cities and their local innovation ecosystems, as well of learning from city to city.

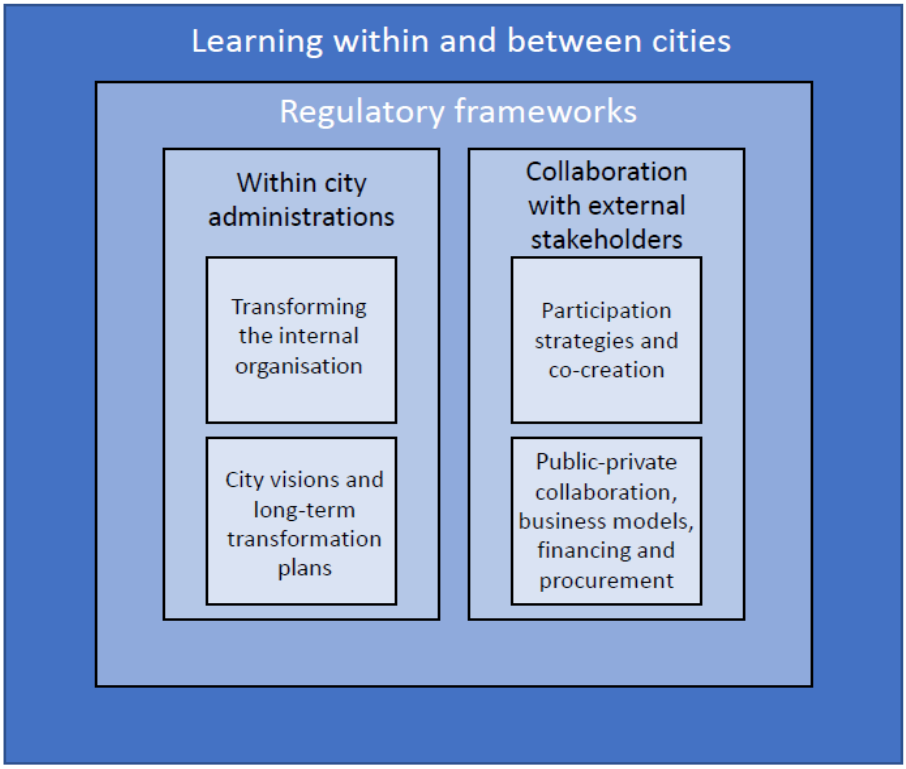


Figure 1: Six broad categories of governance aspects relevant for climate-neutrality

Of course, there are many connections between these six broad categories. For example, the buy-in by citizens for a plan will help to find easier finance and funds for its implementation. Similarly, there are examples of how working across silos can help to reach out to citizens in a more comprehensive way or to identify prohibitive regulations. All main categories of governance aspects in Figure 1 are connected and can mutually reinforce each other in a positive way.

1.2. Why is systemic change in governance needed?

Key questions are why changes in governance are needed to bring about climate-neutral and smart cities, and when and why these changes need to be systemic. Depending upon a multitude of unique factors, such as the local situation, culture and customs, national regulatory frameworks, particular morphologies and contexts, answers to these questions will be highly different. There is not a "One size fits all" for the governance of planning and implementing a climate-neutral and smart city. However, despite the uniqueness of local situations and contexts, specific barriers and obstacles pertinent to climate-neutrality trajectories in cities are quite common.

Common barriers and obstacles

City administrations are usually the spider in the web: they play a key role as orchestrator of the uptake of smart and climate-neutral solutions in their jurisdiction. However, a set of very persistent and highly interrelated barriers and obstacles slow down the pace of the transition to climate-neutral and smart cities. Based on the overviews by (PWC et al. 2016), (Mosannenzadeh, Nucci, and Vettorato 2017), (Vandevyvere, H. 2018) and (Dinges et al. 2021), the most common barriers and obstacles from a governance viewpoint can be summarised here as follows:

- Continuation of business-as-usual is too easy for city administrations and other organisations, due to lower risks and transaction costs, while change is much harder to accomplish, in particular behavioural change of citizens and local businesses.
- Lack of political support may lead to an implementation gap for concrete measures. Especially the short timeframe of the current political cycles, as described in section 4.2, can make it difficult to create the commitment for realising long-term plans and corresponding long-term investments.
- Once going external, local governments often have to face that they are highly dependent upon a wide range of stakeholders for the successful preparation and execution of their climate-neutrality agenda (section 4.4). These stakeholders might be difficult to access and engage, be having other priorities or held back by a limited financial carrying capacity.
- Often, too much emphasis is put on the unique local context and situation, resulting in customised but less replicable and more expensive solutions.
- Upfront investments are often costly and operational savings alone, in form of avoided energy costs, can many times not fully compensate for this. At the same time, local governments' own budgets are usually not large enough to cover the investments needed. When external finance is sought for clean solutions, these high upfront costs and the rather long period before return on investment takes place, make business cases and business models less attractive or viable.
- Benefits from measures can be experienced by others than the party bearing the costs (the so-called split incentives). At the same time, financial viability assessments of climate-neutrality measures more often than not fail to include secondary benefits for society, such as more comfort, less pollution etc. Besides, they seldom include the willingness to pay of local stakeholders for other reasons than financial ones. With innovative value capturing methods still in their infancy, this makes business cases and models of climate-neutral solutions less attractive.
- As a rule, regulatory frameworks are designed to maintain the status quo rather than for future-proofing a city.
- While planning and implementation of climate-neutral and smart city solutions usually require multi-disciplinarity and cross-domain working, these are often found lacking for

making fast progress, due to the infamous siloes, not only in local governments (section 4.3), but also in businesses and research partners.

- And lastly, national or EU regulatory frameworks can be significant roadblocks for wider uptake, for instance by not allowing specific products or technologies, lacking the flexibility in roles and mandates needed for decentral solutions, or hampering pre-commercial and sustainable procurement.

Business-as-usual does not suffice anymore

These common barriers have all profound links to urban governance of pathways towards climate-neutrality. Due to their work on implementing Smart City Lighthouse projects, and for some on preparing climate-neutral city contracts, more and more city administrations realised that for governance, "business as usual" will definitely not suffice anymore to achieve their ambitions on climate-neutral and smart cities. As a consequence, the overall pace of the transition to clean energy and mobility is simply too slow, the scope and depth of the transition are often too limited, and capacities and resources of local governments for adequate policy implementation frequently fall short. Current ways of governance and governance structures simply do not fit the bill. While the necessity to make profound and systemic changes to governance and governance structures is clear, it appears to be not so easy to do so.

Local impact of climate change is increasingly felt

When targets are not met, citizens, local businesses and other stakeholders will increasingly be confronted with the negative consequences of climate change, such as more droughts, heat stress and heavy storm water flooding, failing infrastructures, higher fire risks, lower productivity etc.

Figure 2: Rubble and destruction in Wennington, London, after a large blaze as the UK experienced a record-breaking heatwave. Photograph: Leon Neal/Getty. Source: The Guardian, 20 July 2022

These consequences can have a deep and disruptive impact on local quality of life, the environment, biodiversity, health and the economy. The effects of the recent heatwaves in Europe in July 2022

testify again to this. Other ways of working are urgently needed, and governance is an important part of that (Hölscher, Roorda, and Nevens 2016), (Droege 2006).

Bringing about changes in governance

In recent years, many programmes, initiatives and researchers have looked into the possibilities of bringing about the desired changes in governance and having innovative ecosystems in place that help to make cities more sustainable, energy-efficient and low-carbon. For instance, using concepts such as the Renewable City (Droege 2006), Smart City (Mosannenzadeh, Nucci, and Vettorato 2017), Positive Energy City (Vettorato et al. 2021), Wellbeing and Healthy City (Varcities 2021) and most recently the Climate-neutral City (NetZeroCities 2022).

All analyses come to more or less the same conclusion: that one of the key issues requiring a change in governance is the discrepancy between on one hand a strategic vision on how the city as a system should develop, and on the other hand the complexity and fragmentation of the system(s) in need of change. The strategic vision defines then one or more precise objectives, such as the reduction of greenhouse gas emissions or the transformation of a city into a more resilient one. But at the same time, the complexity of the city as a socio-economic-infrastructural system, and its fragmentation in terms of responsibilities, actors and procedures, make the realisation of this strategic vision very difficult. There is for example fragmentation into silos within the municipalities, lack of communication and trust between the public and private sectors, lack of coordination or resources for coordinating complex projects, or a need for cultural and behavioural changes.

As a result, a major gap exists between technological progress, in terms of solutions available on the market, and the capacity of 'city systems' to adopt these solutions on a large scale, for instance for renewable energy, electric mobility, distributed management, energy storage, nature-based solutions, etc.

As Einstein already remarked, *"Problems cannot be solved with the same mindset that created them".* Complex systems such as cities cannot be changed by following the same rules that created them. Therefore, systemic change must start with an overall rethinking of the way cities function and their respective governance systems.

Transformative governance

Only fundamentally different approaches to governance and governance structures are able to bridge the gap between technological progress and the capacity of 'city systems' to adopt these solutions on a large scale and address the challenges of climate change and other sustainability issues. Such new approaches to governance must involve formal and informal institutions, and both public and private sectors - at multiple scales – to bring about positive changes towards sustainability by addressing both social and ecological aspects. Moreover, these new approaches must tackle the intricacy of modern society's decision-making processes and align different branches and levels of governance better (OECD and International Institute for Applied Systems Analysis 2020).

The so-called transformative governance approach, although still largely academic, provides interesting clues for systemic changes in governance, needed for pathways towards climate-neutrality and other global sustainability goals. This innovative approach is defined as a set of formal and informal, public and private rules, decision-making systems and networks of actors at all levels of human society, that enable transformative change towards sustainability (Könnölä et al. 2021) and (Visseren-Hamakers et al. 2021). The term implies that we need *not only modes of governance* that are capable of steering transformations, but also *a transformation of governance itself* (Chaffin et al. 2016). This immediately brings in a political dimension, as the desired direction of transformation is often contestable and power relations between actors, even within local government departments, may change. For example, in local public administration, there will be a need to review decision-making and process structures that may inhibit, challenge, slow down or reduce transformative change for sustainability, for instance regarding the use of certain technologies, or regarding the functioning of certain sectors and institutions.

The transformative governance approach can be structured around four jointly implemented key principles to address in particular the indirect drivers of sustainability problems

Based on (Chaffin et al. 2016), (Könnölä et al. 2021) and (Visseren-Hamakers et al. 2021) we suggest to use the following guiding principles when designing and implementing a transformative governance approach for climate-neutrality:

1. **Adaptivity** enables learning, through experimentation, in coping with the complexity of transformational change. Adaptive governance makes continuously use of iterative learning opportunities, to be able to adapt responses to uncertainty, social conflict and complexity over time.

2. **360º knowledge systems** are needed to assess transformation processes, to understand their potential consequences, to track how the costs and benefits of transformation are distributed (often unevenly), and to adjust where necessary. Current knowledge production often lacks multi-disciplinary and multi-sectoral contributions. Organising this multi-disciplinary and multi-sectorial input facilitates a much broader view upon the (potential) impact of the transformation, for instance by giving insight into social and economic consequences as energy affordability and energy poverty. Collaboration with other sectors, disciplines and actors on knowledge production generates in the end more credible, legitimate and actionable knowledge outcomes. In particular, it is essential to link the knowledge systems of science and practitioners to policy makers.

3. **Integration** ensures that local solutions have sustainable impacts elsewhere: on other scales, other locations, other issues and other sectors. Unfortunately, complex issues are still mostly governed independently of each other, often in silos. This leads to inconsistent and sub-optimal results. Integrative governance proposes using three approaches together to optimise results:

- A combination of governance tools to address simultaneously the deeper causes of a specific sustainability problem.
- coordination between sectors, issues, levels of governance and places, for example through interaction management tools and meta governance (e.g., coordination of one or more governance modes).
- integration of sustainability issues in different sectors (e.g., through integration and mainstreaming of environmental, climate, energy, health policies, etc.).

4. **Inclusiveness** empowers those whose interests are currently not met and who represent values that embody transformative change for sustainability. Inclusive governance ensures participation in decision-making to capture diverse values, improve capacities and promote accountability, legitimacy and just outcomes, to rights, knowledge and stakeholder. This includes the recognition of practices that give rise to gender, cultural or racial inequalities. It also identifies and engages vulnerable social, economic and institutional structures, where bearers of knowledge and rights are often excluded from decision-making processes.

This solution booklet

So far, governance changes have been often a by-product of other activities. Explicit governance-related actions in sustainable transition projects were frequently reduced to individual business models, roadmaps for groups of solutions or separate participatory activities.

The key starting point for transformative governance is to embrace the principles sketched out above and commence working explicitly with governance changes as an integral part of the clean energy and clean mobility transitions. Importantly, this also entails that the links between innovative solutions or technologies and governance on local level, in terms of organisational structures, strategies, competences, and processes, should be thoroughly explored. Subsequently, city administrations need to evaluate their overall ability to work towards energy and mobility transformation on systemic level and seek ways of improving it. Isolated pilot projects disconnected from key actors in the city and dedicated activities focused on governance cannot effectively contribute to this.

In this solution booklet, we describe innovative and tested governance and governance structures, which have demonstrated that they work and have proven their value. The booklet gives many concrete examples of how to make these changes. Together, they may provide an impetus to local implementation of the transformative governance approach, needed to address the deeper causes of current barriers and obstacles.

2. What is in it for cities?

Achieving local, regional/national and European climate and energy efficiency targets requires a huge paradigm shift and systemic changes in current governance practices. This solution booklet gives practical advice on the process and key enablers which can help to accelerate cities' transition towards climate-neutrality. It provides tips & tricks for local government on how to organise themselves, work together with stakeholders, realise long-term visions, find innovative ways for financing the energy transition, and learn from experiments and each other. The final aim is to overcome the barriers and obstacles sketched in section 1.2. All recommendations and examples are coming from the community of Smart City Lighthouse projects. We hope all municipalities in Europe get inspired by this and "try this at home!"

2.1. Do try this at home!

What can city administrations gain from implementing the changes in governance explained in this booklet? Here, the main benefits are briefly highlighted.

Standing on the shoulders of giants

Recommendations and examples in this solution booklet are based on real life experiences. The 140 cities participating in Smart City Lighthouse projects, have built a wealth of experience on preparing and implementing ambitious projects working towards climate-neutrality in districts and cities in an integrated and smart way: working on energy efficiency of buildings and infrastructures, clean mobility and logistics, realising bold city visions through in-depth citizen engagement and innovative, smart technologies. Although situations differ across Europe, much can be learned form each other. Municipalities can save time and resources by not reinventing the wheel and adapt recommendations and examples to their own contexts.

Testimonial: Practitioners can "exchange examples of these new types of governance, which helped innovators and their stakeholders to understand the ecosystem they are (can be) part of, how they are related, and what interventions made it work better" (Muriel Pels, IRIS).

Faster progress towards climate-neutrality goals

Realising climate-neutrality goals is not easy. The recommendations on governance in this solution booklet enable a faster and more effective realisation of plans, so progress can be shown to and shared with citizens and other stakeholders. Key is an ambitious yet realistic long-term vision, achieved by building consensus with all relevant stakeholders. This builds resilience in the local innovation ecosystem and makes plans less vulnerable to political cycles. It will also help to find

finance and funding, an important roadblock now, as financiers will deem portfolios and programmes less risky when stakeholders are lined up.

Other complex problems require cross-domain working too

It is clear that to make progress towards climate-neutrality, smooth and in-depth collaboration between different municipal departments is a prerequisite. This booklet provides many good examples for how to organise this working across domains. These insights are also valuable for many other thorny and complex challenges requiring in-depth cross-domain working: unhealthy lifestyles, poverty and deprivation, shortages of affordable housing, poorly performing local economies, water pollution and other environmental degradation. Vehicles, organisation charts, roles, responsibilities and processes for working with different disciplines across domains can be also used to address these other challenges.

Co-benefits are benefits for other policy domains

Related to the above, the implementation of clean energy and clean mobility and logistics can also substantially contribute to realising the aims of adjoining topics and other policy domains. Usually, these benefits are referred to as "co-benefits". That might sound confusing, as for other policy areas these benefits are the main benefits. Well-known co-benefits of clean energy and clean mobility and logistics are quite diverse, for example: reduced air pollution and health benefits, reduced traffic congestion, reduced energy poverty, more indoor comfort and energy security, a higher quality of public space, preservation of cultural heritage and economic growth. On top of that, many lighthouse projects have demonstrated that co-creation with citizens and other local stakeholders has resulted in more social cohesion and inclusiveness, with people feeling they can make a valuable contribution to their own living environment.

Future-proof municipal assets, competences and staff

Traditionally, municipalities have a strong focus on providing legally required services and technical maintenance of municipal assets such as roads, housing, sewage systems and urban green spaces. Systemic changes in governance as proposed in this solution booklet, promote a holistic, long-term view of the built environment within the entire territory and aim to make these assets future-proof in the light of mitigation of climate change and provision of clean energy. What is more, some governance changes require a re-assessment of current competences, roles and staff. For instance, for in-depth collaboration with citizens and other stakeholders communication expertise is needed. Similarly, for energy planning of districts, legal expertise might be needed, or data scientists are needed for providing mobility as a service, in addition to engineers, to develop better ways of working. New roles and job descriptions or new procedures might have to be defined. The examples of changes in governance presented here provide an opportunity for Human Resource departments to recruit staff with different profiles to make the municipal apparatus future-proof.

Better negotiations with other local, regional and national authorities on vital conditions

When progressing towards climate-neutrality, municipalities have to work within the legislative frameworks of their region and country, thus with other government levels, such as ministries and provinces, and other local and regional authorities, such as water boards, municipal energy and waste management companies. The governance changes described in this solution booklet, make municipalities aware of how they can make informed proposals for changes in legislation, and negotiate with other government levels more favourable regulations and conditions for bringing about climate-neutrality.

Putting unhelpful regulations on the agenda in Norway

During the +CityxChange project, working on local Positive Energy Block (PEB) demonstrations in Trondheim revealed that eleven changes would need to be made to national energy regulations in order to move from an existing centralised energy system to a decentralized local energy system, enabling the creation of PEDs and Districts as well as climate-neutral cities.

The city, real estate owners and solution providers successfully applied for dispensations to be able to demonstrate a PEB at the Brattøra district, but this was a process that consumed a lot of time and resources and posed a considerable risk to the project in case it would be rejected. Such a process is not sustainable in a commercial market.

In order to remedy this, the municipality initiated a policy brief to inform national regulatory authorities, and invited other organisations from public and private sectors, research, chambers of commerce etc. to join in. A series of meetings and workshops was organized to integrate everyone's perspectives and agree on a common set of requirements. The resulting brief identified concrete barriers in the current energy regulations and ways to remedy them. As the brief was the result of a broad cross-cutting cooperation and an EU-funded innovation action, rather than the activities of one organisation, it was particularly well-received by the authorities, and the authors were invited for follow-up discussions. For further details, see (Myrstad, Livik, and Haugslett 2021).

Legitimacy

Nearly all successful climate-neutral and smart city projects are founded upon successful mutual collaboration between local administrations, research institutes, industry, citizens, local businesses and other local actors. Due to the complexity of these projects, many different stakeholders must be engaged, and diverging interests must be aligned. Stakeholders come from a tremendously wide variety of backgrounds: they can be tenants, owners of buildings and land, NGOs, shops and facilities as schools and hospitals, public transport, energy supplier, energy network operators, businesses such as solution providers, start-ups, real estate developers, consultancy, research and so on. It is not surprising that an important reason for failure of climate-neutrality plans is that citizens and other stakeholders are not fully on board (Drews and van den Bergh 2016).

Throughout the process, all stakeholders and citizens must be invited to contribute to and kept engaged in co-design, co-creation and co-realisation of climate-neutrality plans through communication and in-depth participation. This often goes far beyond what is legally required in

terms of citizen participation. However, it contributes significantly to legitimacy. Not only is it more democratic, but it also empowers citizens and gives them agency and a sense of ownership. By sharing responsibilities, citizens, local businesses and other stakeholders can become agents of change, putting forward valuable suggestions and promoting sustainable behaviour (Hajer 2011). Establishing an energy community is a good example of this. Citizens might also partly finance measures and plans. Pride in joint achievements can make citizens ambassadors for climate-neutrality plans, who inform others about positive results that have been booked; adding to a sense of belonging and community.

Another, often overlooked, aspect of legitimacy concerns whether and how co-created results are adopted by democratically elected mayors, vice-mayors and city councils, and subsequently integrated in mainstream policies. When ambitions grow from climate-neutral and smart districts to entire cities, the design of good processes for political mainstreaming of co-created plans will become more and more important. This solution booklet presents several examples for doing this without compromising the responsibilities of democratically elected representatives.

More possibilities to finance the energy transition

Many municipalities are used to financing project portfolios and programmes from their own budget, through procurement contracts. However, the investment costs can be prohibitively high or return on investment may take a long time. This solution booklet shows that there are also other possibilities for financing the energy transition, such as crowdfunding, tax incentives and private and blended finance. Climate-neutrality plans can also be realised, at least partly, by energy communities, or by building owners prepared to bear a part of the financial burden. This solution booklet gives municipalities examples of other avenues to fund portfolios and programmes.

Branding of innovative local ecosystems

The enormous investments to be made in the built environment (construction, building envelope, installations, appliances and infrastructures) and energy system (renewable energy production, district heating, power grids, distribution, storage and exchange) can reinforce local economies and create a large number of new jobs. Often, they are also opportunities for applying innovative technologies.

In addition, the governance changes recommended in this booklet are a clear example of open innovation (Citizen Engagement solution booklet). These open innovation processes can make the municipality an attractive partner for testing innovative solutions in innovation playgrounds or regulatory sandboxes, in particular for start-ups and scale-ups, and an attractive employer for future employees. In this way, the best governance practices contribute to branding of the innovative local ecosystem in the municipality, facilitating the attraction of talent and capital and consolidating its position.

Nordic Edge brands Stavanger as a Smart City

One of the activities in the Smart City Lighthouse project Triangulum was to organise a yearly conference in the field of smart and sustainable cities. Nordic Edge is a non-profit organisation owned by private companies working in close cooperation with municipalities and city administrations to promote solutions for smarter cities and communities. Nordic Edge has become one of Europe's most important arenas for knowledge exchange and inspiration to creators of smarter businesses, cities and societies. By this expo and yearly conference, Nordic Edge has firmly established Stavanger's position as a Smart City and branded its local ecosystem as a highly innovative one. The activity level in Nordic Edge is increasing after winning several project proposals, both within Norway and from the European Union. One of these is NEBSTAR, with Stavanger and a few other municipalities being one of the five lighthouse demonstrators of the New European Bauhaus. Another one is Nordic Edge establishing a Digital Innovation Hub with several companies, Norwegian regions and agencies, and many other partners.

2.2. For whom?

This solution booklet is primarily meant for city administrations, local politicians (Mayors, Vice-Mayors, Councillors and their staff), smart city project managers and other local authorities, e.g., public transport, housing, utilities or waste management.

However, it can also be very useful to get all partners in the cities' innovation ecosystem on the same page. For instance, businesses (energy network and transport operators, real estate developers and facility managers, solution providers), financial institutions such as banks, pension funds or private investment funds, and civil society, e.g., housing associations, citizens and local companies, Non-Governmental Organisations (NGOs).

Other government levels, such as regional and national governments can also use it to investigate where collaboration with municipalities can be improved and where support for the proposed new ways of working could help to accelerate climate-neutrality plans.

3. Legislative and regulatory frameworks for governance

This section sketches out how governance is commonly organised and provides some practical background in terms of the main laws and regulations that apply in and for cities on their road to climate-neutrality. It is largely based on the situation in Germany, but in general the main elements are also valid in other European countries.

State of Art of legislative and regulatory frameworks

Usually, local governments have limited abilities to make changes to current governance practices, as they have to operate within the legislative and regulatory frameworks of their country or region, and municipalities themselves have only very limited legislative power (Knieling and Lange 2018).

It is self-evident that in this respect, there are considerable differences between European countries, stemming from the number of government levels, varying task and role divisions between them, and diverse legal and regulatory frameworks (Nadin et al. 2018). Only scant cross-country analyses have compared different approaches to governance of energy transition and climate-neutrality (Morlet and Keirstead 2013).

Nevertheless, a general impression is emerging from descriptions of how roles, responsibilities, processes, procedures are organised for several countries. Urban energy governance is usually strongly influenced by and taking place in coordination with national and/or regional energy policies and the conditions of their legislative frameworks for this (Knieling and Lange 2018). As spatial and transport planning are core responsibilities of local governments, we will focus on them in this section for sketching the framework within which municipalities have to operate for their governance.

Usually, energy planning is integrated in spatial planning from local to regional and national level by setting out requirements for energy storage, energy efficiency of buildings and infrastructures, and production of renewable energy for each scale level. As a rule, general objectives at EU and national level are adapted to specific conditions and needs of areas, and legally put into practice by regions and/or municipalities.

A Spatial Planning Act or similar generally sets overarching directives and guiding principles for land use planning at national or regional level, usually including sustainable development. Although these are usually hardly explicit on energy planning, depending upon the task division with regional government, they may provide directives and suggestions or mandatory guidelines on production, distribution and use of renewable energy, for instance by delineating specific priority zones for renewable energy production or specifying conditions for the development of such locations, legally binding or not (Radzi 2018). In addition, a Building Code commonly mandates the creation of urban development plans, usually based on principles of sustainable development, including environmental and spatial quality. The Building Code outlines requirements for procedures, construction,

environmental protection, etc., and stipulates how public and municipal participation should take place (Radzi 2018).

At local level, statutory zoning plans form the core of spatial planning, regulating volume and height of buildings, the use of buildings and land, locations available for development, open spaces and urban green, planning of public facilities and locations for infrastructures. Further, local building rules stipulate structural and technical requirements for buildings, outline procedures for permissions, specify energy efficiency standards for new buildings and those to be renovated, and determine what is allowed in type, size, place of RES installations (Radzi 2018). Additionally, municipal energy plans may indicate the potential of areas for renewable energy and which installations are allowed where. Lastly, municipal local development plans have to be developed for specific urban development, often at much smaller scales than zoning plans. They might regulate particular integrated energy concepts for (re)development areas, such as minimum energy efficiency standards, mandatory connection to district heating, and on-site generation of heat or power from renewable sources Local building rules, land use plans and plans for urban development, can together foster the implementation of energy-efficient buildings and the integration of renewable energy sources by creating the right conditions for this (Radzi 2018).

In general, spatial planning rules determine the volume and location of renewable energy. This is done by indicating maximum size and capacity, and by specifying which locations are not allowed because of negative impact on for instance architecture, landscape or safety or where and when compensating measures are needed. What is more, it determines the rights to electricity transmission and the power distribution network (Radzi 2018). It also regulates participation, ownership and development procedures for renewable energy sources, for public as well as private stakeholders. Usually, no planning permission is needed for small renewable energy sources as PV on rooftops, except for heritage sites and buildings. However, for larger installations, such as wind parks, large biomass facilities, solar farms, etc., a municipality's or region's approval is needed (Radzi 2018). More indirectly, spatial planning plays an important yet more indirect role through requirements on urban densities and multi-functionality for urban development and transformation. These may determine the feasibility of exchange of heat and power between buildings or areas, of possibilities for energy storage on site, and of district heating networks, in particular for low temperature heating networks, thus influencing the energy planning. Lastly, actual areal development is often taking place through concession agreements for areal development, with real estate developers and construction companies. These agreements can include climate and energy objectives.

In many EU member states, regional government is a crucial link between national goals and economic incentives, and local implementation (Knieling and Lange 2018). The region often plays an important role in decision making on larger facilities, such as solar farms, wind turbine parks, hydropower, biomass or bioenergy CHP facilities. These are needed to compensate for a city's use of energy by generation of renewable energy outside their territory. Although the combination of all these different demands for design of buildings, areas and energy networks seems to work well in

general, lack of agreement between different levels of government have frequently caused severe limitations, implementation delays, or less optimal decisions.

For climate-neutrality, local regulatory frameworks for transport are also very important. Usually, local governments work with multi-annual transport plans which plan public transport services and traffic flows for different modalities, attuned with regional and national level. In these plans, local governments work towards clean mobility and logistics, for instance by specifying locations for and constructing charging infrastructures for electric vehicles, by shaping opportunities for electric bike and car sharing schemes, by construction of separate bicycle lanes and of bicycle parking, and by promoting Mobility-as-a-Service concepts and clean last-mile solutions. Apart from shaping the right conditions for clean mobility and logistics for end-users, municipalities can also make direct investments in vehicles and infrastructures, such as electric or hydrogen municipal and public transport fleets, and intelligent transport systems. Lastly, concessions to public transport operators are a very important means to promote clean mobility and logistics, by setting specific objectives, conditions and performance indicators when contracts are procured.

Local or regional energy suppliers and transport operators might be partially or fully local or regional government owned. In some countries, deregulation and privatisation have made implementation of climate-neutrality plans quite cumbersome. As a result, some local governments have decided to re-municipalise their local energy supply or public transportation. The capacity of energy grids with the increase in renewable energy is more and more problematic, in particular for power grids. Municipalities have to negotiate with energy network operators.

4. Best practices on novel governance structures

In this chapter, we describe known innovative and tested governance and governance structures that have demonstrated that they work and have proven their value.

The important starting point is to make governance changes an integral part of the energy and mobility transition and to explore links between innovative solutions and local governance (organisational structures, strategies, competences, processes). So far, governance changes were expected to happen as a by-product of other activities. Explicit governance related actions in sustainable transition projects were reduced to individual business models, roadmaps for groups of solutions or participatory activities.

However, cities need to evaluate their overall ability to work towards energy transformation on systemic level and seek ways of improving it. Isolated pilot projects disconnected from key actors in the city and dedicated activities focused on governance can´t effectively contribute to this. Therefore, this chapter gives recommendations and examples for four quintessential fields of change.

- Making cities future-proof with city visions, long-term territorial transformation and piloting
- Transforming the municipal organisation
- Participation and co-creation with citizens, citizen-driven innovation
- Collaboration between public and private partners, securing finance and procurement

4.1. How to start

Several methodologies have been developed to set up a proper process for developing smart and climate-neutral city strategies and translating them in project portfolios and programmes, for instance the 'Urban Regeneration Models' of REMOURBAN, 'Cities4Zero' of SmartEnCity and the 'Smart City Guidance Package' developed by NTNU and the Smart City Marketplace. All these tools help to get an overview of what needs to be done and explain different steps. Municipalities can use these tools to gain insight into how processes can look like and structure their own processes using these tools.

For instance, the Smart City Guidance Package works with seven consecutive stages. These stages are based upon the Plan-Do-Check-Act concept, which is extended with a couple of stages which are deemed relevant for smart climate-neutral city plans: The 'vision' stage to develop or adjust the long-term strategy, the 'decide & commit' stage to explicitly consent to preparing the plan, and the 'replicate & scale up' to plan already for replication from the start. The order and description of the content of each stage are based on common experiences of cities participating in the European

energy award, lessons learned in the CONCERTO Programme, and material from interviews with managers of Framework Programme 7 and Horizon 2020 smart city projects. Finally, the stages consider that the UN Sustainable Development Goals have been adopted by the European Commission (EC) and are therefore relevant to European smart city roadmaps as well. In this context, the term 'cities' refers to city councils and city administrations. The term 'key stakeholders' refers to those stakeholders crucial for integrated planning and implementation of the smart city roadmap, such as citizens, transport and energy operators, and other businesses such as ICT companies, start-ups, local highly specialised SMEs, etc. Throughout the process, attention to keeping the engagement of all stakeholders and citizens must be ensured, through communication and in-depth participation, co-creation and co-realisation.

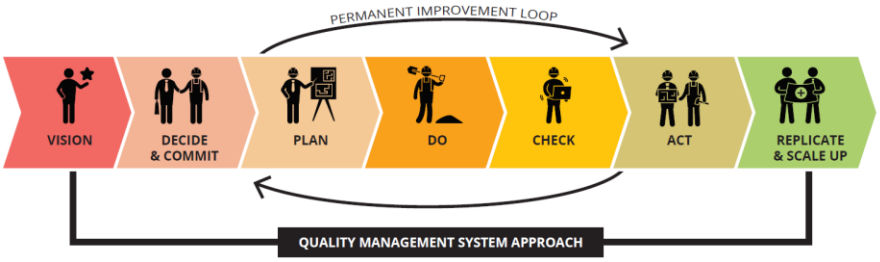


Figure 3: Stages from vision to implementation and permanent improvement loop. Source: (Borsboom-van Beurden et al. 2019)

4.2. Future-proofing cities by a long-term vision, transformation plans and pilots

Why is this so important?

Many cities work with an overall city vision or master plan, encompassing a comprehensive outlook on many aspects of the city: social, economic, environmental, spatial etc. Most SCC-01 cities base their work in the field of climate-neutral and smart solutions on the SECAP signed for Covenant of Mayors or similar plan, with many developing a bold city vision as part of the implementation of a Smart City Lighthouse. City visions and SECAPs then guide the choices to be made on urban transformation, both in the short and in the long run. Pilots can inform this decision and policy making by providing specific information on what works and what does not work. Overall, city administrations and key stakeholder across Europe increasingly realise that regular overall city visions and urban transformation plans usually do not suffice for bringing about the transition towards climate-neutrality for several reasons: the stated ambitions may not be high enough; the vision and transformation plan may not be feasible and actionable; or financial means for implementation are insufficiently secured. This section presents which changes in governance emerged as a result of implementing Smart City Lighthouse projects in the field of city visions, long-term transformation plans, experimenting and piloting. Interesting though, several cities interviewed

indicated that their application for Climate City Contracts as part of the Mission on Climate-neutral and Smart Cities set into motion a review of the suitability of current governance structures for developing and implementing city visions and long-term urban transformation plans, which resulted in proposed governance changes.

Defining a city vision on becoming climate-neutral

What?

The presence of an ambitious, comprehensive, operational and agreed upon city vision, is an important backbone for all governance of climate-neutral and smart city plans and the transformation of the urban fabric. Cities executing Smart City Lighthouse demonstrations have provided good examples of this through road mapping. Others upgraded their city visions, for instance by making them more operational through establishing short-term, intermediate goals, or raising their ambition level.

Many cities have tried to combine the desired technological changes with other changes. For example, changes in the social, economic or public space domain, in line with the needs and priorities of citizens, such as more well-being, or reducing energy poverty. As stakeholders are at the same time also investors, taking a broader perspective than only CO_2 reduction and energy savings, and including other topics relevant to daily life, helps to increase interest and willingness to participate. By focusing not solely on technological innovation, more support for long-term transformation plans is garnered, and ambitious goals become more attainable. An example of a model is certainly the process of creating the Bold City Vision in the +CityXchange project.

On top of that, working out the long-term vision by setting clear short-term or mid-term goals that fit within the local 4 to 5 yearly political cycles, helps to maintain momentum for and commitment to the long-term vision.

Why?

Unfortunately, such an ambitious, operational and agreed upon city vision and/or a long-term transformation plan is often non-existent. Even when such a city vision is present, it is frequently not advanced enough or lacks sufficient quality. While city administrations intend to become climate-neutral by 2030, they often have no idea how they will achieve it technically and socio-economically and are insufficiently aware of possible adverse effects on or synergies with other domains. For instance, the introduction of many heat pumps will contribute to renewable energy production but might create problems with the capacity of the power grid. A clear, realistic and feasible vision, considering the entire city system, is needed to address such problems with governance.

Additional problems regularly occurring when a vision is not in place or has insufficient quality, are:

- a lack of cross-domain integration, e.g., when implementing a SECAP, resulting in power struggles with other departments

- scarce or no operationalisation in concrete actions, so the vision, if it exists at all, stays a wish-list
- a lack of buy-in from key stakeholders to the vision, not only citizens and local businesses, but also energy network operators, housing associations etc.
- a lack of political support for the implementation

How?

First of all, a good vision must be developed through road mapping. There is a wealth of tools that can be used to do this: scenario planning, consultation of and co-creation with citizens and other stakeholders, SWOT-analysis, etc. The self-help guide 'Smart City Guidance Package' gives an overview of the main steps needed for creating a vision (Borsboom-van Beurden et al. 2019), (Borsboom-van Beurden et al. 2021) if one is missing.

Key ingredients of road mapping are:

- A more precise definition of the problem(s) that need to be addressed and its ins and outs
- Creating a common understanding and knowledge base
- Engaging and consulting the local ecosystem
- Exploration of different options
- Co-designing and co-creating solutions
- Achieving consensus on the best solutions
- Consolidation in an agreed upon document.

In the SmartEnCity project, the Cities4Zero tool was used for Vittora-Gasteiz, Sønderborg and (Urrutia, K. et al. 2019). The example of Sønderborg's Roadmap 2025 described below, gives an impression of how the vision was developed.

During the development or update of a city vision, a holistic perspective is an important part, as climate-neutrality usually requires the integration of not only different domains or disciplines and different stakeholders, but also of different technologies. For instance, systems thinking in the REPLICATE project helped San Sebastian, Florence and Bristol to identify who should be engaged, both within the municipality and other local authorities, and within the local ecosystem (Freeman and Yearworth 2017). Systems thinking helps in this way to identify what works for the entire system.

Climate-neutrality cannot be achieved without the help of citizens and other crucial stakeholders as owners of buildings, infrastructures and land, local businesses, operators of transport and energy infrastructures, and so forth. Therefore, the vision must be developed in an open innovation process through co-design and co-creation with the main stakeholders. This guarantees that citizens and stakeholders' opinions, desires and priorities, but also their suggestions and proposals, are part of

the targets and chosen pathways laid down in the vision. Section 4.4 provides many good examples on how to do this from the Smart City Lighthouse community.

Although most municipalities have a climate plan, it is often missing a far-reaching implementation programme, and an effective institutional framework addressing all possible fields of actions (Hirschl 2018). Therefore, to prevent that the climate-neutrality vision stays a "wish-list", cities should operationalise it in sets of concrete measures that the stakeholders can agree upon. In all investigated SCC-01 projects, this has happened in an iterative way: in each iteration, the most promising pathways and measures to achieve the overall aims are discussed with, detailed, prioritised and agreed upon by the key stakeholders, using criteria as current baseline, expected impact, financial aspects, maturity and expected feasibility of the proposed measures.

This iterative process can be difficult at times, due to a lack of incentives or the existence of disincentives for specific sectors of city administration or for key stakeholders, hampering collective agreement. The proposed strategy and policies can disrupt current businesses models and pose threats or opportunities. At this time, it is good to start thinking how the business model(s) might work: how will value (monetary and nonmonetary) be captured, against what deployment of human, technological and financial resource? To this end, the IRIS project adapted the Business Model Canvas tool, a popular tool for outlining and testing business models, for use by cities. All in all, by giving a voice to key stakeholders and engaging them in co-designing and co-producing the eventual solutions from the viewpoint of their own interests, the city administration ensures public support for the actions of a strategy or policy ultimately proposed. These measures have to be aligned with and mainstreamed with other policies.

The long-term commitment required for a process, such as the transformation towards climate-neutrality, can be difficult to maintain with the short 4-5 year political cycles. By setting and working towards short and medium-term targets that fit within the short political cycles, this can be remedied, in particular when frequent monitoring of the progress is in place. For instance, in the SmartEnCity project Sønderborg updates its Roadmap every 5 years and checks the progress made per main category of CO_2 emission every three months. In Sønderborg, monitoring is equally important for the motivation of transition stakeholders as it shows whether the efforts are producing the desired results and is used for national and European reporting, for instance to the Covenant of Mayors.

The actions described here can also be used to update and ameliorate visions.

Sønderborg's Roadmap 2025 - 50 steps towards a carbon neutral Sønderborg

Using SCC-01 SmartEnCity's tools for continuous introduction of renewable energy, integrated energy planning, coordinated actions, and monitoring, Sønderborg developed its Roadmap 2025 which aims to achieve 75% carbon reduction in 2025 compared to 2007. The process is carried out in eight steps:

1. **Approval of Roadmap2025:** April 2018, the City Council approved the launch of the roadmap project, which results must be integrated in municipal plans contributing to a good life,

sustainable city and green growth. It is supported and coordinated by the public-private partnership ProjectZero, established in 2007.

2. **Scenario workshop:** May 2018, nearly 40 local stakeholders develop four scenarios that are will be used to test and pressure test the drafted project proposals, aided by an external facilitator.
3. **Kick-off workshop:** June 2018, about 90 local stakeholders and experts attended the workshop kicking-off the actual Roadmap2025 process. Participants are informed about the four scenarios and Sønderborg's energy balance and are encouraged to have a holistic view. In eight working groups, they define potential Roadmap2025 projects.
4. **Sector-focused working groups:** Over summer 2018, eight working groups with more than 100 participants worked eight key sectors: owner-occupied housing, housing associations, private rentals, private transport, businesses, agriculture, heavy transport and energy production. Participants represented not only these sectors but also sector-related stakeholder who had insights and a business-driven motivation to participate. Some groups used external consultants to get a better understanding of the themes or of the impact of specific proposals.
5. **Evaluation and calculation:** In total, the working groups prepared 56 project proposals using a specific draft Roadmap2025 template. The 56 proposals were consolidated into 40 integrated concept proposals, consistent with the EnergyPLAN tool that provided insight into the potential contribution of each proposal to the transition in 2025 and 2029
6. **Midway discussions:** October 2018, 35 working group representatives and external experts met to test the scenarios and discuss the draft project proposals, their impact and implementation, and any further measures needed for reaching the 2025 goals and becoming carbon-neutral by 2029. Additional workshops were organised on the dynamic energy system of the future, with regional power utilities, local businesses and external experts, with the aim of highlighting the challenges and potentials of the future's dynamic and market-driven energy system.
7. **Reporting:** Autumn 2018, the target groups, messages and format for the actual Roadmap document were set to enable targeted production of content. Not only the conclusions of the eight working groups, and Sønderborg's thinking, but also how the outcomes of the process will be integrated into municipal planning and the tools used.
8. **City Council authorisation:** December 2018, the Board of ProjectZero approved the Roadmap2025 report as an action plan for the sector efforts up to 2025. The eight working groups commit themselves to follow up on the proposals. Subsequently, Sønderborg City Council approved the Roadmap2025 report and its recommendations to the City Council. The City Council's approval is key for ensuring integration into municipal planning and to emphasise the City Council's many roles in executing Roadmap2025.

With the experiences of this completed road mapping process, ProjectZero recommends that similar road mapping projects organise these processes early and identify the relevant stakeholders so that both the project and the process are provided with the necessary insights and skills to carry out the task.

https://www.projectzero.dk/toppages/om-projectzero/roadmaps

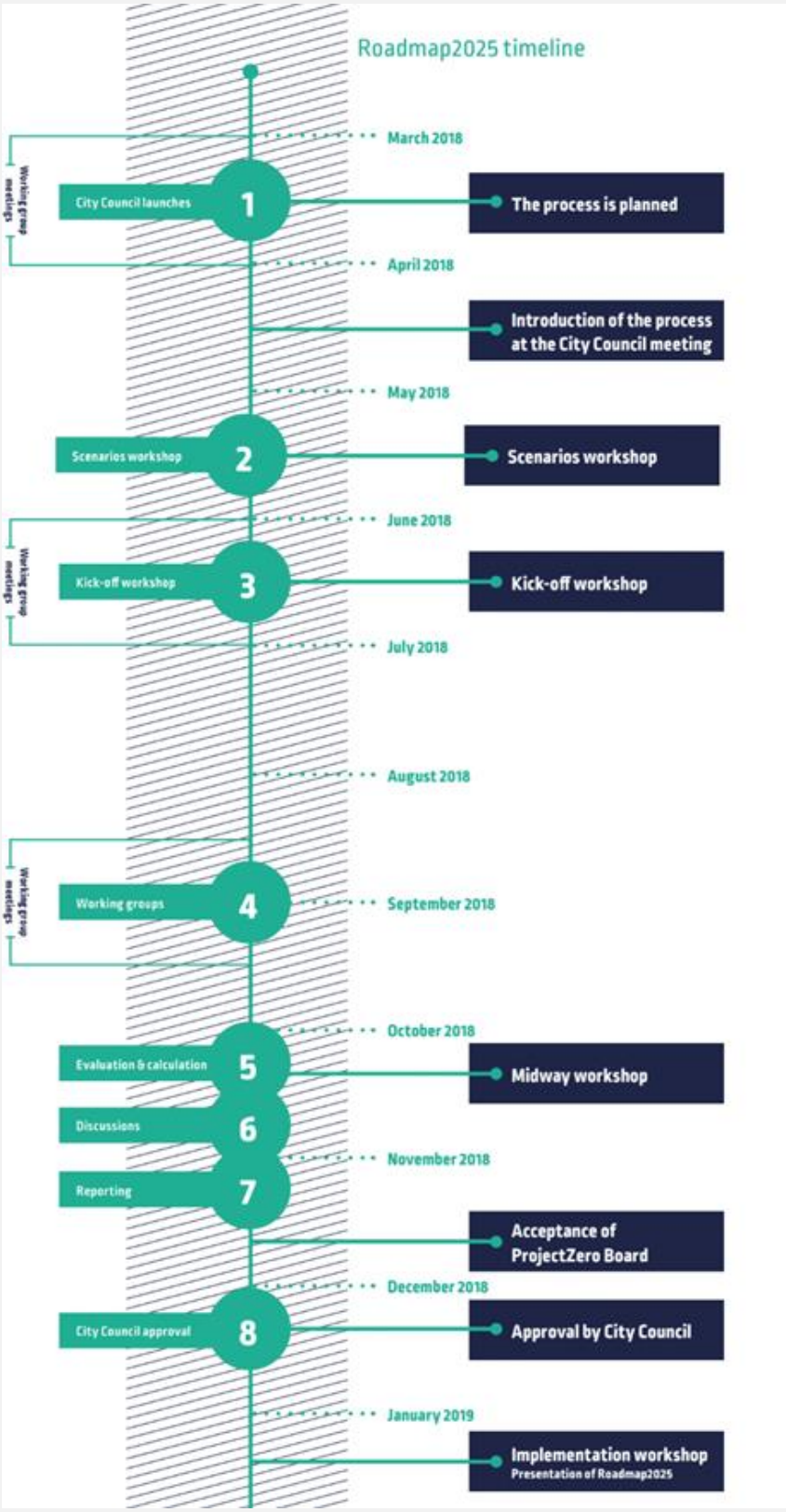


Figure 4: 50 steps towards a carbon neutral Sønderborg. Source: (ProjectZero Foundation, 2018)

Innovation Playgrounds and Bold City Visions in Limerick

The **+CityxChange project** is certainly a pioneer in defining tools such as the 'Bold City Vision' and 'Innovation Playgrounds'. The Innovation Playground is used for urban prototyping and co-design of the different aspects of the +CityxChange project. This includes Innovation Labs, which are physical spaces located within an urban area to be transformed, to encourage innovation through new products, technologies, business models etc. Another component that promotes a common agenda is the 'Energy Model' that helps municipalities to create energy scenarios for 2030 and 2050 (e.g., in the lighthouse city Trondheim). The intention is that the creation of energy scenarios, will serve as a political tool for accelerating investments in local renewable energy generation, storage and flexibility. These models have shown to be a useful tool for politicians, decision makers, planners and citizens to understand the role of energy in city development in Lighthouse city Trondheim. These models help to guide the development of the Bold City Visions.

Bold City Vision is intended to guide the process of replication and upgrading in cities in small-scale labs. Also, +CityxChange reported that in the case of Trondheim, one of the main barriers identified in the Innovation Playgrounds is that current ways of thinking are isolated, and this hinders the collaboration and creativity needed to address sustainability and energy challenges. Through the use of Bold City Vision workshops, new ways of thinking about these challenges can emerge and be implemented. The co-creation and adoption of an innovation workshop and innovation agenda in the **City of Limerick** has helped to enable municipal authorities, energy providers, businesses, citizens and communities to test and prototype innovative ideas to enable movement towards smart growth. The innovation workshops also proved to enable entrepreneurs to develop their prototypes with tools such as information and data sets, collaborative space and connections with other solution providers, technology leaders and demonstration projects. An important moment of testing and showcasing of the Bold City Vision workshop reported by +CityxChange was with the Trondheim Municipality leader group. The goal of this workshop was to test the Bold City Vision framework with the leaders in the context of localising the SDGs within their respective departments. Bold City Vision workshops have been also replicated in Asker Municipality in Norway, and among Follower Cities in the +CityxChange project, which demonstrates their usefulness and potential for upscaling.

Integrate decarbonisation plans and co-created results into mainstream policies

What?

Develop a clear process for how long-term decarbonisation plans and co-created results will be included in mainstream policies on urban transformation and receive political approval. Virtually all cities have decarbonisation strategies and plans in place for their path towards climate-neutrality. However, quite a few of them are executed in parallel to mainstream policy and decision making. The same goes for co-created plans that are sometimes not (well) incorporated in mainstream policies – maybe because formal adoption has not been arranged. Only a handful of examples of formal adoption of co-creation processes by elected officials exist – also here it is often a largely parallel trajectory. While the level of mainstreaming seems to vary between SCC-01 cities, there are definitely good practices visible for how to integrate such long-term decarbonisation strategies into mainstream policies. This can be done by adding lists of decarbonisation criteria to procurement and

by providing guidelines to municipalities for mainstreaming. Also, for co-creation results different trajectories to formalisation have been and are being demonstrated.

If this mainstreaming is not in place, there will always be a lack of budget and time for implementing decarbonisation plans and co-created results and wonderful ideas and activities will remain a paper reality. What is more, good proposals of bottom-up initiatives are lost, and stakeholders will get disappointed.

Why?

SCC-01 projects demonstrated convincingly that considerable progress can be made in CO_2 reduction, energy efficiency and renewable energy production. However, frequently they have been isolated initiatives without a clear replicability strategy and their results did not end up in mainstream policies – the latter often sticking to business-as-usual. If new knowledge and experiences, and lessons learned, are not flowing into mainstream policies and long-term transformation plans, through adjusted /new procedures, current flaws of governance on climate-neutrality will stay in place.

How?

Develop a clear process for how co-created plans will be included in mainstream policies on long-term transformation plans and if needed get approval in form of an official political decision by a democratic elected body, usually the City Council.

Integration of the Strategic Plan and Action Plan in municipal planning in Sønderborg

As part of its Cities4ZERO method consisting of 16 steps, the SmartEnCity project promotes an explicit integration of the co-created urban transformation strategy for cities' decarbonisation in ongoing and new municipal planning policies in step 6 (Urrutia, K. et al. 2019).

This type of mainstreaming is important because the local government has to ensure the right legal, administrative and physical conditions for the later implementation of the actions and key projects proposed in the earlier co-created Strategic Plan and Action Plan. Besides, the local government has to ensure compliance and integration with municipal planning instruments. For instance, an update or change of the local land use plan or zoning schemes might be needed for legal reasons, or for finding space and location for the proposed actions. In addition, feedback from all municipal departments will not only help to avoid common obstacles in future and stimulate cross-domain collaboration within local governments, but also provide a better alignment with other current and planned initiatives, strategies and policies. To achieve this, the Strategic Plan and its Action Plan have to be thoroughly reviewed and explicitly acknowledged by each department in the city administration (Urrutia, K. et al. 2019).

Sønderborg's integration process exemplifies this. The Strategic Plan helped to not only diagnose the city's energy system, but also develop realistic plans for the decarbonisation of Sønderborg's energy system. The Strategic Plan was closely linked to the two-yearly overall municipal plan, which is the formal steering document for politicians and municipal employees. As a result, the Strategic Plan became more integrated in the general urban planning process, what helped to smooth barriers experienced earlier, such as budget and urban planning issues. Furthermore, the 50 key projects proposed by the local partnership ProjectZero, were thoroughly analysed by each department to find out how to engage with and support these projects. Thereafter, all agreements and commitments were consolidated in an internal booklet, which created the right conditions for the eventual preparation and implementation of these key projects (Urrutia, K. et al. 2019).

Define clear expectations for pilots and demonstrations

What?

It is important to choose your experiments (pilots, living labs, testbeds, demonstrations) wisely and also define what you want to test, and how to handle its outcomes, both successes and failures, before embarking upon experiments. Which results are useful for the city and how does that influence the design of the experiment? How will the result be taken up by the city administration and what to do if the results are less positive then expected?

A wide range of terms is used to indicate **different types of experiments** relevant to climate-neutral and smart cities. Here we summarise the most relevant ones in no particular order:

Pilot: a test of a scheme, project, etc. on a smaller scale before introducing something more widely.

Living Lab are open innovation ecosystems in real-life environments using iterative feedback processes throughout a lifecycle approach of an innovation to create sustainable impact. They focus on co-creation, rapid prototyping & testing and scaling-up innovations & businesses, providing (different types of) joint-value to the involved stakeholders. In this context, living labs operate as intermediaries/orchestrators among citizens, research organisations, companies and government agencies/levels.

Testbed: is a platform for conducting rigorous, transparent, and replicable testing of scientific theories, computational tools, and new technologies. The term is used across many disciplines to describe experimental research and new product development platforms and environments, varying from hands-on prototype development of engines in manufacturing to testing a particular module (function, class, or library) in software development apart from the program/system it will later be added to.

Demonstration: an act of showing something exists or is true by giving proof or evidence

These terms reflect different types of experimentation, but their meanings overlap to some extent. All Smart City Lighthouse projects have worked with experimentation in different forms and have in practice acted as Living Labs, where a multitude of smart and sustainable solutions and methods have been developed, tested, validated and sometimes scaled through pilots, testbeds and demonstrations.

Source: ("Oxford English Dictionary" 2022), ("What Are Living Labs" 2018), (Wikipedia 2022)

Why?

Testing requires a city to commit resources in form of time and budget. For that reason, city administrations have to be sure that the outcomes of the pilot will help the city to achieve its long term aims as laid down in the city vision. The outcomes of the solutions tested should be relevant for and transferable to many other parts of the city's jurisdiction. They should also create significant impact: outcomes should help to implement the vision and long-term transformation plans. Hence, the question to which extent the results of the experiments are transferable, has to be answered before a "go" is given. What is more, it has to be crystal clear what it is that you intend to test and how the result will be taken up within the municipality and its plans. Politicians are afraid to invest public money in project that might fail.

How?

Predefine what the city intends to test before the experiment is approved. Clarify what and how you will measure the impact that will often be broader than only CO_2 avoided and energy savings. Ask for honest feedback of respected experts. Analyse in advance where you could roll-out more widely, e.g., by doing a GIS analysis of the urban fabric, before deciding to set up or embark on an experiment or living lab. And lastly, make sure the political route is clear for wider uptake of results of the testing – be they failures or successes.

Prepare an action plan for what happens after a successful pilot

What?

All SCC-01 Lighthouse cities have ample experience with piloting. The Smart City Lighthouse projects have demonstrated convincingly that it is possible to make districts hugely smarter and more climate-neutral (Garcia-Fuentes et al. 2020); (Smarter Together, Sharing Cities, REPLICATE and SmartEnCity 2021). However, more is needed to ensure a wider uptake of the results of the pilot, foremost in long-term transformation plans. Wider uptake does not happen by itself, so this section describes different strategies for making this happen and make a plan of action for the "afterlife" of the successful pilot!

Why?

Several factors make wider uptake of good pilot results often rather cumbersome.

Firstly, pilots are often managed as separate projects, running separately from mainstream policies and the execution of the political programme. They can be isolated initiatives: there is no link to the surrounding policy and decision-making landscape. No processes or procedures or responsibilities are foreseen to ensure the wider uptake.

Secondly, it is widely acknowledged that it is difficult or maybe even impossible, to just "replicate" solutions: buildings, infrastructures, areas and inhabitants, users and other local stakeholders are often very different (SPES 2020), (Nunez Ferrer et al. 2017). This means that some considerable adjustments to the successfully demonstrated solutions or best practices have to be made: solutions can hardly ever just be replicated and more often than not need to be adapted to other situations and contexts. These activities are often underestimated and not foreseen in municipal budgets and workstreams. The Replicate project made a thorough analysis of modifications and adaptations needed for a wider roll-out of smart solutions solely in the lighthouse projects themselves, and concluded that such a roll-out will only be successful if properly integrated into the long-term planning and policy frameworks of these cities, thus securing support and resources for adapting and optimising to local conditions. In addition, for technical solutions with intermediate TRL-levels another step is needed for the solution to become market ready. As innovations in governance are not commercial products, other mechanisms than the market are needed for replication.

How?

An action plan should be part and parcel of any pilot or demonstration plan before it starts.

Resources have to be reserved to evaluate the merits of the pilot and investigate in which other parts of the city its results can or could be useful. Where are comparable circumstances, what is the low hanging fruit in that respect? As soon as approval is given to work with a specific pilot, such an action plan should be developed, and a process devised on how it feeds into long-term transformation plans. However, such a process can be reinforced by making this a specific role and responsibility: the appointment of an innovation manager whose task is to feed positive pilot results into the mainstream municipal policy and decision-making processes.

Scale up solutions where they are happening. A good strategy is to extend the spatial boundaries of the current pilot area: the situation in surrounding areas is probably to some extent comparable and the earlier demonstrated success will motivate to do more.

Finally, several SCC-01 cities have indicated that a good local innovation ecosystem and having innovation management in place (see section 4.5) are also key for expanding the impact of a pilot. The innovation ecosystem will by nature promote wider uptake of experimentation outcomes.

Innovation Manager City of The Hague

The City of The Hague has appointed an innovation manager who gathers all results of pilots, living labs, and demonstrations. This person assesses in which processes these outcomes should be incorporated, connects the innovators to the persons responsible for the topic within the municipality and sets up meetings to discuss whether the innovation is useful and can be incorporated in the municipal ways of working. This has worked well for outcomes of Living Lab Scheveningen. Scheveningen is a neighbourhood along the beach and Living Lab Scheveningen tests crowd management with camera surveillance, traffic flows, protection of biodiversity against light pollution and many other things.

4.3. Transforming the municipal organisation

Currently, most city administrative structures are oriented and organized to respond to the day-to-day management of urban operations and provision of municipal services. Their structure in departments, with specific skills, knowledge and data, serves this purpose perfectly. This way of organization is often defined as a structure in "silos." However, it is important to note that these "silos" can refer both to the administrative structure which divides competencies and allocates rigid budget lines to each department, and to a mental structure that does not invite departments and especially the departmental officials to collaborate with each other.

On the "silos" discussion - from the public administration point of view:

In public management, a "silo" is defined as a hierarchical organization that seeks to maximize vertical coordination at the expense of horizontal coordination. It is a self-serving organization that cares only about outcomes consistent with its narrowly defined goals. Silos have a bad reputation.

Much of the academic literature speaks of their inability to share information, resolve jurisdictional disputes with other government organizations, and horizontally coordinate effectively (Scott and Gong 2021), (Kettl 2006), (Jurkiewicz 2007).

Silos have been criticised for leading to 'sectoralism', to become 'single-purpose organisations' with a tendency to 'tunnel vision' (Scott and Gong 2021), (Gulick, L. 1937), (O'Leary and Chanin 2010). Failure to overcome these problems can have disastrous results, such as delays in decision-making, duplication of resources, poor service delivery, inability to address cross-cutting 'wicked problems' and difficulties in working with non-governmental actors. The problems of silos have prompted calls for their dismantling, explosion or destruction in other ways.

Although this is often the reality, administrative systems dominated by silos can still find ways to overcome or prevent inconsistency in governance. The problem is not so much the structure of silos, but the lack of effective coordination mechanisms among them. Therefore, it is important to identify also what modalities can enable silos to work successfully with each other and under what conditions, so that we do not have to pursue a total breakup of silos, which can be politically and administratively costly.

According to (European Commission. Directorate Research and Innovation 2021) the present silo-based form of governance, designed and developed for traditional city operations and services, cannot drive an ambitious climate transition. Therefore, a systemic transformation is urgent, accompanied by a more strategic, holistic and long-term climate investment approach, together with a new city governance for climate action. The transformation will be based on three principles:

- a holistic approach to foster innovation and deployment
- a matrix of integrated and multi-level governance, and
- a deep and continuous collaboration between all stakeholders.

This model requires a strong commitment from cities and their political leadership to innovate the administration and to bring on board all stakeholders, business, academia and civil society.

A new city governance model able to push a systemic transformation to climate-neutrality should also encourage the concerned public administration to evolve from its traditional silo based working culture and organisation to a more strategic, cross-cutting, integrated, citizen driven way of working. Without a clear political and organisational evolution in this direction, such transformation will not be possible.

The holistic approach, as opposed to or synergetically to the silo approach, will require a change of habits and style of management. The main capabilities/competences that should be assured at the city level are as follows:

- Organizational capabilities, including orchestration; connection with regional, national and European initiatives; and political support

- Technical capabilities; learning by experimenting; advising; financial and project management
- Design and monitoring capabilities, including designing; strategic and evolutionary evaluation; and KPI monitoring.

The required paradigm shift should lead to the adoption of integrated urban planning practices that approach the city holistically, promote multi-benefit solutions and break the traditional silos in urban projects. This type of urban development and projects can yield solutions that make efficient use of resources and provide significant benefits for cities, their citizens and the economy.

Promote a common agenda for collective impact across departments

What?

The creation and promotion of a common agenda, including a common understanding of the problem, a shared perspective on how to achieve change and a common approach to solving it through agreed actions, is a prerequisite for collective impact achievement by different departments.

Why?

The lack of such a common agenda, a shared perspective on changes needed, and a common approach to solving it through agreed actions is a major bottleneck as it leads to isolated impacts and prevents achieving collective impacts. Learning from the definition of Governance Analytical Framework provided by (Hufty 2011) where "governance" is defined as: "The processes of interaction and decision-making between the actors involved in a collective problem that leads to the creation, reinforcement or reproduction of social norms and institutions", we can derive some assumptions in relation to the need for systemic change.

Currently, also according to (Kania and Kramer 2011), the public and non-profit sectors most often operate with an approach called “isolated impact”. This is an approach geared towards finding and funding a particular solution within a single department or organisation, coupled with the hope that the designated or most effective department/organisation will grow or replicate the solution to extend its impact more widely. Despite the predominance of this approach, there is little evidence that isolated initiatives are the best way to solve many social problems in today's complex and interdependent world, such as the paradigm of the transition to a climate-neutral city. No single department or public organisation is responsible for a major global problem.

Moving from isolated impact to “collective impact” means encouraging greater collaboration within the municipalities but also among the public-private partnerships and requires a systemic approach to social impact that focuses on relationships between organisations and progress towards shared goals. Moreover, it requires the creation of a new set of not-for-profit management organisations that have the skills and resources to assemble and coordinate the specific elements necessary for successful collective action.

How?

Awareness that much more collective impact can be achieved by following a common agenda across departments is widespread among Smart City Lighthouse projects. Different mechanisms have been used to ensure the promotion and implementation of such a common agenda.

A Task Force for promoting a common agenda in Florence

In 2010 and in conjunction with signing the Covenant of Mayors commitment, Florence established an extraordinary task force, which became part of the ordinary activities and integrated into the governance system of the city. The task force is made up of several departments with the objective of co-involving them in environmental planning decisions and accessing their technical capabilities. Coordination of the task force is handled by the city manager, identified as the highest level of management within the city. This made it possible to involve the directors of individual departments as being responsible for their departments' participation in the task force meetings. In some cases, the directors then delegated their collaborators.

An important aspect was always to consider the working group as a platform for sharing objectives so that the impacts of individual actions could also become added value for the individual departments, and this proved to be very effective in aligning the timing of the actions within the various departments. The working group was also frequently used outside SECAP, when it was also used for other plans and projects. Initially, a schedule of two meetings per year was assumed, but the frequency of meetings has been much higher. Not all departments are always invited, but the working group widens or narrows depending on the subject matter.

The working group has become official body under the coordination of the City Manager, but it is not a new department and instead a horizontal working group that reports to the City Management.

City Strategy Coordinator in Valencia

The City of Valencia has reported a learning process that has led to the recent establishment of a city strategy coordinator who is in charge of the implementation of the Urban Agenda and the Mission Climate Neutral City. The working group is interdepartmental and meets every two weeks. Also, but not only, the MAtchUp project highlighted the need to work more horizontally between departments and to better integrate the work done by individual departments in order to avoid overlaps and lack of coordination as well as misunderstandings that could result from a lack of precise information on the activities and objectives of the project.

A very important element that emerged from the interviews was the vulnerability of long-term objectives to political election cycles. In order to ensure continuity, the need emerged to obtain a very large majority approval of the plans by all political colours, in order to have a long-time horizon for the implementation of the plan.

Go beyond the usual cross-departmental cooperation

What?

Nearly all Smart City Lighthouse cities have indicated that a much higher level of interdepartmental collaboration is needed in order to successfully realise climate-neutrality and smart city plans and achieve the collective impact aimed for. More importantly, a much higher level of working across domains and disciplines is needed.

Why?

Several interviewees indicated that the usual level of cross-departmental collaboration does not suffice to realise "horizontal" or cross-domain interventions. Besides, a lack of multi-disciplinarity in teams makes it more difficult to put these interventions into practice. City representatives agree on the need to have in almost each department some experts in sustainability and innovation, able to join the discourse by bringing sectorial competences, without losing the holistic perspective and having clarity on how to steer investments in that direction (and hopefully having the needed leadership to make them happen).

Many different types of expertise are needed to enable proper preparation and implementation of climate-neutrality projects and programmes, specific expertise might not be available "in house". Sometimes technical departments struggle to co-create plans with stakeholders because they lack vital expertise, for instance in the field of communication, IT or law.

Behind this could be a more fundamental problem hiding in plain sight. A large part of municipal duties is not executed as projects, but as a sequence of tasks assigned to individual employees. This means that many times, there may not be a team at all, let alone a multi-disciplinary one.

How?

During the REPLICATE project, the City of Florence developed for example with its partner SPES a "Smart Priority" which involves many external aspects in the decision-making process and business model (a "city model canvas" developed by partner ESADE). Not only specific technical expertise is needed but also staff knowledgeable on general sustainability matters to facilitate internal co-creation within cities.

For municipal duties related to climate-neutrality that are not carried out in the form of a project and associated team, a review of how the execution of these tasks might benefit from bringing in more multi-disciplinarity and from setting up a team could be useful.

Create trust through mutually reinforcing activities and excellent communication

What?

The paper 'Governance of City Resilience' that analysed Bristol, Barcelona and Lisbon, (Colclough et al. 2021) reported on the challenges of making cross-silo working within local public services, particularly across sectors (public/private), and to some extent between tiers of government. It also detected improvements regarding collaboration and actions that support and institutionalise ongoing relationships among stakeholders.

Why?

Weak mutually reinforcing activities and weak communication can feed mistrust among departments, government agencies and private sector.

It usually happens when different stakeholder groups are unable to work together, and/or are not encouraged to undertake the specific set of activities in which they excel so as to support and coordinate the actions of others.

Lack of trust between stakeholders often arises when the reference politicians belong to different parties and might consider each other as competitor in the political arena.

This lack of trust can also be caused by different departments having different groups of stakeholders. Stakeholders might not yet be convinced that their interests will be taken into account.

How?

Trust between different departments and government agencies is created by regular meetings and mutually reinforcing activities such as in the examples of Valencia and Parma (see text box below). These serve to accumulate enough experience to recognise and appreciate the common motivations behind their different efforts. This extends to building trust between civil society, non-profit organisations, and companies: trust is created after several years of such regular meetings. This gives stakeholders the time they need to understand that their interests will be treated fairly and that decisions will be made on the basis of objective evidence and the best possible solution to the problem.

What is more, involving business and civil society actors in the climate-neutral and smart city development can help to build consensus across the political spectrum and thus reduce tensions and distrust across stakeholders.

Different ways of building the much-needed trust between parties

Among others, the Smart City Lighthouse project **Making City** reported that commitment of decision-makers and managers is crucial to achieve a collective change. Inefficiency and lack of commitment can also lead to failure of interconnections with the other governance layers like the Province or the Region.

A promising solution to promote mutual reinforcing activities and communication among stakeholders comes from the Territorial Alliances model (the creation of multi-stakeholder strategic alliances, often promoted by public authorities, within the quadruple helix framework).

The alliance focuses on the interplay of technologies, business models and governance approaches for sustainable urban development. The fundamental goal of the network is to accelerate developments that helps reducing energy and resource consumption while also enhancing the liveability and prosperity of a city. The alliance is based on an action-oriented model for accelerating and strengthening the sustainable development, as illustrated in several Smart City Lighthouse projects.

The "**Carbon Neutrality Alliance of the Province of Parma**" is a great example of such an agreement that aims to coordinate all local stakeholders towards the primary objective of carbon or climate-neutrality, and to outline their respective roles and commitments. Partly within the context of the RUGGEDISED project, the Carbon Neutrality Alliance was established to identify a local strategy to pursue the objective of carbon neutrality by 2030.

The alliance has the ambition of involving different categories of stakeholders (businesses, schools, citizens, trade associations, environmentalists, etc.) and to facilitate the adoption of the Carbon Neutrality Alliance model in other areas of the region while ensuring first and foremost

the monitoring and certification of the territorial carbon balance. On 15 December 2020, the first step in this direction was taken: the signing of the Carbon Neutrality Alliance of the Province of Parma by the representatives of ten public and private parties committing themselves to the agreement. This included the Emilia Romagna Region, the Province of Parma, the Municipality of Parma, the Management Body for Parks and Biodiversity of Western Emilia, the University of Parma, ARPAE Emilia Romagna, the National Research Council, and further the Parma Union of Industrialists, Parma, I'm in it!, and the Kilometroverde Parma Forestry Consortium. The last three organisations represent many private companies, many of whom are active in the food sector.

The partnership was formalised by drafting a bylaw, which indicates the three main steps of developing the Private Public Partnership to achieve the Carbon Neutrality of the Province of Parma by 2030. **Phase 1** had the purpose to set a carbon baseline for the path towards carbon neutrality. To this end, the University of Parma had the task of developing a carbon budget quantifying and mapping the emissions in the Province of Parma. The carbon baseline was finalised in January 2022. In parallel, the Working Table of the Carbon Neutrality Alliance had to set the basis for a governance proposal built on the review of the best practices from the Green City Partnership in Bristol (where the Green Capital award was born), and the Low Carbon Framework in Sunderland. This identified specific elements which were of particular interest to the Province of Parma:

- An **Integrated System of Bottom-Up Plans**: The unification of different plans into a single integrated plan centralizes the monitoring actions and create synergies.
- **Monitoring the actions and of progress:** standardization of the monitoring methods among the members of the Alliance supports the commitment in reporting the reduction of emissions. In both examples a scientific committee has the task to validate the progress of decarbonization.
- **Creation of an operational branch** of the Alliance: a private company is the perfect operational organization, as seen in Bristol. This company carries out the engagement and marketing activities and it is closely linked to the members of the partnership. This private company functions as an accelerator of the Partnership.
- **Involving students and young people** in the vision of the city in the future: In Sunderland, a Young People Advisory Board periodically reports wishes, desires, and complaints of young people of all ages up to university students the Board their City Partnership.
- **Multi-cultural engagement activities**: for instance, Green Mingles, in which members of the Partnership host concerts, spectacles, theatre events for promoting a sustainable lifestyle, by providing free entertainment activities for citizens.

In **Phase 2**, partners established a consolidated governance for the city partnership and an integrated system of (bottom-up) decarbonization projects of partners, including a monitoring system. In this phase, the Alliance can start the engagement activities to prepare the scaling up process, which is part of the **Phase 3**.

The **City of Valencia** worked on a strategic agenda for climate-neutrality inviting several departments and external stakeholders to coordination meetings on a case-by-case basis. The reduction of distrust was promoted at political level, resulting in an overwhelming council endorsement with 31 out of 33 votes. Clearly, this can only come about after mediation tables and the search for compromise.

Finally, the **Triangulum project** proposed the 'Morgenstadt: City Insights', an alliance of high-ranking partners from a range of industry sectors, leading-edge sustainable cities, and key research institutes. Using innovation management methodologies and a range of tools and measures (international city surveys, "City Labs ", analytical tools, online assessment instruments etc.), 'Morgenstadt: City Insights' aimed at developing and implementing socio-technical innovations and lighthouse projects to provide answers to the challenges of the cities of tomorrow.

Explore how to re-organise to “change the city”

What?

The achievement of complex goals, such as climate-neutrality, implies an administrative vision aimed at "changing" the city, not only maintaining it. The dilemma between maintaining the city and changing the city prevents the achievement of collective impact by different city departments.

This difference, between the city maintenance goal and the city change goal, thus turns out to be the most important challenge facing cities in their reorganization. A separate, specialised organisation is needed to act as a backbone for the coordination of complex initiatives.

Why?

A lack of basic management support can lead to ineffective and inefficient collaboration between different departments and slow down implementation. Coordination of complex challenges such as climate-neutrality is time-consuming and usually none of the participating organisations have much time available. The expectation that collaboration can take place without a supporting infrastructure and budget is one of the most frequent reasons for its failure. The grassroots organisation requires dedicated staff, separate from the participating organisations, capable of planning, managing and supporting the initiative through ongoing facilitation, technology and communication support, data collection and reporting. Collective impact also requires a highly structured process leading to effective decision-making.

How?

A vehicle like a public development company can speed up implementation but there are also other models that have proven to work well. Awareness of having to change their administrative/ organizational setting has been addressed by the cities analysed in several ways:

- by reorganizing their departments.
- by working on the strategic plan and on a working group that is transversal/horizontal to the departments.
- by delegating to external entities, with an official political mandate, the objective of transforming the territory (e.g., urban transformation societies or public development company).

These three different models will be analysed below, evaluating their pros and cons.

Model A – Reorganisation of departments

This solution consists of a reshuffling of the competencies present in the various departments and the transformation of existing departments into new ones (e.g., sustainable development department, climate-neutrality department, Climate action and Innovation Department, Placemaking, etc…), the definition of new specific objectives for these departments, and the

acquisition of new competencies to be attached to these departments. In the cities observed, this solution was adopted mainly by medium-sized or small cities (e.g., Limerick). Conversely, it was discarded as a solution by medium to large cities (e.g., Amsterdam). In fact, in these cities the organizational structure is obviously more complex and the cost of reorganizing the administrative apparatus would be enormous and would see the displacement of hundreds of officials. In such cases, it is common for departments to change their names but in fact they do not change their objectives (e.g., 'urban' department becomes 'sustainable urban development').

Vice versa, in medium-small cities, the magnitude of the projects financed (also in terms of ambition and total budget compared to the City´s turn-over) that went in the direction of climate-neutrality were received as highly disruptive and allowed for a rethinking of the internal organizational structure.

PROS

- The concentration of diverse disciplines and competencies in a single department undoubtedly has advantages in terms of operations and immediate implementation of concrete activities.

CONS

- Newly established specialized departments are positioned at the same level of governance as other departments. Therefore, horizontal coordination may be lacking, and strategic decisions may be slowed down (e.g., allocation of funds, prioritization, multisectoral activities).
- The model does not appear to be fully compatible with large cities.

Examples

Limerick (around 100.000 inhabitants)
It reports an experience of internal governance reorganization, driven by the +CityxChange project, which saw the creation of two new departments: 'Place Making' and 'Climate action and Innovation'.

Amsterdam
Reports on the management of the Atelier project, by the sustainable development department, with some difficulties in initial dialogue with other key departments (i.e., innovation), where several key competencies are located. It also reports an incremental process of collaboration between the two departments, thanks to the realization of the added value of mutual synergy.

Model B – Strategic planning and horizontal working group

This solution has been adopted by most of the cities analysed with a fair degree of success, and especially by medium to large cities. In practice, these cities started with a strategic planning project - very often completely unrelated to the funded EU projects and in some cases starting several years earlier and with long-term targets (e.g., 2030 - 2050). The implementation of these long-term strategic plans therefore called for the need to equip themselves with internal bodies capable of

horizontal dialogue between departments. In most cases, transversal working groups have been established during the strategic plan preparation, coordinated or supervised by the General Management of the City Council - thus by a superordinate level of governance - through which the link between the technical and political sides is also guaranteed. In other cases, the decision to establish horizontal working groups was made instead after an initial failure to achieve strategic goals through a traditional governance structure.

In all the cases the figure of reference is the city manager, or general manager of the municipality (the figure may vary from country to country but is very similar to the CEO of the municipality) and in some cases internal discussion boards have also been formed for each cross-cutting topic also inviting external agencies and stakeholders to participate (including private actors).

PROS

- Linking long-term strategic planning and horizontal governance seems to be a successful approach because of the possibility of discussing cross-cutting issues between different departments and also inviting external stakeholders to contribute to the discussion.

CONS

- It is essential to have a very strong political endorsement. Therefore, coordination of the horizontal group occurs at the general management level, just below the mayor´s level. This opens up a risk related to the temporal continuity of strategic priorities, which could change with a change of mayor or council.
- Working groups can become very large, with dozens of people, and their coordination may not be effective, especially if fast decision making is required.
- Between the strategic decisions and the operations, there is an intermediate level of governance that may limit the effectiveness or speed of implementation of some decisions. In addition, budget lines allocated to individual departments may not be consistent with decisions made in meetings and thus require continuous financial review.

Examples

Valencia
The city became aware of the need to adopt a strategic approach and horizontal coordination to achieve climate-neutrality. The MAtchUp project helped build this awareness, showing some limitations in operationalization in the early stages, mainly stemming from the lack of dialogue between departments. Currently, the City of Valencia has a strategic agenda for climate-neutrality and a multi-departmental core group that invites other departments and external stakeholders to coordination meetings on a case-by-case basis. It also reports success in ensuring a long life for the strategy, gaining council endorsement with 31 votes in favour out of 33 votes. This can ensure the strategy's endorsement even with a future change of mayor or council.

Florence
The city builds on a very long strategic planning journey that began ten years ago with the signing of the Covenant of Mayors. It currently has a horizontal working group, coordinated by the city´s general manager, which involves several departments and has the goal of turning the city of Florence into climate neutral.

Gothenburg
The city created a sustainable development guide consisting of seven goals, each of which has a board within the city made up of different departments. The goal of the boards is to identify and solve challenges to achieve the goals. The seven goals are 1) improve internal skills; 2) finance to transition; 3) circular economy; 4) sustainable living; 5) sustainable building; 6) a green and resilient city; 7) sustainable transportation.

Stockholm
The city applies the concept of multilevel governance that serves integration and horizontal collaboration between project portfolios, the Innovation Team and city decision-makers at different levels.

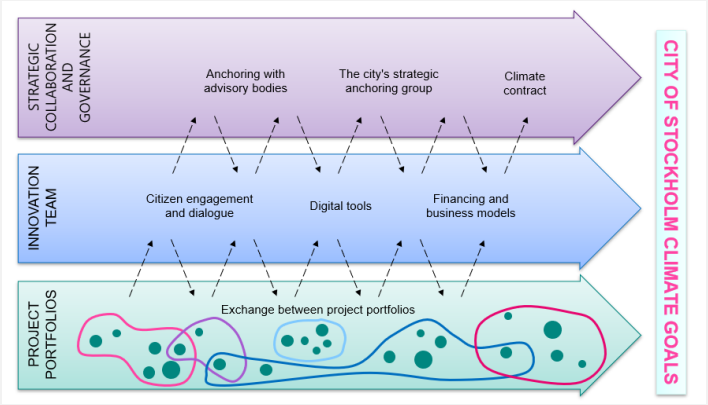


Figure 5: Illustration of multilevel management and collaboration considered for reaching the City of Stockholm's Climate Goals. Source: Appendix 3: Multilevel Governance, City of Stockholm, Climate-neutral 2030 Mission

'The Innovation Team serves as the backbone for the Swedish climate city contract process and is the main platform for collaboration within and between city administrations, between the city and actors from industry, civil society and academia, as well as between the city and other municipalities, authorities and national actors. Its role is to provide the city with documentation, ideas and networks of contacts. An initial task for the Innovation Team has been to cluster the multiple ongoing projects in Stockholm, in a project-portfolio structure, to support replicability and scalability.'

Model C - The public development agency

Another pattern recorded among the experiences of the cities analysed relates to the establishment of a third-party entity, normally a public development agency or urban transformation corporation, to which the task of transforming parts of the city is delegated. In particular, these agencies are often 100% controlled by the public entity, working with the private sector (real estate developers, energy companies etc.) to achieve in an expeditious manner the transformation of brownfields or the construction of new greenfield areas, following a model of integrated urban development. In the SCC-01 community, this has been done in Lyon (Smarter Together project) and Vittoria-Gasteis (SmartEnCity project).

PROS

- In these cases, operations and speed are maximized and public-private partnerships start working right away.

CONS

- There is a potential lack of connection between development agencies and city governing bodies (offices, departments).
- The development agencies work for specific projects, with urban dimensions limited to the areas of focus, and thus may lack connection to the city´s strategic development.
- In some cases, the dynamics of free market and profit seeking, may limit the achievement of some sustainability goals.

Public development company SPL Lyon Confluence

Lyon has ample experience with an urban development agency, 100% public, shared between Lyon Metropolitain and the City of Lyon, where the Mayor of Lyon is chairman. The company, called SPL Lyon Confluence, managed the transformation of a specific area of Lyon and promoted the transformation of other areas. Due to this urban development agency, the speed of implementation has been much higher as no time was lost with aligning different departments.

A special Digital Unit for climate-neutral and smart city projects in Leipzig

Leipzig started as a follower city in the Triangulum project and continued as a Lighthouse City in the SPARCS project. The experience from being follower city led directly to changes in the organizational structure of the municipality. A new "Digital unit" was created to oversee Smart City projects and international collaboration. The city realised that it needed a dedicated unit to develop and implement specific organizational capacity and processes for effective design and execution of Smart City and international projects, and to engage local stakeholders in these projects. The design of the new unit was inspired by other cities engaged in the Triangulum project. This demonstrates learning from own experience combined with mutual peer-to-peer learning. This learning continues in SPARCS. The lesson from this project is that the unit responsible for the project execution needs to have experts from different departments directly involved in the project team (environment, transportation, etc.) who bring the needed expertise, facilitate communication with their own department, and transfer key knowledge and lessons learned to these departments when the project ends.

Measure success to ensure alignment of efforts and transparency on accountability

What?

A shared measurement system is essential for achieving collective impact. Agreement on a common agenda is illusory without agreement on how to measure and report success. Often shared measurement systems are inconsistent or lack essential information.

Why?

Collecting data and measuring results consistently on a short list of indicators at the community level and among all participating organisations not only ensures that all efforts remain aligned, but also allows participants to hold each other accountable and learn from each other's successes and failures. This helps to evaluate the contribution of departments and staff to progress towards climate-neutrality.

How?

Different ways of implementing a shared measurement systems from the Triangulum and RUGGEDISED projects

One example of this comes from the Triangulum project: the Morgenstadt approach is based on an integrated reporting of fields of actions and indicators. Each indicator is compared with a benchmark to find critical indicators. The results of the on-site evaluation of the Morgenstadt City Lab in Prague showed the solutions' ability to identify the city's strengths and weaknesses in different areas and fields of action for smart and future-proof development. It was also possible to identify key future opportunities, current obstacles and to show possible paths for a sustainable development of Prague.

In order to achieve an in-depth understanding of the sustainability performance of cities both qualitatively and quantitatively, the Morgenstadt model is structured into three levels of analysis:

- Performance indicators (quantitative analysis);
- Key action areas (qualitative analysis);
- Impact factors (qualitative analysis).

The first two levels of analysis, i.e., performance indicators and action areas, are generic, which means that they should be applied without differentiation to the sustainability performance assessment of each city participating in the City Lab project. The third level of analysis - the impact factors - aims to identify factors and barriers that are specific to each city and depend on its unique historical, cultural, economic, climatic, morphological, etc. characteristics. In this way, the impact factors complement the overall model and tailor it to the unique needs of each city, thus providing an objective performance profile while setting the basis for an individual sustainability roadmap. In this way, the combination of quantitative and qualitative analytical tools ensures the creation of an objective performance profile.

The RUGGEDISED project (e.g., in Rotterdam) instead developed a layered architecture model on smart cities based on (existing) vertical oriented applications and silos within the municipality and companies. On top of that it includes horizontal cross-application and cross silo collaboration and data sharing. The architecture model is based on combining public and private data sources into a data marketplace and extending these with (open) data sets to create a digital city platform, which can be the basis for new business models and smart city applications and services. This Collaborative (sharing) business models approach shown to be important to create a (shared) perspective on smart cities and its smart solutions and components.

4.4. Participation strategies, co-creation and citizen-driven innovation, communication

One of the key points addressed by Smart City Lighthouse projects concerns active engagement of citizens in the definition of new sustainability transition pathways, urban innovation strategies, and brown field/green field development.

Co-creation is a collaborative approach to engagement which allows stakeholders to collectively design and build more inclusive and sustainable mechanisms for change (Morello et al. 2018). The main steps encompass co-identification, co-design, co-implementation and co-identification.

Co-identification deals with a deeper investigation of the context, to unveil local needs and expectations (to be coped with strategic high-level aims and goals) and to stimulate the emergence of unknown resources. Digital platforms and social media, combine with local events in person are useful at this stage.

Co-design involves the collaborative design of the urban strategy/interventions with stakeholders. Either novel smart platforms or technologies can be applied in this phase with the aim of improving the overall involvement of citizens in the process and to stimulate the development of a quadruple helix innovation model.

Co-implementation means translating ideas into actions, to showcase the effectiveness of co-designed solutions, together with local stakeholders and partners. A soon as possible the monitoring of performance and data collection system should be in place, to sustain the development of the next step.

Co-evaluation of the collected data is done to assess not only the success or failure of the implementation based on the outputs, but even more importantly is based on the impact perceived by the stakeholders (the outcome of the process), as well as durability and quality of the interventions. The feedback loop between co-implementation and co-evaluation phases will further increase the quality of implementation, and introduce changes and updates to actions. Local smart urban platforms may be used to collect data to evaluate the implementation progress from a district / city-wide perspective.

Co-design and co-creation of urban interventions are widely recognized as an effective approach to solve urban issues and provide citizens with more pleasant places to live in, assuming that only expert knowledge and technical notions are not enough to frame problems and challenges in the right way, and to provide innovative and viable alternatives. Co-design and co-creation can be applied when municipalities lead processes where urban interventions are developed together with citizens, researchers, professionals and private stakeholders (Burón and Sánchez 2020).

Moreover, when innovation becomes a citizen-led process, it paves the way to accelerated societal changes, as people themselves become the main driver of changes. A common feature of several cities successfully involved in SCC-01 projects, is having in-depth experience with co-design and co-creation preceding the start of the Smart City Lighthouse project, often long before writing the project application. Many cities are not starting co-creation out of the blue and have traditionally used integrated and inclusive planning to reach out to all relevant stakeholders. This is an important precondition for real participation. For instance, the 'integrated planning approach' of the City of Limerick aims to include all relevant stakeholders and invites them contribute to the preparation of

plans. The City of Florence has a long tradition of listening to stakeholders and ensuring stakeholder participation. Such an inclusive approach influences how the city enters the project, how the city defines the ecosystem of stakeholders to derive innovation, and how the city shapes its strategy and builds knowledge on insights gained by new practical experiences. Those cities that did not work with this integrated and inclusive approach will face some difficulties later during implementation.

Although the value of a participatory culture and of sensitization approaches is widely recognised among European countries and cities, what it means in practice and how to do it varies greatly between cities. Some cities already use participatory methods, even integrated by digital tools, to engage with local stakeholders, partners and communities, however, the level of true interaction varies enormously. This can be because this interaction often happens on already defined projects or intervention measures, where decisions have been taken for the larger part, thus reducing participation to consensus building. Further, it is observed that technical difficulties are frequently a reason for amendments, but the outcomes of participatory process hardly ever differ significantly from the original idea in a Smart City Lighthouse projects.

Some more advanced cities have developed a proper co-creation strategic approach, where co-identification, co-design, co-implementation and co-evaluation are embedded since the inception of the whole process. This is "an alternative to traditional consultation processes in which citizens can only participate at the very end" (Walsh and Mee 2020) or a paradigm shift, compared to the usual "decide-announce-defend" approach taken by some public administrations, as rightly mentioned by the City of Amsterdam. Nevertheless, even such advanced cities are still in a rather experimental learning-by-doing process. So far, there is hardly any official documentation, manual or step-by-step guide systemizing and codifying this experimental approach, with the knowledge and experience not widely shared but embedded in individual inspired officers or single advanced departments.

Moreover, translating the theory into practice is not an easy task, as complex projects require alignment of multiple stakeholders next to an overall sustainability-oriented approach, which is still not fully embedded in many departments, institutions, or market players. Moreover, technical departments are by definition largely composed of technical staff (engineers, architects, urban planners, ICT technicians, data analyst, etc) used to do desk work, interacting with the general public at most during "front office time". Such structures often lack professional figures skilled on communication and social sciences and experienced in communication and engagement methods and in using practical tools. On top of this, some development initiatives, although conceived through Smart City Lighthouse or Positive Energy District (PED) projects, lack proper stakeholders (in terms of final users) to be engaged. This is the case for green field developments, where there is not an already existing community to discuss with, in contrast to rehabilitation of brown fields and retrofitting of existing buildings.

This section presents recommendations and validated solutions, gathered from SCC-01 projects and interviews with representatives of cities and lighthouse projects. There is not a sharp boundary between the narrative on systemic changes in internal organizational models and stakeholders' engagement, as both areas tend to be linked together and to a considerable extent integrated. This

fuzzy edge again testifies to how impossible it is to think of governance of complex processes as transition to climate-neutrality, without the deep involvement of (and acceptance of responsibility by) multiple actors, both internal and external to the city administration.

Adopt a facilitator role to steer stakeholders towards consensus

What?

Several SCC-01 projects reported that it is important to establish the role of a facilitator who has the task to steer the process of bringing stakeholders with non-aligned interests to a situation of consensus on the best approach and interventions. Having an inspired or charismatic person in this role is essential.

However, a single person or a small passionate team is not enough. To shift from the usual top-down approach not only skills in engagement processes are needed, but also an adequate mindset (or a behavioural change) in most of civil servants and local decision makers should develop. It means, moving from a hierarchical, role-oriented and service-oriented perspective to a more informal, egalitarian and person-oriented perspective.

Why?

As pointed out during the workshop on 7 April 2022 by Henk Kok (City of Eindhoven), "there is an issue of hierarchy and bureaucracy that needs to be considered. Several departments may be involved in the same EU project, and it is often difficult to ensure coordination among all of them because of the need to create alliances in different silos and get approval from many people responsible for the silos. This can slow down the process. There is a need for an owner, a project leader".

In this regard the implementation of a matrix structure for project management, as tested by the City of Limerick, can be a valuable solution. The design of this kind of structure is conceived to keep the communication between teams open, fostering innovation and exchange of ideas. Under this structure, team members typically report to multiple leaders (at least two): the department head (similarly to a traditional hierarchical organizational chart) and the project manager (who coordinates people belonging to various departments who temporarily work together to achieve a specific goal). The project leader should be charismatic person, as stated by Francesco Sacco (RISE) the best would be 'identifying a "flame soul" to lead the process', and the way of acting of the public body should move from formal, hierarchical, role and service-oriented to more informal, egalitarian and person-oriented.

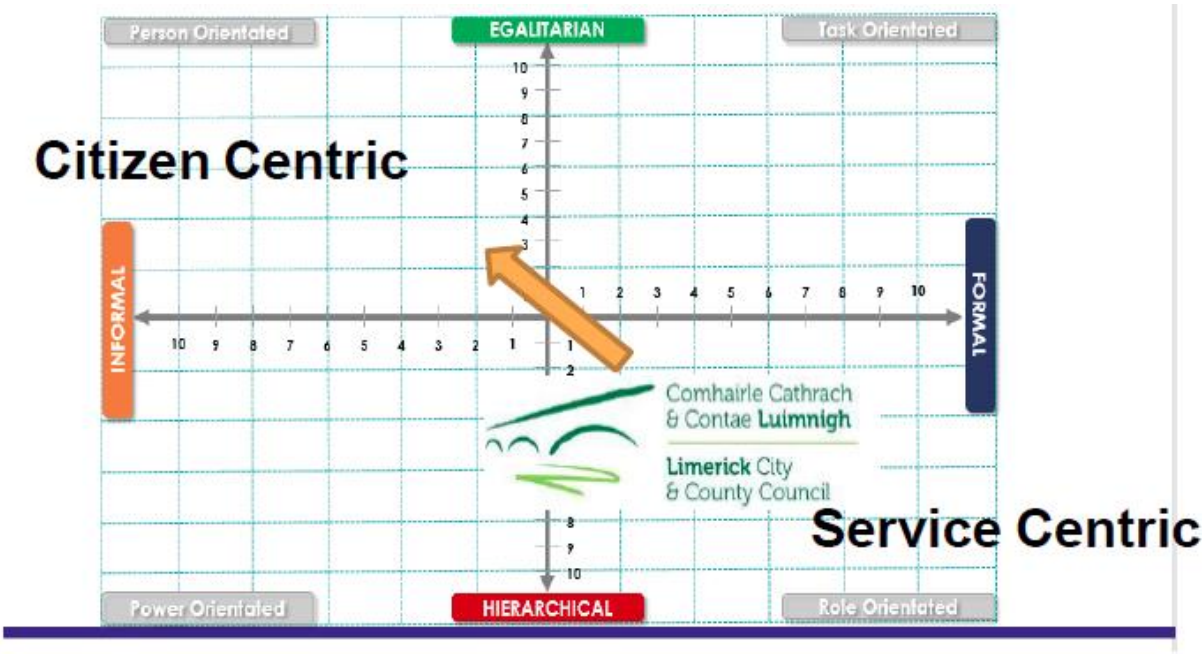


Figure 6: Rosie Webb (City of Limerick), Source: Citizen Innovation in +Limerick (presentation given on 27th January 2022)

How?

The City of Limerick has established a dedicated department on "Urban Innovation". Soon the department's name will change into "Climate Action Innovation", stressing even more the strong relationship between urban transformation, energy transition, adaptation and mitigation. Its activity is also complemented by the "digital strategy" at Limerick City and County Council, and the Limerick Clare Energy Agency (LCEA). Limerick wants to become a leader in innovation, investments, and low carbon development, by embedding the "citizen innovation" into the way of acting of the public sector.

The City of Sønderborg also wants to innovate through its strategic energy plan and has clear in mind that there are some preconditions to be met. The first is having committed politicians, deep diving into the technical contents of the strategy and understanding it, not only agreeing on the general principles. The second is to have committed civil servants and a way of doing that inspires people. In Sønderborg municipality, about 600 employees are working every day to implement the right solutions, to be a role model. Because citizens meet the municipality from childhood to adulthood (from going to kindergarten to living and working in the city), the city must give the good example, being the first in demonstrating positive behaviour, for instance by retrofitting all its buildings and providing better climate conditions, and by explaining and making tangible the benefits

of indoor comfort. Technical directors are committed to tell everyone why the City of Sønderborg is doing this and making everyone understanding the meaning of it.

As also experienced by Trondheim in the +CityxChange project, co-creation processes should be supported by documents explaining in non-technical terms the key framework for the co-creation, the dilemmas around climate-energy transition and the innovation concepts related to the framework itself (see textbox on quadruple helix model), otherwise complex issues are not understood by participants.

An example of the facilitator and figurehead role in Gothenburg

The City of Gothenburg filled in the facilitator and figurehead role by organising a place where the various departments can meet the citizens, namely the "Citizen Lab". In April 2022 the City of Gothenburg signed with the Swedish Viable Cities network its first Climate Contract with the aim of achieving climate-neutrality by 2030. The contract focuses on three pillars: industry, transport and electricity. To achieve this ambitious target, a strong interaction with companies is foreseen, but even more important, the strategy is based on the development of a "collective intelligence" and on active engagement of citizens.

The city representatives know that everybody has to cooperate, otherwise it will not be possible to bring about the huge transformation towards climate-neutrality on time. Two-way interaction is required: citizens should move towards sustainable consumption and a sustainable lifestyle, but the city should provide the right means for doing that, for instance offering clean transportation modes, and spaces for a sharing and circular economy. The City of Gothenburg is very well aware that creating the right conditions through seven strategies for sustainable living is essential to promote citizen-led innovation. The seven strategies are connected to the so-called "sustainable lifestyle wheel", which considers how citizens eat, live, consume, travel, work and are educated, spend free time and engage with society.

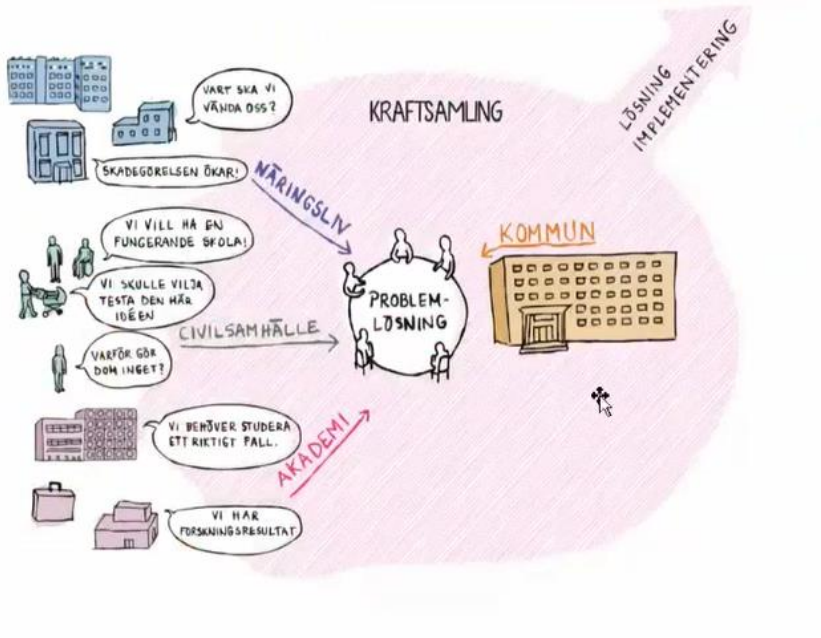


Figure 7: Kristina Eberth (City of Gothenburg), A climate neutral city by 2030. Climate transition and citizen's engagement

The preparation and realisation of the Climate Contract started by mapping which actor, department or company has something to do with a reference area of the Contract. Reference area means here the part or specific chapter of the Climate Contract referring to a specific department or service of the municipality. Subsequently, the focus shifted to the organization and organizational structures: What should be done, which roles and functions are required to implement the changes? The City of Gothenburg acknowledges that apart from involving the quadruple helix in identifying and working out possible solutions, trusting relationships are quintessential, as well as taking away any barriers between the bureaucratic and social worlds.

These are in short, the principles guiding the city towards the testing and implementation of the "Citizen Lab", where citizens can further make recommendations for public actions, for example on sustainable food by involving related actors and areas.

Broaden and adapt the narrative to connect with citizens

What?

One key element for successful participation and co-creation is often overlooked: it is not uncommon that stakeholders and project initiators start the process from highly different perspectives. Estefania Vallejo (CARTIF) points out how usually "citizens don't see climate change as a priority because they have other priorities" (such as waste or sewage disposal, reliable public transport, healthcare facilities, social services for youths and families, access to internet connection), and other very practical and day-to-day urgencies. A similar observation came from Mari Hukkalainen of VTT: "environmental problems should be considered as a piece of the overall problem of the district, for instance, social housing districts often face poverty as main issue, and inhabitants' focus is different from climate-neutrality".

These testimonials highlight how the narrative should be adjusted according to the group's, or single person's, expectations and interests. It is a matter of understanding what counts for anyone and to demonstrate which interests are shared and which kind of multiple benefits may be delivered thanks to the implementation of climate transition actions, by paying attention to the impacts closer to the community and potential negative side effects, instead of focussing on high level and global targets. This means that the overall strategy and its narrative must be broader than only combatting climate change, and not just to garner buy-in but to co-create "with" stakeholders.

Why?

Too many urban programs have not changed from planning "for users" to co-creating "with users", i.e. together with people, researchers, companies and institutions (representing the four major actors in the quadruple helix innovation model). When the quadruple helix elements work together, inspired by common principles to implement a shared vision, profiting from digital technologies, and following co-creation principles, one can finally speak of a real local innovation ecosystem.

Alan Dooley (City of Limerick), recalling his previous working experience in the private sector, sees a great disparity between the innovation capacity of the private sector and the public one. Private companies have always been forced to invest in R&D, because this is the only way to stay on the market, and now becoming compliant to environmental, social and governance (ESG) criteria is like

a mantra for them, while traditionally public entities have been not interested in innovation and "climate change issues" still are considered of interest only by some departments. But now, things are rapidly changing, and cities willing to lead the climate and energy transition should have a dynamic approach, because societal changes lead to new demands to be answered in an innovative way. To some extent it is needed to look at the return on investment of public activities under a different lens, which is obviously not the profit, but the delivery of multiple benefits to stakeholders of the urban ecosystem.

However, this raises questions on how to demonstrate those multiple benefits (see also section 2.1 on co-benefits). As stressed by Henk Kok (City of Eindhoven), the real problem is that "there is no clear approach on how to calculate impacts of interventions aiming to achieve climate-neutrality". This is an issue, especially for politicians, as these are usually elected for three to five years. Therefore, that is the maximum length of projects the politicians are interested in and the maximum period they are willing to see tangible results materialise in. As a consequence, "its is very difficult to put climate-neutrality priorities on top of politicians' mandate, as there is a short time perspective. Nevertheless, demonstration of multiple benefits could have more impact. It could tackle the siloes on the political side and have impact on the organization, but a certain trust is needed".

How?

Once again, it is relevant to recall how the facilitator of the engagement process should not underestimate that participants and stakeholder may have contrasting views and disparate interests. Steering them towards a consensus agreement or a unified direction, avoiding inconclusive drifting is not an easy task and often requires a broader perspective and narrative than solely mitigating climate change. For that reason, neither the main message nor the implementation strategy should be taken for granted.

Estefania Vallejo (CARTIF) mentions that the Atelier project promotes the concept of "PED Innovation Atelier" by focussing on citizen-drive initiatives related to Positive Energy Districts (PED). The project partners found fundamental having a clear shared ambition, a goal and envisioning to attract citizens and stakeholders. In this way "the partners of the Innovation Atelier can communicate their dream"; bridging together the "innovation-management perspective" with "stakeholder-management) is considered a crucial element in establishing the Innovation Ateliers" (see D3.1).

Estefania consider this a "good experience to change the knowledge and stakeholders' participation. It is quite an innovative concept. A good example to be replicated" to aggregate stakeholders on common goals, including energy transition issue, but not limited to that.

As said before, private companies do extensive research and consultation before taking decisions of entering a new market segment or launching a new product, because failure can seriously endanger their existence and have serious implications for those who made the wrong decision. On the contrary, decision makers and those responsible for technical departments cannot always rely on well-informed decision-making, or they follow political trends by applying a copy-paste method and assuming that it will work equally well in their local context, without considering the repercussions,

advantages and disadvantages, and the everyday practical experience of those who will be affected by the decision. Radical change is not an easy task, as "designing and creating with people from the beginning is a leap that requires momentum and belief, cooperation and dissemination by many" (TWS, 2022). The joint co-creation activity, where experts and people work together seems to work particularly well when digital technologies and physical spaces converge (see also the next paragraph on real and virtual spaces).

Create processes and define responsibilities for following up and for mainstreaming

What?

It is key to define flexible and permeable organizational structures, to adapt to new processes and overcome siloed actions. One of the weaknesses of many early urban innovation strategies or energy transition programmes was that they were conceived and developed either as a too broad framework (assuming innovation itself in any form should be pursued) or as stand-alone documents (that focus only on energy balance, energy carriers, and technical systems) not well integrated into the overall long-term urban master planning of the city and not fitting into the traditional distribution of roles and responsibilities across departments. While this integration is now becoming better understood (see the examples of the bold city vision in section 4.2), it appears that another key element is often overlooked, which is the interdepartmental cooperation, integrated into the co-creation strategy with the external stakeholders. Processes and responsibilities must be in place to take up ideas, mainstream with other policies and politically approve results that were co-created.

Why?

Open and transparent dialogue, understanding of various needs, feelings and expectations are key elements of interdepartmental cooperation processes.

Not missing good suggestions from other citizens or colleagues, exploit synergies with other departments and institutions, facilitate a systemic approach are the cornerstones. However, incorporating them into the decision-making process requires not only adequate mindset from people, but also flexible and properly designed and collaborative working environments (see for example RUGGEDISED 2020).

How?

In 2010, the City of Florence established an interdepartmental Task Force in the framework of Covenant of Majors activities. This Task Force implements Florence's SEAP/SECAP and uses the European Energy Award system to monitor progress. During the REPLICATE project sectors not yet included, in particular the ICT department, were invited to join the Task Force as new members. The Task Force holds regular meetings to monitor activities, align with other sector's plans still under development, benchmark and exchange with other cities and initiatives.

The comprehensive approach followed by the Task Force encompasses:

- A formal and strong commitment by using the common vision as a guiding principle for all integrated plans.
- Inclusion in the team of an employee of the Mayor's Office. This City Manager is the lynchpin between the Mayor's Office and all sectors involved. The role of the City Manager is to translate the political inputs into technically feasible activities and measures that contribute to better coordination of the activities.
- The adoption of the "everything counts" strategy: i.e., every suggestion both internally and externally is taken into account, and every sector is considered when discussing new activities.
- A systems thinking approach developed earlier during the Horizon 2020-funded STEEP project for participative decision making about complex problems, such as energy transition and smart city development.
- Interaction with several "habitat teams" formed by specific stakeholders and citizens. These so-called habitat teams are composed of citizens that are taking part in specific projects and are steered by a member of the "coordination team", who is an expert from politics and administration.

In this model the Task Force plays the role of the owner of the planning procedure and interacts with several "habitat teams" formed by specific stakeholders and citizens.

Every member of that Task Force oversees a specific theme: the civil servants coordinate the subgroups and pass results to the steering team. The coordination activities as well as the "consistency checking" is carried out inside the internal group. This is a powerful example of not only a strong process, but also of appointing clear roles, responsibilities, mandates etc., both internally and externally. In this case a pivotal role is played by the "city manager" who liaises between the political bodies and the technical sectors.

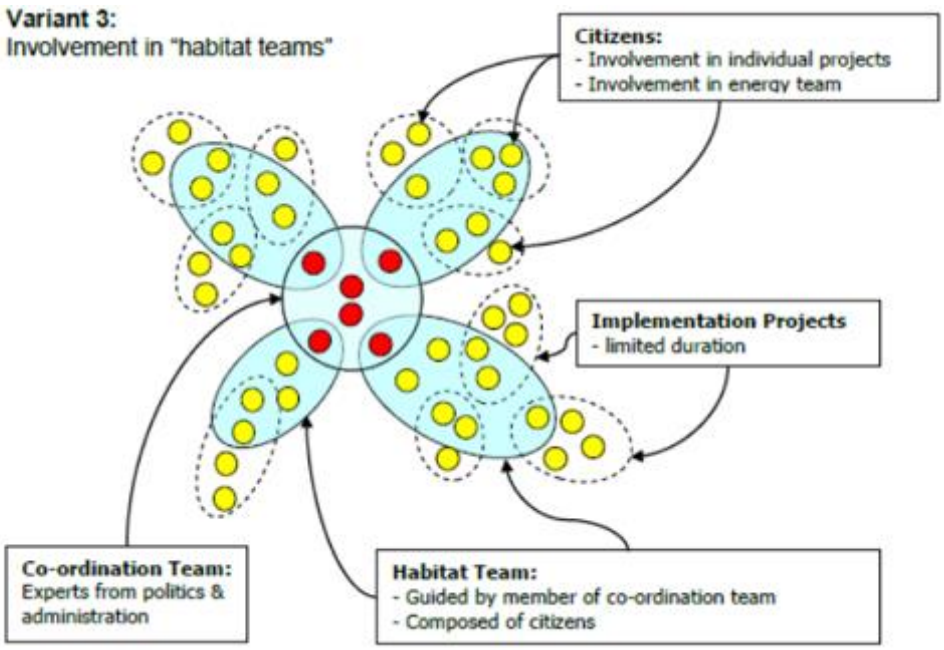


Figure 8: The management model adopted by the City of Florence, as explained by Alessandra Barbieri (original source of the picture: European Energy Award)

As reported by (Sanmartí and Sola 2019) and based on the experiences of the Lighthouse Cities Barcelona, Cologne and Stockholm, in order to activate effective transition measures, it is a must to involve participants from the very beginning of a project or programme, and from the early stage of interventions. For example, the GrowSmarter project strongly recommends that end users actively participate, for instance in the design phase, and that citizens are put in the position to join co-financing programmes for building retrofitting, even for public buildings, and have the possibility of entering the energy business (see also the section on Public-Private Partnerships – PPP). Including "genuine public participation" is also an effective way to limit upfront possible rebound effects that might result from inadequate behaviour and lack of understanding of innovation, as behavioural changes are among the least expensive and most cost-effective measures.

Internal and not only external dialogue to build consensus is also of paramount relevance. This advice comes from Ernesto Faubel (City of Valencia) in relation to the MAtchUp project. He recalls that "after a difficult start, where some colleagues from other departments were hesitant about the project, because they felt that it was not answering their needs" a long bilateral discussion took place and in the end some of those more sceptical became supporters and actually are going to replicate some actions beyond the minimum requirements. His colleague Laurie Barriol explains how involving citizens, making them part of the change has been a success: they are now realizing the first social solar plant on a public building financed by investment of citizens. This is a very innovative way of crowd funding (shares range from 100 to 2000€ and the number of small investors is around one hundred), and the best way to collaborate to the energy transition. Other actions are now in

place to sustain the creation of green employment, thanks to the cooperation of the trade unions, other associations, regional government, etc., and it could very well be that this working group will continue after the project.

Combine virtual and physical participation to ensure effective stakeholder engagement to build trust

What?

SCC-01 projects usually add a digital component on top of existing governance structures, which were often established previously to tackle energy planning issues. This is not limited to involving other municipal departments responsible for ICT management, data collection and administration, or external agencies, or new skilled professionals. Adding the digital component means starting to exploit the full potential of digital technologies and platforms for stakeholder engagement activities and for delivering citizens-driven bottom-up innovation. Even though digitalization has become a pervasive element of the society (because of global trends and latest pandemic events), the existence of physical places to meet up, discuss, brainstorm and practically test should not be underestimated, as in person and face-to face relationships matters, as well as some specific places elicit emotions and express particular meanings.

In particular the combination of a physical space for citizen engagement, a regulatory sandbox and both physical and online tools have proven to be very powerful, as reported by (Walsh and Mee 2020). Because it is important to facilitate true dialogues, it is important to be close to the place where the actions are implemented (Garcia-Fuentes et al. 2020). Communication campaigns to inform, educate and activate citizens are key to overcoming social and cultural barriers. More conscious and better informed about climate change and other urban challenges will citizens be more motivated to contribute to co-design and co-creation of solutions. Real and not only virtual spaces and platforms are key to build trust and sense of belonging.

The regulatory sandbox is a controlled urban environment where accredited entities and operators are allowed to test technologically innovative products and services dealing with the urban activities and sectors (e.g., energy in buildings - PED, mobility, environmental management, climate resilience, connectivity, etc.) not compatible with the current regulation. The design of the test should take place in close liaison with the deputed authorities benefitting from a simplified or specific regulation regime and its execution last for a limited period. The authorities can observe the latest technological developments into a real-world experiment and identify the subsequent regulatory interventions to facilitate their implementation (Sareen et al. 2022).

See also: ("Regulatory Sandbox" 2022) and (BMWi 2019).

The **quadruple helix model** originally developed by (Carayannis and Campbell 2012) demonstrates that there are four core elements to be included in a series of dynamic, bi-directional interactions to develop a working well innovation ecosystem: universities and research centres (academia), private companies and business players (industry), political representatives and institutions (government), and groups of interests, citizens and associations (civil society).

Why?

Virtually all Smart City Lighthouse projects have reported that engaging citizens has been crucial for a successful preparation and realisation of the plans, as end users that might have to change their behaviour and might act as co-producers of change, for instance by financing specific measures as house owner. This means that the level of ambition, input and exchange must be much higher than the rather passive public hearings usually required by law. Putting the communication with citizens and other target groups high on the climate-neutral and smart city agenda, means that city administrations must devote more resources in terms of budget and capacity to communication about the climate-neutral and smart solutions during the planning, implementation and evaluation phase of projects and programmes.

How?

In Limerick, citizen-driven innovation has been tested and developed in the so called "Innovation Playground": a combination of a physical meeting space in the city, a programme for citizen engagement and a regulatory sandbox where the quadruple helix structure can become reality. Including from the start local authorities, energy providers, businesses, citizens and communities to test and prototype innovations has been considered a crucial factor. Examples of emerging Limerick solutions that have been trialled in the Limerick Regulatory Sandbox are:

- Small Business Innovation Research (SBIR)
- Limerick Shannon Turbine: a tidal energy generator
- Limerick Community Grid (LCG)
- Limerick Citizen Energy Community (LCEC)

According to this experience real and not only virtual spaces and platforms for collaboration are needed to help participants in developing a tangible sense of place. Moreover, engagement should not be limited to chats or virtual spaces. Live events and meetings are the best way to build trust and a sense of belonging to the local community. Combining both results in a "*phygital*" dimension where human relationships and tangible objects are developed in synergy with digital elements and technologies, profiting from simulation tools to provide real time alternative scenarios and configurations.

A synergy between communication, visualization and modelling is also offered by "3D digital twins", where interventions can be graphically presented to people as a "bird's eye view". The digital twin and the dashboard can be made available on screens at the physical place hosting the "innovation lab". The combination of communication, visualisation and modelling in digital twins makes them a tool that can greatly support decision making.

As reported during the European Scalable Cities Community Event in Utrecht held on 1-2 June 2022, the urban digital twins are carried on wave of enthusiasm as a tool to support co-creative smart and sustainable city development. Key recommendations provided by Lydia Stulen, when explaining how the digital twin of Utrecht has been developed and the main challenges encountered, were "Connect

front- and back-end on common perception of value" and "build trust by clearly defining roles" in the governance system.

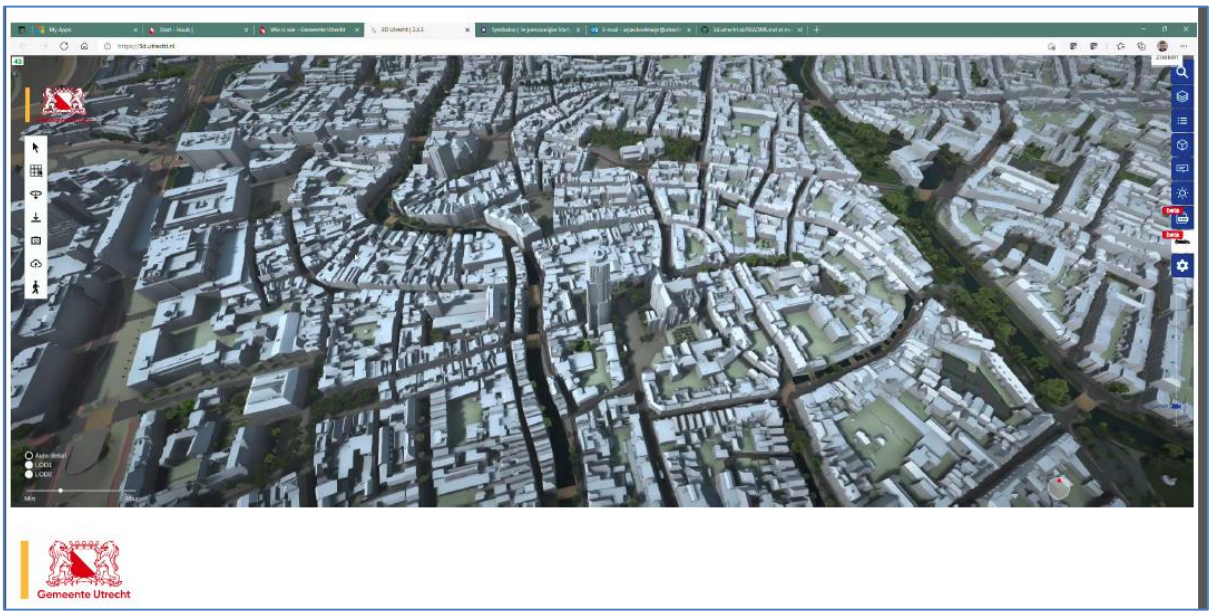


Figure 9: Picture of a digital twin taken from: Lydia Stulen (Digital Innovation Advisor, City of Utrecht), European Scalable Cities Community Event in Utrecht 1-2 June 2022

In the City of Gothenburg, where the smallest departments have merged to reduce the overall number of departments in an internal restructuring process, the need to accomplish the tasks without losing the local knowledge and experience, as well as the possibility to directly interact with citizens, emerged after this restructuring. To this aim, a dedicated infrastructure has been built in the form of a digital platform. It provides opportunities for meeting and discussing on specific local issues related to circular economy or climate proof urban transition for both citizens and those working for the city administration. It is a kind of citizen lab, where the technical content must be filled by the different departments.

In the future there it is intended to couple the digital platform with physical spaces and to involve people with specific skills in communication and participatory processes, to facilitate the dialogue.

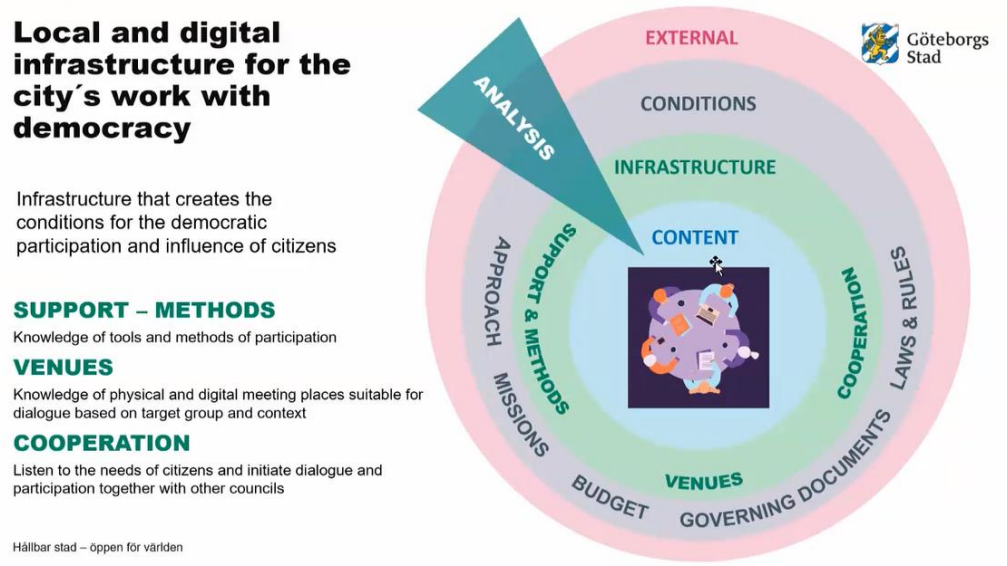


Figure 10: Kristina Eberth (City of Gothenburg), A climate neutral city by 2030. Climate transition and citizen's engagement (slide taken from the presentation shown during the interview recorded on 25th May 2022)

Another example of the importance of having "live" meetings is coming from the REPLICATE project. There the project partners of REPLICATE agreed on a specific approach of going to people and actively listening to them, more than calling people to workshops or meeting at the town hall or university (see textbox below).

Active listening for real engagement and building trust in Florence

Alessandra Barbieri (City of Florence), referring to the REPLICATE project and its specific Work Packages (WPs), explains how the following principles, stemming from the discussion among the project partners and external observers such as the European Energy Award (EEA) network, have been developed and adopted in WP7 since the beginning to find the best solutions and delivering them to the cities:

"To multiply the impact of successfully tested innovations, it is necessary to plan efforts in fostering policy development on a lasting basis" (WP2 and EEA network). This is why the roll-out actions have been embedded in the cities' planning framework and not just listed in a stand-alone dedicated plan not integrated in the policies and in the usual procedures. 'Plan' marks scaling up as a guided process from cities' point of view, in contrast to the spontaneous diffusion of innovations; 'on' a lasting basis" highlights the importance of institutional capacity-building and sustainability. Innovation means that "something" has been perceived as new, but it doesn't involve only new technologies, typically it could consist also of management processes necessary for a successful implementation (WP2 and EEA network). Replicate doesn't mean 'copy & paste' of a best practice but 'adapt and optimise to local conditions', as explained by the specific City-to-City learning program".

In Florence citizens and other main stakeholders have been reached by social media activities and through their associations' representatives. Yet the public debates (called in Italian "maratona dell'ascolto" which literally means "listening marathon"), were the real milestones for the acceptance of the activity plans, by having physical meetings close to the demo sites, meeting people and listening to their needs.

Private companies do extensive research and consultation before taking decisions of entering a new market segment or launching a new product, because failure can seriously endanger their existence and have serious implications for those who made the wrong decision. On the contrary, decision makers and those responsible for technical departments cannot always rely on well-informed decision-making, or they follow political trends by applying a copy-paste method and assuming that it will work equally well in their local context, without considering the repercussions, advantages and disadvantages, and the everyday practical experience of those who will be affected by the decision. Radical change is not an easy task, as "designing and creating with people from the beginning is a leap that requires momentum and belief, cooperation and dissemination by many" ("The Sixth W Manifesto" 2022).

Too many urban programs have not changed from planning "for users" to co-creating "with users", i.e. with people, researchers, companies and institutions (representing the four major actors in the quadruple helix innovation model). When the quadruple helix elements work together, inspired by common principles to implement a shared vision, profiting from digital technologies and following co-creation principles, one can finally speak of a real local innovation ecosystem.

Integrate new professional profiles to sustain co-creation beyond individual projects

What?

Many Smart City Lighthouse cities have reported that they require other competences, skills and qualifications than traditionally recruited, such as backgrounds from communication, sociology, anthropology, IT or law, to be able to continue inclusive and otherwise valuable ways of working beyond the lighthouse project. Similarly, new job positions with different profiles have frequently to be created, as more personnel with non-technical competences has to be attracted and recruited for hitherto predominantly technical departments.

Why?

Many lighthouse cities will endorse the City of Florence's opinion that "citizens participation, supported by the availability of enabling systems like the apps or the smart benches and the communication panels, is a transversal basic condition for a city like Florence, that considers the direct exchange and the interaction with its citizens the real answer beside any ICT supporting tool" (Alessandra Barbieri of REPLICATE project). This entails that Slack, WhatsApp, Telegram, and similar apps can be very useful as dialogue channels and for creating team chat platforms.

Additional human and financial resources needed for social media

Social media refers to a broad range of platforms and applications that focus on communication (written or through the use of photos and videos), community-based input, peer-to-peer interaction and content-sharing. Basic principles of using social media in the proper way encompass having a clear editorial plan, consistent writing style, ability to keep the attention on high level topics (e.g., climate change) by focusing on local issues closer to the community, managing the discussion in a proactive way (e.g., providing kind answers also to negative comments, without deleting them from the public chat board). Not only skilled human resources

are needed to do that, also financial resources for paid marketing campaigns should be allocated, as the algorithm of such social media may otherwise make efforts to increase the visibility of the project fruitless.

However, the effort required to maintain and moderate message boards and social media (Facebook, LinkedIn, TikTok, Instagram, etc) should not be underestimated, if not managed by a dedicated professional such as a social media manager. Similarly, digital collaboration tools like Miro, Mural and Jamborad, require proper training if to be used in an effective way and not to result in a waste of time leading to frustration.

However, setting up such dialogue channels and using tools in an appropriate way is not easy to be done, because in the majority of the cases "people at the municipality have too much workload, there are too many functions and too few people" (Rosie Webb, City of Limerick). Furthermore, "it is not an easy task to have a leadership of your employees involved because they have other obligations" (Henk Kok, City of Eindhoven) meaning that the participation to special projects or activities is often "on top of" daily duties. Sometimes those appointed for managing the communication of the project are not able to do that, because of a lack of language and social media use skills (Ernesto Faubel, City of Valencia). What is more, once the project ends, overstretched resources might become even more of a problem: "Many barriers are due to a lack of resources, and time-consuming resources are an extra effort. Following a co-creation approach is time consuming and also an extra work for technical departments" (Estefania Vallejo of CARTIF, replication leader in Atelier with the fellow cities).

How?

The +CityxChange project provided its Lighthouse cities with the Citizen Participation Playbook (Burón and Sánchez 2020), which is not a mere catalogue of physical and online participatory tools, but a detailed roadmap of four distinctive citizen participatory processes to co-design activities, including phases, steps, stakeholders, outcomes and a catalogue of physical tools and a set of online tools.

The four processes reported by +CityxChange project in the Citizen Participation Playbook are:

1. **Co-design of urban interventions**. A co-creation process in which municipalities together with citizens, researchers, professionals and private stakeholders can plan and design physical interventions in cities.
2. **Collaborative Legislation**. Collaborative process in which all stakeholders can actively participate in preparing municipal legislation and action plans.
3. **Participatory budgeting**. A citizen participatory process in which the local community decides how to allocate part of a municipal budget.
4. **Citizens Proposals**. Enables direct and bottom-up citizen participation in which any individual and/or organization can submit an initiative to municipalities.

The Citizen Participation Playbook helps to spread and consolidate expertise on citizen participation within a wider group, as employees previously lacking these skills can rely on the playbook to develop them; it is one of the first attempts to codifying the process.

Many projects have made good use of participatory mapping tools for citizen engagement, going towards the previously mentioned "phygital" integration. Tools such as UMap portal or ONA are useful and well understood by citizens, as they allow photographing and geolocating data at the urban level. However, such tools should be also integrated with the city's GIS ecosystem, general IT infrastructure or Urban Data Platform, and not be conceived as "stand alone" products. Therefore, it is necessary to the setup a participatory mapping platform (PMP) (Walsh and Mee 2020), up to the development of a public participatory geographic information system (PPGIS). Having two separate places where geographical information is stored (on one side the institutional one, like zoning maps, and on the other those collected by citizens) makes effective co-creation difficult as access to more detailed information by non-professional users as citizens, is impossible.

This example highlights how innovation is not sufficient, or not giving the best result, when designed as a separate element of the public governance system and staff members are not able to interact in a proper way with new emerging digital tools (for example, because for example they have been conceived by external experts and simply delivered to the municipality as a "turnkey" product or service). The mere existence of new peculiar services to engage with citizens and to stimulate co-creation should be deeply integrated to deliver long-term positive effects. This means that those in charge of designing such tools should be clear from the beginning how to deal with them under the system integration (or integrated planning) perspective. The existence of satellite structures (see example in the text box) may help different departments to align on specific topics and to create a common glossary and shared vision.

A Satellite Structure in Leipzig

The Department of Climate Protection and Sustainability in Leipzig has developed a "satellite" structure. The department trains and appoints sustainability managers in other units of the city administration (urban planning, transport, economic development). This creates a network of experts in specific agendas of the city. This can be more efficient and effective than having every department developing their own expertise in sustainability. However, it is still challenging since the managers are in a situation where they have "two bosses" and often need to reconcile different perspectives on a project.

The inspiring examples and practical experiences presented in this section should be considered as compass to effectively navigate the wide ocean of the urban process of innovation and participation. In practice this means a strong and steady focus on the creation of an active citizenship, where citizens are co-innovators because new urban products and services are developed and designed around them, based on their needs and user experiences, to ensure they are really practical and easy to use. And finally, pursuing the activation, development and implementation of new strategies and services through organizations whose purposes are primarily social, led by people with an adequate mindset, surrounded by experts having not only technical but also communication skills.

4.5. Collaboration between public and private partners, securing finance and procurement

Ambitious business models, next to financing and procurement of smart and climate-neutral solutions, need effective and innovative governance at the city level. An open and dynamic engagement of local businesses and economy is a crucial factor for building the confidence and trust with solution providers and investors needed to participate in smart and climate-neutral city initiatives. Therefore, driving successful partnerships and business models not only depends on technological innovation, but also on organisational and operational innovation, and the development and implementation of novel business practices. This means that governance changes are often directly related to capacity building and partnership management (many times the first hurdle for the smaller cities), and on timely inclusion of economic and business-orientated innovation from the outset of the project.

Regarding the uptake of climate-neutral and smart solutions, it is frequently remarked that many climate-neutral and smart solutions still lack the right business model. However, very different points of departure and processes are hidden behind this rather general observation. For the sake of clarity, we distinguish here three main categories or "markets", each with their own challenges (see Figure 11 below). Smart City Lighthouse projects usually deal with all three categories.

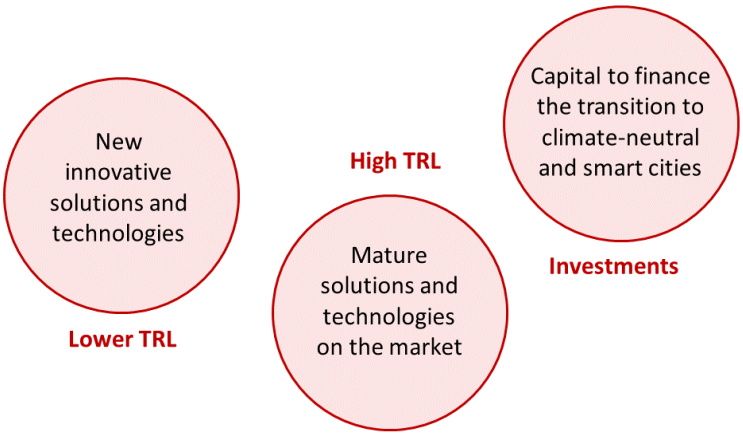


Figure 11: Different situations regarding financing climate-neutral solutions. Source: (Borsboom-van Beurden, J. 2022)

The first category deals with innovative technologies and solutions, which might have been tested in urban pilots, but are still not fully mature. These solutions might still have teething problems, their performance under different situations not yet be fully known and not yet be commercially viable. They have a lower Technology Readiness Level (TRL), and urban stakeholders and city administrations have not yet fully embraced them. It is the domain of start-ups and incubators and of valorisation of research, for instance in an urban living lab.

The second category is about mature solutions and technologies that have proven themselves but are not yet widely applied. Perhaps regulations hinder the market uptake. The price is still too high, there are issues with marketing, or simply the demand has been overestimated. Here the aim in general is to get a higher market share by wider application.

The third category is the domain of the financiers: banks, collective investors as insurance companies and pension funds, private equity, venture capital etc. They can make direct investments in clean technology solutions for buildings and infrastructures, and co-finance the urban transformation.

Below, we highlight several changes in governance piloted in the Smart City Lighthouse community, covering these three main categories.

Invest deeply in the local innovation ecosystem for scaling of solutions

What?

Both the city administration and the regional authority can play an important role in shaping the right preconditions for the development, deployment and scaling of climate-neutral and smart solutions. Apart from the city administration itself, the local innovation ecosystem comprise research and innovation partners (universities and consultancy), transport operators and energy providers, industry and other businesses active in development and management of real estate, construction and installation, IT, owners of buildings and land, citizens, NGOs etc.

A good governance practice is to nurture this local innovation ecosystem with the aim of fostering the four C's as recommended by the European Innovation Council: Connectedness – Capital – Competences – Cross-cutting (European Commission. Directorate General for Research and Innovation. 2020). For instance, city administrations can encourage businesses in the local innovation ecosystem to team up with other businesses and solve a problem by offering a more comprehensive, integrated approach instead of a partial solution that has limited overall impact. Further, it should not be underestimated how important it is that cities can provide opportunities and room for experimentation and testing in pilots, living labs, experiments etc. This helps companies to demonstrate the usability of their solutions under different contexts, producing references that show their potential for a wider range of applications and situations, and in different countries.

Why?

City administrations play an important role regarding the uptake of smart and climate-neutral solutions in their jurisdiction: not only as orchestrator and facilitator but many times also as (launching) customer. However, especially for innovative solutions, local governments' practices vary enormously: from lack of innovation work to advanced innovation practices, and from only using traditional internal municipality financing resources to innovative public-private-partnerships and new business models, while organisationally cities span from traditional internal siloed work

practices to dedicated cross-silo teams and strong collaboration with external stakeholders (Edelstam, M. 2016).

Several estimations have stressed the huge market potential for climate-neutral and smart solutions and technologies. Frost and Sullivan estimated the global market for smart cities to be worth over €1.78 trillion by 2025 (Frost and Sullivan, 2018). For the Netherlands alone, a study from 2017 by the Netherlands Environmental Agency calculated the total costs for the transition to a climate-neutral country until 2050 as amounting to 460 billion Euros (Ros and Daniels 2017). For the C40 Cities, McKinsey estimated the market for these solutions as on average at least 1 billion of investments per average-sized city (McKinsey 2018).

However, despite this huge market potential and many successful demonstrations as performed in the Smart City Lighthouse projects, the wider market uptake and upscaling are rather limited so far, and a widespread breakthrough has not yet taken place. This limited impact is not only a consequence of the scope of most projects: more or less singular, tailored to a specific context and situation, within a specific area, and often subsidy dependent. It is also a consequence of the set of interrelated and persistent barriers to wider market uptake of climate-neutral solutions that prevent the realisation of the full market potential, as summarised in section 1.2.

For each category in Figure 11 this plays out differently. Innovative solutions at lower TRL levels (start-ups) are often not perceived as proven technologies and seen as riskier by prospective customers, despite successful testing and demonstration. This makes it more difficult to get them applied and financed, the latter because financial organisations often lack the technical skills for assessment of these solutions. Sometimes, their scope is too narrow, only offering a partial solution with limited impact while prospective customers need a complete solution across a longer value chain (Borsboom-van Beurden et al. 2021).

For mature technologies and solutions with high TRL-levels, other factors are at play. Adjustment to specific local situations and contexts is often not factored in, as it is falsely assumed that solutions can be simply replicated. Van Winden et al. (2016) showed convincingly that replication in the same or another city is much more sensitive to other contexts than roll-out or simple expansion of a pilot project. The REPLICATE project confirmed this: it experienced that in general, climate-neutral and smart solutions will need considerable adjustment when replicated.

Further, as mentioned in section 1.2, business-as-usual can be too easy for city administrations and key stakeholders, leading to an absent or limited interest for innovative solutions (Vandevyvere, H. 2018). As described earlier, silos can make it difficult to find the right department and lack of political leadership can slow down transformation process. If all stakeholders are not yet on board, delays may occur. Privatized (parts of) former governmental organisations might prioritise economically sound motives beyond sustainability. With replication and upscaling not being in the core interest nor a clear responsibility of city administrations, SMEs have to start all over again in every city where they want to do business (Borsboom-van Beurden et al. 2021).

As a result, it is often not only challenging for start-ups to create solid business models and develop markets for novel solutions, but also for scale-ups to bring about a wider uptake. An active city administration and good governance practices can definitely help to incubate promising solutions and contribute to a wider uptake by deploying the local innovation ecosystem: demonstrating that innovative solutions work, promoting the collaboration between relevant parties, and creating business opportunities.

How?

How can city administrations create a healthy local innovation ecosystem to foster not only development but also uptake and scaling of climate-neutral and smart solutions? The overview below has been largely based on Smart City Lighthouse projects' experiences, the public consultation on innovation ecosystem in (European Commission. Directorate General for Research and Innovation. 2020) and (Van den Broek et al. 2020). Dependent upon the role a city administration aspires, different measures can be taken:

- A facilitating role:
  - by providing a **physical space for experimentation**, such as a building block, street or neighbourhood.
  - by **reducing the regulatory burden** and by fostering regulatory sandboxes, often located in the physical spaces for experimentation. In regulatory sandboxes dispensation is given for specific regulations (see for example +CityxChange).
  - by **subsidies, guarantees and financial support**, for instance co-funding the business cases for sustainable solutions, or giving guarantees reducing the financial risks of innovative solutions. This is sometimes done in collaboration with the region, for instance with the regional development company.
  - by setting up and supporting **business incubators** with human and financial resources. These business incubators have the task to promote and support start-ups that will hopefully contribute to the local economy.
  - by providing **help and go-to-market services** to businesses and research and innovation partners that take account of the hampering factors. For instance, some municipalities employ matchmakers to help start-ups and scale-ups find suitable business and government partners.
- An orchestrating role:
  - by **improving the connectedness** within the local innovation ecosystem: foremost by bringing together and engaging the local public entities and key local innovation stakeholders, and co-designing solutions with them (see section 4.4). But also, by improving the connectedness with **other government levels** as region and nation.

- by **creating a learning environment**: to set explicit learning goals about what works and what not in terms of technological, economic, regulatory and socio-cultural embedding, reserving room for proper evaluation and also allowing for failures.
- by **making real-world pilots and living labs part of a wider environment** by a programmatic approach, e.g., coming from (inter)national innovation strategies or complementary and overarching initiatives.
- by addressing the lack of **innovation capabilities** within public stakeholders by organising training and capacity building within city administrations.
- by anticipating in time on **follow-up needed for scaling**, e.g., by engaging specific stakeholders.
- by timely **identifying and engaging intermediary organisations** in different routes to scaling. Intermediary organisations play a key role in each route for the technological, economic, regulatory and socio-cultural embedding of successfully tested innovations. This will enable societally robust learning about wide embedding of innovations and connections to wider networks (Van den Broek et al, 2020).
- by consolidating a **structured and international network** to promote internationalisation.
- by **embedding and enshrining climate and energy policies into local (planning) regulations and constitutional documents**. This helps to set up an ethical framework for investments (see also section on procurement). For instance, cities such as Frankfurt and Munich have embedded ambitious climate and energy goals in the local building code, land use planning and zoning schemes (Radzi, 2018). As described in the example below, the City of Utrecht used very low parking norms to promote electric car sharing in the Cartesius Driehoek neighbourhood.
- by setting up **public-private collaboration and partnerships** (see also section 4.3).

- A (launching) customer role:
  - by **buying innovative solutions** from start-ups and scale-ups. Besides keeping the companies economically alive, this also helps to collect references that the innovative solution really works. In addition, it provides insight into what needs to be improved for wider roll-out and which context factors are important for the replication potential. What is more, setting the good example, by deploying innovative solutions in urban development or for deep retrofitting of municipally owned public assets as buildings and infrastructures, will help to build trust within the local innovation ecosystem.

- by ensuring that climate and energy policies are properly reflected in procurement criteria for **public procurement of smart, climate-neutral and sustainable solutions.**

Many of these measures are part of the example of the IRIS Smart City Lighthouse in the City of Utrecht described below.

A tale of scaling: from local innovator to an international service provider

Local innovator Robin Berg, who is passionate about sustainability, noticed around a decade ago that in Japan a technology had been developed for storing redundant electricity in the battery of electric vehicles. He decided to introduce this technology in the Netherlands and the rest of Europe, for use by his e-car sharing company We Drive Solar, to store excess power produced by photovoltaics. The technology was tested in the Lombok neighbourhood in Utrecht, and its upscaling became part of the Smart City Lighthouse project IRIS (IRIS Smart Cities 2020).

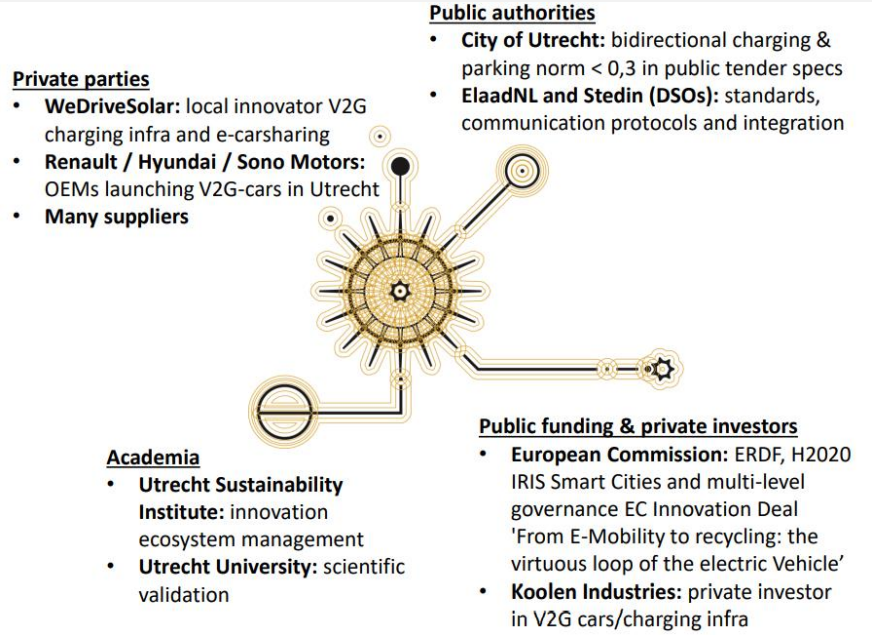


Figure 12: Local vehicle-to-grid innovation ecosystem. Source: (IRIS, 2020)

Soon car manufacturers started to show interest in this vehicle-to-grid technology. Renault stepped in, while the Province of Utrecht, the City of Utrecht, the Utrecht Sustainability Institute of the University of Utrecht, and French Ministries started shaping the right preconditions for upscaling the ongoing experiment, which was facilitated by a European Innovation Deal. Dedicated software was developed to manage the charging infrastructure for electric vehicles. This even resulted in a new European standard for bi-directional vehicle-to-grid technology for power exchange, peak shaving and balancing the power net (ISO standard 15118). Subsequently, five pilots were executed with partners from the local innovation ecosystem with financial support of the City of Utrecht. The results of these pilots were picked up by a branch organisation for electric mobility in the Netherlands, making their impact even visible on a national level. What is more, large real estate developers as Ballast Needam and MRP became interested.

Currently, a crucial role for this vehicle-to-grid technology is foreseen as part of the energy planning of urban redevelopment areas. The recently started urban transformation of the Cartesius Driehoek area now builds on the very low parking norm of 0.3 parking place per household and revolves around e-car sharing and production of solar energy on the roofs of the new buildings. As the City of Utrecht considers the vehicle-to-grid technology as an essential component of its future mobility system, the technology has also become part of the public tendering of a concession for installation of 500 charging poles.

Figure 13: We Drive Solar e-vehicles. Source: (We Drive Solar 2022)

In retrospect, the local innovation system has played a crucial role as an incubator: it provided a knowledge network, with the Utrecht Sustainability Institute in the role of intermediary and facilitator of knowledge exchange. Besides, it provided opportunities for validation of the technology and had innovative businesses that could install and construct it.

Watch:
https://www.youtube.com/watch?v=jhjVaEtpd_Y
https://www.youtube.com/watch?v=iaHwxzplZZQ
(379) IRIS Webinar: Vehicle 2 Grid (V2G) technology - YouTube

Anchor responsibilities for innovation locally through direct organisational roles

What?

The previous section stressed the importance of the local innovation system for public-private collaboration on the development, uptake and scaling of innovative solutions. Not surprisingly, this must be accompanied by anchoring the responsibilities for climate-neutral and smart city innovation within the local government, and if needed, the wider ecosystem. This can be done in several ways.

Direct roles can be established in the municipal organisation, for instance the job of innovation manager, a person who liaises with the innovation ecosystem and ensures promising innovations are absorbed by the municipal apparatus. Alternatively, innovation advisory boards on the transition to climate-neutral and smart cities can be established. They may consist of representatives of different organisations in the local innovation ecosystem. In this way, the responsibilities for the local innovation ecosystem are clearly anchored.

Why?

If responsibilities are not anchored within the local government's organisational structure, city administrations run the risk that promising and innovative climate-neutral and smart city solutions are missed as they are not in the picture and that the local innovation ecosystem and economy underperforms. Having responsibilities for innovation clearly anchored will help to create a better learning environment, to integrate pilots and living labs in a wider programmatic approach, to signal a possible lack of innovation capabilities, and to embed policies in regulations. In that way, city administrations can be more successful in their role of orchestrator (see previous section).

How?

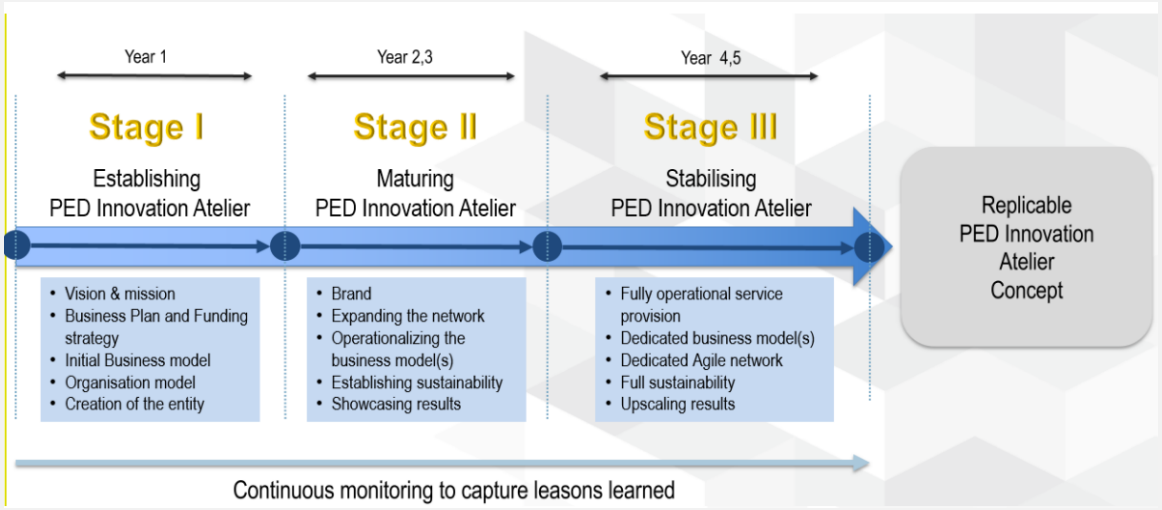
The Gothenburg example suggests that defining direct innovation roles within the governing structures, such as with innovation managers, can be an effective operational way forward. Another example suggested by Leipzig (Future Expert Labs) and Amsterdam (Innovation Ateliers) is the establishment of innovation advisory boards that will include experts from both public and private sectors. In either approach, the key is in developing systematic ways to deal with innovation but at the same time focusing on the external engagement with private sector. In the case of Sønderborg, connecting private (citizen) transport into the project showed the depth of the innovative approach based on practical engagement with stakeholders to the citizen level.

Innovation Boards and Innovation Ateliers promote good cooperation among key stakeholders

Smart City Lighthouse project ATELIER developed and tested an open innovation model in its Innovation Ateliers for realising Positive Energy Districts (PEDs). This Innovation Atelier depends on collaboration with partners, participants and stakeholders. Having a clear ambition and goal and envisioning an ideal that appeals to the target group helps to attract and bind future members to the organisation. To this end, a vision and mission statement were defined, put into action by strategies. With this vision, the Innovation Atelier partners share their dream: what they believe to be the ideal conditions for the community. Alongside an innovation-management perspective, stakeholder-management is considered another crucial element for establishing the Innovation Ateliers. Stakeholders possess unique knowledge. Well-designed processes for collaborative knowledge production help to generate meaningful results for the involved policy makers, researchers and stakeholders, for instance by jointly making documents, models, fact finding etc.

A key challenge is to achieve the Innovation Atelier's economic and societal objectives. Potential value creation was defined by mapping the ecosystem, technology and business services and activities that Innovation Ateliers can offer, and what they yield in financial or non-financial contributions. However, these revenues are often insufficient to cover the costs for all three stages of the Innovation Atelier. So-called initial and structural funding gaps were identified, and possibilities for financing (private) and funding (public) explored. To manage resources and help partners to understand their positions, line of interactions, responsibilities or liabilities to each

other, organizational models are crucial. They govern and establish collaborative linkages among organizations and partners. Potential models fitting Innovation Ateliers are network organization,



virtual organization, membership association, and open innovation platform.

Figure 14: Three stages of the PED Innovation Ateliers. Source: (Sprenkeling et al. 2020)

The open innovation model of the PED Innovation Ateliers offered to its cities and stakeholders a place and network to discuss, learn, collaborate, and strengthen the local innovation ecosystem. Ultimately, this helps to implement the innovative smart urban solutions in PEDs. Through the Ateliers, the local innovation ecosystem is involved in the joint development, assessment and review of technical solutions and measures. Additionally, partners are committed to not only develop and review supportive measures, but also to identify, and where possible, remove obstacles coming from conventional or old structures that might be in competition with the PED development. Lastly, partners have an important task in developing and reviewing new institutional arrangements, new forms of cooperation and governance, new business models and funding mechanisms that support these smart urban solutions.

ATELIER's Lighthouse Cities Amsterdam and Bilbao established successfully the PED Innovation Ateliers, adopting dedicated organisation structures to shape the collaboration among key stakeholders. Discussions among the partners in the cities' PED Innovation Ateliers have led to objectives and the formulation of visions and missions, which in turn resulted in identification of topics and issues to address, as part of workshops and sessions with partners and external experts to help implement specific measures.

https://smartcity-atelier.eu/allgemein/learn-about-ped-innovation-ateliers/
https://smartcity-atelier.eu/app/uploads/D3.1-The-PED-Innovation-Atelier-Organisation-Document.pdf

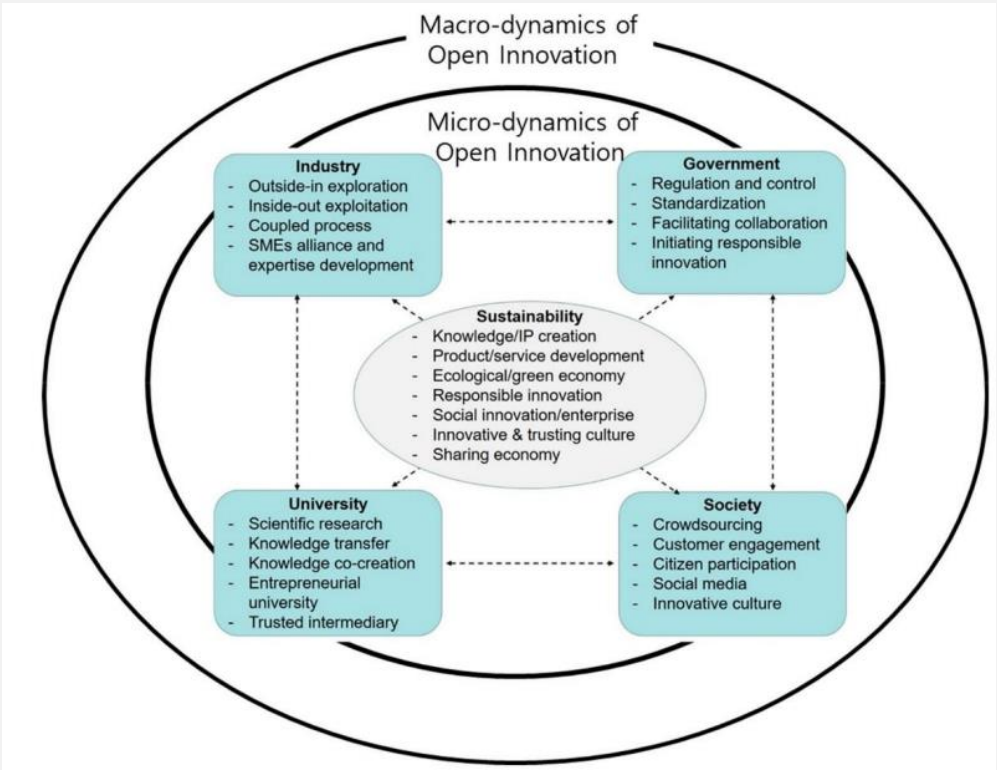


Figure 15: The quadruple helix in an open innovation system. Source: (Yun & Liu, 2019)

Use Public Private Partnership schemes as an implementation and engagement platform

What?

Public-private partnerships (PPPs) can be very effective in accelerating the uptake of climate-neutral solutions, more than public subsidies (Buso and Stenger 2018). However, PPPs are not only useful for implementation but also play a role as an engagement platform. Several SCC-01 projects have demonstrated that flourishing PPPs contribute to a local innovation ecosystem where the four Cs are connected.

Why?

The dynamics of PPPs can be complex. PPPs involve companies of different sizes and with different objectives. Deciding to participate is often motivated by normative objectives like sustainability, energy savings or by an intention to build links with local government and/or to network with peers. The creation of a PPP can even be initiated by business partners and not on a city initiative (case of Sønderborg).

Section 4.3 explains different schemes for PPPs. According to (Buso and Stenger 2018) government interventions correct market failures, and the adoption of PPPs may be particularly beneficial in a context of high uncertainty and incomplete contracts[1]. They researched that PPPs are always optimal with respect to public subsidies in terms of final outcomes, but that they represent the best solution only when the decision-making process is not perceived to be too lengthy or costly. It is easier to achieve a successful adoption of governance arrangements involving public and private participants when the bargaining power is not excessively concentrated in one part and when private and social returns are similar.

Apart from this, Public Private Partnerships (PPP) can be more than a set of operative project tools, and also provide an engagement platform between cities and businesses. In several cases, PPPs faced real challenges in long-term projects such as those on urban transformation, climate-neutrality and smart cities. These challenges where in most cases coming from the business partners. Not because of the lessening of their commitments to the general objectives, but often because of business management or operational changes. This means that the main cornerstone of an effective PPP should be clear and actionable working and legal arrangements, tailored to large or small businesses. Some Smart City Lighthouse projects have experienced that it is necessary to engage every partner in the lighthouse project though a formal and legally binding agreement, rather than to base the partnership solely on fragile trust that can be compromised by shifted priorities or conflict of interests during implementation.

How?

There is no blueprint or one-size-fits-all approach for governance when it comes to engagement with businesses on critical sustainability or energy transition issues. Still, a practical toolbox or a set of standard rules can be helpful to support, especially medium and small size cities, in their path to unlock private sector engagement. The smart city market stimulation package (Wahlström and Norrman 2021) is an effective tool in driving private sector and investor confidence.

Legal arrangements are key for the collaboration with any partner, especially private ones, so these must be an integral part of the PPP. In some projects, such as on acquisition of data on citizens' energy or mobility use that resulted in a significant asset growth, a lack of clarity on ownership or legal arrangements at setting-up stage of the PPP have resulted in strained relationships. Setting up an effective PPP necessitates not only the recognition of risks and bottlenecks, but also awareness of the city governance strengths and weaknesses. This can be ensured by involving the broadest levels of city government (not only sustainability or business relations department, but also those working with procurement, culture and civil society).

Public-Private Partnership ProjectZero in Sønderborg in SmartEnCity

In the document "Roadmap2025 - 50 steps towards a carbon neutral Sønderborg" the City of Sønderborg proposes 50 solutions at different scales and with a different composition of promoters

[1] According to (Buso and Stenger 2018) a contract is incomplete when some targets of the project cannot be part of the agreement because it may be hard to specify their values in advance and/or because, in the event of litigation, they cannot be adequately verified ex-post by a Court of Justice.

and stakeholders to bring the city to climate-neutrality. The city proposes the transition to a novel energy system based on 100% renewable energy, which must be phased in with respect for solutions and the market. Three main challenges have been addressed:

1. Securing production value when there is surplus, to prevent a large part of the energy produced being sold at low or nil prices.
2. Guaranteeing adequate production capacity when there is no wind or sunshine. Wind and solar expansion mean that it will be less attractive to build traditional power and heating plants.
3. Managing the uncertain predictability of wind and changing production patterns.

ProjectZero was conceived by a local think tank in 2007 and was founded as a public-private partnership shortly thereafter, with support from both the City Council and local businesses. The idea was that only through a collaborative culture where businesses, residents and organizations contribute, can an entire region lift itself out of provincial thinking, to the benefit of the community and the stakeholders themselves. In the same spirit, Alsion, Kultur i Syd, the Gehry Harbour Project, the House of Science, UNESCO Learning City, Nordals Holiday Resort and the Centre for Industrial Electronics have been established as public-private partnerships.

Some examples where the PPP model was applied are the following:

The **ZEROhousing** customer journey helps homeowners implement profitable energy renovations. The customer journey has 11 steps, which:

- support the decision-making process and subsequent implementation.
- help the homeowners to showcase their efforts; and
- help them to initiate new renovation projects.

Green district heating
The Sønderborg area's district heating plant has phased out fossil fuels over the last few years, and the heat supply is now based on sorted waste, biomass, large heat pumps, solar heat, geothermal power, etc. The municipal heating plan (2015) forms the basis for district heating expansion and fuels. On the island of Als, biomass is converted into gas and surplus heat for housing in both Nordborg and Guderup. The Sønderborg area's district heating is therefore a carbon neutral, cheap and future-proof source of heat for homeowners in urban areas and thus also the foundation for phasing out the approximately 400 oil burners and 3,700 gas burners in current or future district heating areas.

Roof-integrated solar cell solutions for detached houses expect that approximately 20% of homeowners will have established their own roof-integrated solar cell solution by 2029.

Heat pumps will phase out 5,100 oil and gas burners outside the district heating areas upgrading the current 1,850 oil burners and 3,300 natural gas burners in the city´s houses.

Certified leases to motivate landlords and tenants to perform energy renovations. The increasing demand for energy-efficient rental housing seems to be the main driver. Therefore, it is essential that tenants can navigate between the different rental homes and choose based on energy consumption. The certification can be used by landlords to market their leases. At the same time, the tenants are also given a better basis for choosing a residence. It should help to put the focus on the total costs for the residence.

Biogas in the South Sønderborg area
Biogas production is an important part of the Sønderborg area's transition and efficient use of local resources. In recent years, ProjectZero has collaborated with Nature Energy, local farmers and Sønderborg Municipality to establish biogas plants in the area. Specifically, two large biogas plants will be built. They process manure from local agriculture and produce up to 45 million m^3 of green gas per year. The biogas is being upgraded to natural gas quality (biomethane) and is fed into the natural gas network.

Figure 16: Total annual carbon reduction in 8 areas in 2025. Source: (ProjectZero Foundation, Roadmap 2025)

Explore and use innovative financial schemes to scale transformation

What?

The scale and pace of investments in long-term transformation can be increased by using transaction enablers and de-risking tools besides simply providing capital through credit and (revolving) funds (European Commission. Directorate General for Energy 2022). Examples of such transaction enablers and de-risking tools are guarantees, standardised contracting enabling bundling and aggregation of projects, and standardised risk assessment. Energy performance of equipment and building envelope can be guaranteed by Energy Service Contracts, such as the well-known Energy Performance Contracts. More recently, new performance-based contractual models have emerged, for instance Lighting as a Service, Efficiency Service Agreements, Managed Energy Service Agreements (European Commission. Directorate General for Energy 2022). Many innovative schemes for financing energy efficiency combine technical assistance, credit and funds, for instance in ESCOs or local authority formed vehicles. Nearly all SCC-01 cities have experimented with these for residential and commercial buildings, and explored promising avenues, such as the area-based business model for clean energy in the City of Umeå in RUGGEDISED Smart City Lighthouse project.

Why?

The Energy Efficiency Financial Institutions Group observed recently that, despite an annual funding gap of 275 billion Euros for renovation of buildings between 2021 and 2030, there is a far greater supply of finance and investment funds than there are projects to be financed. From the financial sector perspective, they outline as critical barriers high investment and transaction costs, the poorly known risks of specific energy efficiency projects, difficult access to finance for in particular low-income households and SMEs, and lack of reliable data and information on real energy performance (European Commission 2022).

At the same time, as large investments are needed to create future-proof cities, public finance will not be enough and private finance often prefers other investment opportunities, perceived as less risky or with more attractive business cases. As a result, it can be difficult to get climate-neutral and smart city projects, portfolios and programmes financed. Based on the combined experience of the 42 cities participating in the SCC-01 projects GrowSmarter, REMOURBAN, Triangulum, Smarter Together, REPLICATE, SmartEnCity and Sharing Cities, two key SCC-01 publications (Garcia-Fuentes et al. 2020) and (Smarter Together, Sharing Cities, REPLICATE and SmartEnCity 2021) highlight which factors have been experienced by cities making it difficult to secure finance for climate-neutral and clean mobility solutions for districts and cities.

Foremost, **economic factors** are at play. For *city administrations*, the usually sizeable up-front costs of solutions and their long payback periods, uncertainties around development of heat and electricity prices and lack of guarantees thereon, and insecure investments due to complicated cashflow models are making it difficult to secure finance.

For the *finance industry* the usually small(er) investment volumes of urban projects may lead to relatively high transaction costs and less profitability. In addition, complex stakeholder constellations of climate-neutral and smart solutions make cashflow models unclear: who is benefitting from what, and who has to bear the financial burden of investments? This unclarity is reinforced by different national landscapes for incentivising technologies, for instance on feed-in tariffs for renewable energies (Garcia-Fuentes et al. 2020). Overall, the smaller investment tickets and complicated cashflow models are making it more difficult to provide finance.

Besides solely economic factors, **cultural, organisational and political factors** play a role as well, and prohibit a smooth flow of finance into climate-neutral and smart city projects. Cultural factors are that city administrations are used to cover costs themselves of outsourcing and contracting. They are often not used to working with external finance not on the municipality's balance sheet, especially when coming from the private sector in the form of loans. Also, issues related to trust and transparency play an important role, such as scepticism and lack of experience with emerging markets, where economic feasibility may seem far out of reach. When details are missing about the performance of solutions, for instance when integrating innovative technologies, or standards are missing, solutions are labelled 'high risk' for investment with an unsecure return of investment (ROI). It might also be that the financial industry lacks the technical skills to properly assess the perceived risks (Garcia-Fuentes et al. 2020).

Further, there are **organisational factors**. City administration staff frequently lack the know-how and expertise on climate finance and climate investments, creating a need for tailor-made support to access funding and finance projects, for example through long-term partnerships with financial experts (NetZeroCities 2022). Besides, financial institutions are often poorly involved in early stages of a project. This means that the design and planning phases of the project cannot take into account possible preconditions from financial parties that might influence the project's design and preparation.

And politically speaking, politics usually prioritize new buildings and not the refurbishment of existing buildings, that is more costly and might have lees financial benefits (Garcia-Fuentes et al. 2020).

How?

Within the seven projects just mentioned, several solutions have been identified and sometimes implemented to overcome the barriers described above.

These range from developing skills and competences in new technologies through training, to the promotion of innovative financial schemes such as crowdsourcing, microfinance, and community investments. Some cities, for example Gothenburg, established entities that share risk and costs, such as public-private partnerships, while others "outsourced" investment costs and risks in innovative contracting or service models to overcome a lack of own means. The external operator then takes care of the planning, installation and operation of the smart energy network or the clean mobility solution.

Providing incentives to citizens and local governments, such as subsidies, tax reduction or discounted energy fees, by regional and national government can be very effective, while also creating many new jobs, for instance in local installation or construction businesses. Besides, in the long term and given the size of the task ahead, this might not always be a sustainable solution as subsidies and other forms of public funding are inadequate to covers the costs of the entire transition to climate-neutral and smart cities, and business cases cannot fully rely on them.

Very important is to identify beforehand the most suitable business model and financial scheme for the type of intervention (energy, mobility and ICT), and to consider which other benefits (environmental, health, etc.) could have a major impact on the medium or long term (Garcia-Fuentes et al. 2020).

In this light, it is interesting that a few years ago, the EU Taxonomy for Sustainable Activities was published to help investors, solution providers, and policy makers to understand whether a project is meeting robust environmental standards and to report on this once finance is attracted. This sheds more light on which performance can be expected of climate-neutral and smart solutions. It is expected that increasing amounts of capital will be looking for projects that align with this EU Taxonomy (Borsboom-van Beurden et al. 2020).

Lastly, several cities are developing and piloting alternative financing tools and schemes to accelerate climate transition, such as climate budgets, green bonds and crowdsourcing

(NetZeroCities 2022). These will not be sufficient to cover all costs involved but can contribute to a sense of ownership of citizens and local businesses, thus reinforcing the local innovative ecosystem.

Gothenburg - Climate Partnership

The City of Gothenburg has set up the Gothenburg Climate Partnership, which is a long-term, active collaboration between the business community in the Gothenburg region and the City of Gothenburg to reduce its carbon footprint. Being part of the partnership offers many benefits for companies, like collaboration opportunities, marketing of their climate actions, access to key actors within the city, and support to implement sustainability projects. Additionally, the city has developed a Strategic Business Programme which is the city's common roadmap for creating better conditions for entrepreneurship.

Figure 17: Session on governance for climate-neutral cities during the Energy Cities Forum April 2022

Use procurement (and alternatives) to realise a city's long-term aims

What?

Procurement is an important mechanism in delivering climate-neutral and smart solutions. Inclusion of sustainability and other non-economic benefits is usually not easy and requires these criteria to be part and parcel of cities' policies. While cities are coming from a culture of contracting through procurement and therefore still hesitate to use private finance, more and more alternative financing

possibilities come into being, each with their own conditions and legal requirements. For instance, joint ownership of clean energy installations, crowdfunding and energy communities.

Why?

The implementation of climate-neutral and smart solutions in cities, can be severely hampered by non-attuned public procurement processes. Garcia-Fuentes et al. (2020) give an overview of the main issues that are summarised here. First of all, the procedures for procurement involve many stakeholders at national, regional and local level, which makes them complex, and are usually time-consuming and heavy. As the main criterion for selection is usually the best value for money, and non-economic values are often difficult to capture and calculate, this usually results in a choice for the lowest price for the best offer. Due to the complexity of the process, there is hardly room for changes and proposed changes will inevitably result in delays, as validation is needed from federal/regional and local levels. There is a lack of experience in and knowledge of more innovative instruments such as public procurement of innovation and pre-commercial procurement. Municipal staff have no experience in the methodology that should be applied for public procurement of innovation and pre-commercial procurement and are generally not fully aware of its benefits.

Besides, having very detailed specifications in the tender specification might lead to less innovative solutions being offered. For instance, the IRIS project describes how the City of Utrecht has currently procurement contracts with very detailed and specified technical requirements for the demanded products and services (Wahlström and Norrman 2021). IRIS questions whether complex and innovative smart city applications can be specified in such technical detail up-front, or whether a more functional specification of requirement leaves more room for innovative solutions from supply partners (Wahlström and Norrman 2021).

Lastly, in a common municipal culture of outsourcing, tendering and contracting during short political cycles, the contribution of separate bids to the long-term plans and ambitions is not always taken into account.

How?

First of all, the criteria city staff intend to use in procurement must be aligned with and also included in its policies and long-term aims. Without having that in place, the procurement lacks the political support and possibly also the legal basis needed. If a city does not have these criteria in their policies, it will be more cumbersome to assess bids for their contribution to especially non-economic values (Energy Cities 2022).

Other suggestions from (Garcia-Fuentes et al. 2020) are to use accelerator and incubator programmes for issuing challenges instead of giving very detailed specifications. The programme can usually provide legal and economic expertise to promising new technology owners. Further, risk and cost sharing entities can encourage SMEs to engage more actively in climate-neutral interventions in districts and cities. Community ownership of clean energy solutions such as wind turbines and solar farms or even group approaches to energy market transactions are mentioned as

other solutions that can avoid slow decision-making processes or restrictions of local governments. Energy communities are increasingly seen as an alternative to government actions. Word of mouth recommendations through informal neighbourhood networks can also generate interest at district level.

Additional critical success factors in public procurement are:

- Reducing the complexity of public procurement processes as it can be frustrating for SMEs. Because of this complexity, some SMEs perceive public procurement as a black box, not being able to evaluate business risks.
- An open dialogue and early engagement can generate a SME-friendly public procurement.
- Digitalisation and new technologies can serve as a tool for incentivising innovation in green public procurement.
- Companies and businesses operate in an open commercial market and they often like some further incentives such as opportunities for visibility and promotion in the project.

City-level recognition and integration of innovation in business models, market awareness, green public procurement end transparency in the governance processes will facilitate the financing of renewable energies systems and other types of sustainable investments in the cities. Public resources and public money should be used as a locking facility to enable private sector financing and investment. This has also been proposed by the Energy Efficiency Financial Institutions Group in their advice to the European Commission (European Commission. Directorate General for Energy 2022). Opening to the investor market necessitates the same internal governance changes as with unlocking public procurement and with establishment of well performing public private partnerships. Effective call financing is subject to simplification of city ambitions and in connecting these ambitions to the technology availability in a most straight forward way.

Apart from the Energy Efficiency Financial Institutions Group, several recent EU-funded projects such as the Investor Confidence Project[2], indicate that rather than the lack of money, the main issue is effective evaluation of what is perceived a complex project. Investor confidence can only be built by fully understanding the project and risk involved. In the same way as with the companies, looping in potential investors very early in the project development process could create a foundation for later investments. Public resources and funds should aim to be used to mitigate perceived risks by, for as example, providing investment guarantees such as through ESCOs.

Finally, the lack of financing is also due to city projects often being small from the financier's perspective. Cross-European smart city dialogue and exchange of best practices regarding unlocking private financing could be a good way to drive understanding of investor risks. It could also lead to the development of pan-European innovative business/financing models or drivers such as grouping

[2] http://www.eeperformance.org/

or clustering of small projects into the larger smart city initiatives that are more investible. Banks, investment funds, pension funds should be part of this cross European smart city dialogue.

Proposing a thermal energy concept for the area before tendering concessions for real estate development

The City of Rotterdam had learned from the Smart City Lighthouse project RUGGEDISED that it was not enough to offer a Smart Thermal Grid (STG) and expect real estate developers and facility managers to take care of the connections and ensure the sustainability of the solution after development contracts had been agreed upon. Implementing the grid and its energy sources as well as connecting the buildings to the grid encountered resistance, as the system was unknown and unloved. Even though the buildings were designed to meet the requirements of the STG, the developers had difficulty with the interdependences on each other.

The city administration felt it was lagging behind in such cases, so it decided to follow another approach for the urban development of former harbour Rijnhaven. Here, a draft energy concept proposes which energy solutions to implement within the area. Recently, a market consultation was launched and prospective bidders for the concession to develop the energy network have the chance to give their feedback on the energy concept. This gives the city administration valuable information on what is feasible and what not. What is more, it provides insight into which prospective bidders would be happy to work with the proposed concept and might meet or even surpass the sustainability criteria. Further, prospective bidders are aware that connections to the proposed energy concept will be mandatory. Bidders will be required to demonstrate that they provide the most sustainable solution. If that is not the same solution as the energy provider has proposed, this means the energy provider has to go back to the drawing table and propose a more sustainable solution.

Figure 18: Artist impression areal development plan Rijnhaven. Source: (City of Rotterdam, 2022)

Procurement of vehicle-to-grid charging poles in Utrecht

The City of Utrecht considers bi-directional charging as a key element of a sustainable mobility system, as there are 150 000 cars in the city. Having 10 000 charging poles with this vehicle-to-grid technology, would make a tremendous difference in the sustainability of the mobility system. In retrospect, the local innovation ecosystem has played a crucial role laying the foundation for these plans. As a knowledge network, it helped to build experiences, with partners playing different roles. For instance, the Utrecht Sustainability Institute of the University of Utrecht was in important intermediary in this process and facilitator of knowledge exchange. Besides, the knowledge network provided possibilities for validating the technologies in real life, while an innovative company can actually implement the solutions. Based on its experiences in the Smart City Lighthouse project IRIS, the City of Utrecht has recently issued a tender for the public procurement of 500 bi-directional charging poles is a first step in realising the 10 000 poles. This shows that the city administration can make a difference through public procurement.

Interest from the private sector in REMOURBAN

Before the formal procurement process, potential bidders are often invited to comment on a proposed project structure. The comments are based on a pre-bid road show, a briefing, or a project paper, which is shared. Often, the opportunity is described in an "Information Memorandum", a summary of the key attributes of the project, the operating environment, and anticipated financing. These discussions also generate market interest in an opportunity and may broaden the pool of potential bidders. Collecting this market feedback from potential private partners during the design/preparatory phases ensures that the bid package attracts interest. Based on these three criteria, the available options can be ranked, and the government can take an informed decision on the PPP strategy to be adopted. The road map will then be updated to reflect the PPP option selected and preparatory work can start.

5. Facilitating learning in urban innovation projects

5.1. Learning mechanisms and key lessons

This section summarises the main themes repeating throughout multiple projects and interviews and proposes general directions for reflecting these lessons in individual projects, local governance, and funding programmes.

When it comes to the design of Lighthouse projects, learning of key stakeholders and systemic change were usually expected to happen as a by-product of testing a new solution or approach in the city environment and engaging stakeholders in the process. Learning and governance change were not systematically managed and monitored and therefore they are not well understood. This makes it is difficult to assess why certain activities contributed to systemic changes and then use this knowledge in further improving the design of projects and transferring useful learning to other cities.

Another factor that reduces the impact of these projects is the fact they are often seen by the city administration as a way of co-funding already planned investments or just generally improving the city by investing in "anything new". They are managed by a small team of people who lack a sufficient mandate to propose and implement systemic changes. This is combined with a lack of clear political leadership regarding urban innovations/transformation - the agenda is divided into several departments or political mandates. This leads to isolated projects running in parallel with other agendas of the city often duplicating what the city has already done (visioning, roadmaps, data collection) and not actually driving systemic change.

According to the city representatives directly involved, one of the most valuable lessons generated by Smart Cities and Communities Lighthouse projects is learning on how to manage urban transformation and how to improve the process in the future (Evans et al. 2021). The projects helped these individuals to understand roles, organizational structures and processes that are needed to implement innovative solutions in specific areas (energy, digitalization, transportation) or that would improve the overall capacity of the city ecosystem to effectively develop, test and implement new solutions and practices.

Yet this learning is mostly limited to the people directly involved in the demonstrators as the key process is social learning taking place through direct interaction of stakeholders with the project and other people. This is a natural way people learn to adapt to new challenges, adopt new values, learn to perform new roles and establish connections to others. People need to interact with their peers, see them react, find new ways of working together, etc. The result of participating in pilot projects is a unique and complex shared experience and mutual understanding of how the change could look like and what each stakeholder needs to do to contribute to help implementing it. The experience

and lessons of this kind are difficult to share with people who are not directly involved and often are not even acknowledged and reflected. This makes coordinated actions of key stakeholders not involved in the project less likely, since they do not share the transformative experience, understanding of the problems and solutions and roles they should be playing regarding transformation processes.

However, the Smart Cities and Communities Lighthouse projects surely opened discussion on windows of opportunity for structural change. Even though this was not an intended activity in most projects, many cities actually reflected the learning these projects generated in terms of governance and developed replicable measures related to systemic governance changes and improved design of urban innovation projects. This document is an example that Lighthouse projects can in fact drive systemic change and produce lessons for others. What is needed is a more systematic approach to producing, implementing, and sharing organizational learning and include systematic governance changes as a key category of impact of the project with dedicated indicators, deliverables and activities.

When it comes to Follower (or later Fellow) cities in SCC-01 projects, changes in their role and status can be seen when comparing the first-generation projects with the later ones. The earlier project designs focused on replication of specific solutions from lighthouse cities to the followers, while the later did not have very active role in first half of the project. They were getting familiar with what the rest of consortium is doing and effectively waiting for some solutions to be implemented in Lighthouse cities so they can start working on their replication plans. The shift in later projects was reflected in changing the term to Fellow cities and promoting collaboration and knowledge exchange earlier in the projects. The cities had more freedom in defining their own priorities and adopting lessons to their specific context.

Certain shifts in engagement of Follower/Fellow cities can be seen even within individual projects. Representatives of some cities (e.g. Leipzig in Triangulum) realised, that there are valuable lessons to be learned which concern innovation management, stakeholder engagement, planning and implementation of innovative solutions both in general and in specific domain (energy, transport, ICT). These individuals started to proactively seek these lessons and proposed systemic changes, which would increase the capacity of the city to manage urban innovation projects and in some cases to become a Lighthouse city in upcoming call. This general capacity building, mutual learning and emancipation of Fellow cities should be an important part of the design of future projects. This is especially important for cities in newer member states (widening countries).

Therefore, the general recommendations for cities are:

- Develop a process for extending learnings on roles, organisational structures and processes beyond people directly involved in demonstrations or projects
- Allow space for (systemic) changes in governance frequently happening as “by-products” of testing new solutions or citizen engagement

- Organise mandates for proposing and implementing systemic changes in governance – in tandem with political leadership of urban innovations and transformation
- Produce lessons for others, as is happening in the SCC-01 community: this governance paper is an example.

5.2. Boosting learning and organizational transformation within cities

This section summarizes the main recommendations on how to support learning and organizational transformation through urban innovation projects with emphasis on international EU funded projects.

Create the mindset for learning

Learning and organisational transformation need to be acknowledged as one of the key elements of your project. The project coordinator should design activities that explicitly aim to produce, capture, reflect and implement learning related to the implementation of new solutions. The learning focus needs to be explicitly communicated to stakeholders. People involved in the project need to have dedicated space and time to process new lessons together. As one city representative put it "Innovations require space in your mind and space in your day".

Include key stakeholders in the design of the project

Make sure you involve key stakeholders who are relevant for the area of innovation or challenges addressed by the project. Discuss their needs, priorities, plans, challenges, and their potential role in the project. How can they benefit from the project? How will they contribute? Which of their activities can be related to the project? Define the specific relationship of the most important stakeholders to the project. It is not always possible to include all relevant stakeholders in the consortium of an EU funded project, but there are alternatives such as the creation of intra-organizational teams through memorandum specifying non-financial benefits and non-financial contributions of the local actors.

Create innovation teams around challenges, rather that single projects

This follows the previous point. Innovations often require systemic changes and systemic changes require coordinated change in several organizations and across agendas. This takes time and requires involvement of the right people in each relevant organization. Experienced cities recommend creating cross-department teams that are collaborating on a specific challenge across multiple projects and align their capacity, budget and roles in a way that allows effective pursuit of common goals and implementation of innovative solutions.

Support social learning

The most natural way of learning and adopting new ways of doing things is learning in a social context and through personal experience shared with others. Create opportunities for relevant stakeholders to interact with new concepts, solutions, and trends through small-scale experiments, pilot projects, models, or exhibitions. Make sure this learning has the social and inter-personal dimension. Key actors need to be able learn together, discuss their roles, reflect new lessons, and propose joint way of moving forward. They need to be able to imagine outcomes of implementing new solutions, realise what their own role in the change can be and develop an understanding of how the system as a whole needs to adapt to make the change happen.

Relate the project to the specific context of your city

This is especially important in international projects designed by external coordinators, since there is a risk that a third party proposes a project design, which does not reflect the specific situation in your city. This then leads to activities that are misaligned with the city agenda and cannot really boost transformation and learning. Example would be developing a city vision as a project activity if your city just finished this process, or testing a solution, which is already being implemented in different project in your city. The project should be linked to existing city strategies, agendas and visions and activities proposed for your city should be tailored to fit your city and to leave space for an agile approach. Explain your situation and priorities to the partners in the design phase and make sure the project reflects them. If you feel that the project is misaligned with the priorities and needs of the city in the realisation phase, communicate this with your partners and try to find a solution.

Make efficient use of data

Engage data scientists or analysts in your project and make sure you effectively use data that your city already has and collects, and integrate new data produced by your project. The data can be useful but also misleading if misunderstood or misinterpreted. Consult experts to improve your understanding of the limits of the data and stories they can tell. Find engaging ways of presenting the data to your stakeholders and citizens to: explain and discuss status quo; model future scenarios and simulate outcomes of proposed measures; monitor and evaluate results of interventions.

Engage artists and the creative sector

Engage the creative sector to accelerate learning, provoke discussions and include aesthetics in urban transformation and innovation projects. There are great examples of exhibitions, installations and art in public space that can drive public discussion on key issues and present challenges, trends and possible futures in a creative and engaging way. Digital artists can help creating augmented reality to project history or future on current city structure or develop interactive games or apps helping citizens to learn about urban transformation in an interactive way or, for example for about one´s impact on environment.

Example of this type of collaboration was **Urbania exhibition** developed by the **City of Prague** to capture and share their experience from being a 'Fellow city' in the Triangulum project. Urbania

was an interactive Exhibition aimed at promoting principles of sustainable development and lessons from Triangulum to local citizens, municipal employees, and other key actors on the local level. Each exhibit demonstrated one of the principles of good governance that were chosen based on interviews with local actors and international experts. The exhibits offered real life example of these principles being implemented in the city context from the perspective of civil servants or citizens and allowed the visitors to interact with them to immerse them in the experience and facilitate learning. Trained guides took visitors on a guided tour of the exhibition, which featured light, sound, and interactive installations. The experience included facilitated debrief session allowing the visitors to share their experience and discuss how it can be reflected in their own work or lives.

Figure 19: Urbania Exhibition in Prague. Source: IPR Praha, Jan Malý

Build symbiotic relationships with universities and research institutions

Universities and research institutions can help your city by co-designing quality project designs, finding partners, providing independent expertise and mediate transfer of learning from the international academic community. Engage specific experts and teams in long-term symbiotic relationships so they can be part of the transformation and serve as ambassadors of universities in your city ecosystem. Look for ways of engaging students into urban innovation projects so they can both contribute and develop new skills. Make the partnership with university and research partners official and develop framework formalising the collaboration. Co-create long term general strategy for engagement of and mid-term strategy for specific areas of innovation with specific research teams or departments and their representatives in your city's innovation teams.

Create physical space for innovations

Creating dedicated space for co-creation, piloting and showcasing urban innovation can help concentrating stakeholders in one location and increase likeliness of their interaction, mutual leaning, and cooperation. It can promote development of formal and informal networks and communities of practice which help exchanging, absorbing, retaining, and developing know-how that can result in new business opportunities and drive local urban transformation.

There are various models related to urban innovation spaces that vary in scale and specific focus. The **City of Limerick**, for example, created **Citizen Innovation Lab**: a physical and digital space where citizens can work collaboratively with the local authority, University of Limerick and other interested stakeholders to develop solutions focused on the energy transition, climate action and sustainability. A large scale-innovation zone can be found in **Espoo** called **Innovation Garden** which brings together to Aalto University, research centre VTT, companies, start-ups, cultural and sports organisations, city employees and residents. Consultation of these actors enables "encounters - planned or serendipitous - between people are a source of innovation and new experiences". Physical spaces dedicated to innovation also help make urban transformation more tangible and present in minds of local actors and residents.

Figure 20: +Limerick Citizen's Innovation Lab. Source: +City Exchange, City of Limerick (https://cityxchange.eu/limerick-citizens-innovation-lab)

Create organisational space for innovations

If a specific project "works" and creates a transformational experience for stakeholders, do they have a clear pathway to embed the lesson in their organisations? For cities is there a window of opportunity to inform or influence a specific policy or set of guidelines? Can urban projects be designed to provide lessons and insights to a range of stakeholders who are involved?

Aim for broader impact of the project

Do not focus solely on implementing one new solution or approach. Urban innovation projects can have many additional benefits for the city and local stakeholders e.g.: talent attraction & development; support of local start-ups and businesses; citizen engagement and community

building; transferring successful organizational and governance models from partner cities; engagement of students and development of their skills; increasing attractiveness of the municipality as a partner and employer etc. Identify those positive externalities and make them an explicit part of the project with dedicated activities in the project.

5.3. Transferring knowledge and supporting replication between cities

This section summarizes how cities can learn from others and share their own lessons and best practices to be used elsewhere:

Support personal learning

If you aim to learn from a specific city or network, identify individuals who will be directly involved in implementing the lessons in your city and find a way of connecting them with their peers in a partner city or network. Organise workshops, arrange in-person or online meetings, send people to relevant international events and help them to connect with their peers. Personal peer-to-peer learning enables people who have expertise to share not just solutions, but lessons related to their implementation and operation. Peer-to-peer learning can also boost motivation of involved individuals and create strong long-term partnerships enabling two-way exchange of lessons in the future and mutual support.

Organise study visits

Identify cities that can be a source of inspiration in particular area of urban transformation and organize visits of key stakeholders in that city. Make sure that you bring a diverse team of stakeholders that represents all relevant organizations and sectors. Ask the representatives of the city you are visiting to organize meetings with key actors responsible for the transformation in the area of your interest. This type of learning enables your stakeholders to share the experience and learning from the visit and reflect on what are the key lessons for your city and how they can be implemented. It is important to proactively identify and engage relevant stakeholders and design the visit in the most productive way in terms of learning.

Organize local workshops with international guests

Invite guests from abroad to present their experience and insights at your local events to provide lessons, examples, and an outside perspective. This can change the dynamic of discussion and help overcoming psychological and organizational barriers of experimenting with new concepts and ideas. It is not always possible to replicate the exact solutions but is very useful to learn from the experience from elsewhere and to discuss what local stakeholders can learn and how the presented solution could be adapted to the local context or vice-versa.

Capture and share transformative experiences

In your own projects, try to capture personal experiences of stakeholders involved in the project and moments and factors that shaped key decisions and contributed to the final result. Actively seek feedback and testimonies of organisational actors and citizens. These lessons can be transformed into stories that will capture the complexity and personal dimension of your journey to sustainable transformation and can be used both for scaling up innovative solutions locally and replicating them elsewhere.

Translate lessons learnt into your local context

Do not try to force a specific solution or model onto your city. Try to understand why that specific model worked elsewhere and how this can be applied in your context. Use examples to spark discussion with local stakeholders and to arrive at your own version of the solution that is fully integrated into your local infrastructure and organizational structures.

Link concepts with specific examples of solutions

When transferring lessons from elsewhere, make sure your stakeholders develop mutual understanding of the general concept behind specific examples (e.g., Mobility as a Service, Positive Energy Districts, New European Bauhaus etc.). Use emblematic projects and examples to explain the underlying principles of the concept or approach before discussing transferability of specific solutions and measures.

Provide simple communication materials for stakeholder engagement

Provide visual aids and materials that can be used to brief your stakeholders quickly into key concepts and project basics when reaching to them for the first time. During the project, visualise organizational structures, concepts, business models, processes, and links of new solutions to existing infrastructure. Use these aids to ground discussion and to make sure that everybody is on the same page and that common understanding of the concept and language exists.

Exchange templates

Many cities found it useful to share templates of contracts, procurement guidelines, questionnaires, project plans, strategies, competition rules etc. These can often be directly replicated and accelerate implementation of new measures and solutions into organizational structures in partner cities.

Don’t sugar coat your experience

Cities often provide polished PR versions of their project inflating the positive impact and leaving out any negative lessons and issues that hindered the process. This makes other cities repeat mistakes and individuals can feel stressed since they compare their uneasy path to the idealised stories other cities present. Share what did not work, the reasons for that and how you managed to overcome the issue. These lessons are often the most useful for the cities and can have therapeutic effect for all parties involved in the exchange since they can share the uneasy reality of their professional experience and support each other in overcoming the obstacles.

An overview of worst practices

Many times, one can learn much more from another one's failings than from one's successes. However, it requires courage to be open about things that did not go so well. A good example of sharing things that did not work as planned, is the recently published overview of "worst practices" as part of the description of each city's journey towards zero carbon emissions in the SmartEnCity project. This overview does not just list the worst practices but also contains advice for other cities as well as main lessons learned. Food for thought! (Smarten City 2021)[3].

[3] https://smartencity.eu/outcomes/worst-practices-lessons-learned/

6. Where to find more

Smart City Lighthouse project deliverables and key city documents

+CityxChange

D3.2: Delivery of the Citizen Participation Playbook (Burón and Sánchez 2020) D3.2: Delivery of the citizen participation playbook - +CityxChange

Atelier

Deliverable 2.2. Report on Smart City Planning Groups (SCPGs) 2021 F. Verspeek, N. Kim, J. Gonzales Mancisidor, K. Löcsei-Tóth, P. Santos, K. Kaugurs, K. Dyhr-Mikkelsen, J. Slimák, G. yczka, A. Lopez Romo Koldo Urrutia and C. García https://smartcity-atelier.eu/outcomes/deliverables/

IRIS

Deliverable 3.6 IRIS City innovation management performance and roadmaps 2021 U. Wahlström and J. Norrman https://irissmartcities.eu/public-deliverables/.

GrowSmarter

D2.6 Implementing low energy districts in European cities – conclusions from GrowSmarter. Concluding report WP2. 2019 M. Sanmarti, A. Sola, Catalonia Institute for Energy Research (IREC) and GrowSmarter Work Package 2 (WP2) leader file:///C:/Users/glori/Downloads/Attachment_0%20(3).pdf (Sanmartí and Sola 2019)

Making City

D2.22 New Policies in Oulu [Initial Version] 2021 S. Rinne and City of Oulu in general (OUK) https://makingcity.eu/results/#1551706653078-f45cc6aa-d082

D8.19 MAKING CITY political positioning and policy recommendations report Initial version 2021 M. Segovia Martínez, A. Ruis Pastor and E. M. Mitre https://makingcity.eu/results/#1551709343301-68338d25-5ff3

MySmartLife

A guide for the transition of EU cities towards a new concept of Smart Life and Smart Economy. Smart People - Smart Economy - Smart Cities. MySMARTLife Best Practice booklet. https://www.mysmartlife.eu/fileadmin/user_upload/mySMARTLife_booklet_WEB_final.pdf

REMOURBAN

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The Path from Pilot to Scale (Smarter Together, Sharing Cities, REPLICATE and SmartEnCity 2021)

7. Contributions

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Daniele Vettorato – EURAC (expert)

Tomas Vacha – CZUT (expert)

Dusan Jakovljevic – EE-IP (expert)

Hans-Martin Neumann – AIT (review)

Cities of Valencia, Lyon, Gothenburg, Florence, Limerick, Amsterdam, Sønderborg, Leipzig.

Annemie Wyckmans, Muriël Pels, Roel Massink and all other members of the City Coordinators Group

Scalable Cities consortium, in particular Ghazal Etminan and Sovantania Kauv – AIT, Hans-Martin Neumann - AIT, Sofia Corsi – Energy Cities, Philippe Fournand – BlueSight

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9. Annex – Interview Guide

Guide Group Interviews Expert Assignment "Systemic changes in governance" Version 2

Date:
Names interviewer(s):
Names interviewee(s):
City:
Function(s):
Consent to record interview?

Background of this expert assignment:

What is it about
Governance structure as the framework of rules, processes, procedures, roles and responsibilities that constitute decision-making processes and project management.
The transition to climate-neutrality calls for inclusive co-creation with stakeholders as citizens and requires new ways of thinking, working and collaborating integrated, across silos, innovative and IT supported, in public-private partnerships, etc.
The expert team has been tasked with summarising which changes in governance and governance structures are needed to facilitate this and provide guidelines for local authorities.

Why are we interviewing you
The expert team has executed a desk research based on project deliverables of SCC-01 Smart City Lighthouse projects. However, we found that many good information is not written down in the project deliverables, and some essential information, for example what has not worked well, is missing. The information from the interviews will be used to complement the desk research. Besides, we are still looking for good examples!

How will we use the results
The information will only be used for this project and anonymously in the report, unless explicit consent of city administrations has been given to mention city and employee names and share the provided information publicly.

1. General questions about the making of the demonstration and the SCC-01 Smart City Lighthouse project in short:

a. How did the demonstration evolve over time?
b. What worked well?
c. What was more difficult or did work less well? Which main barriers/pitfalls/opportunities did you experience?
d. What would you change in the project design and execution if you had to do it again?
e. Which main advice/tools/suggestions/lessons learned can be derived from your demonstration for other cities?

2. Governance and governance structures

a. How was governance organised at the beginning of the project? E.g., internal and external collaboration on the demonstration, financing, procurement, PPP,
b. Were there any changes in governance (structures) resulting from the SCC-01 project?
c. If so, in which field?
   - ☐ Communication, participation and co-creation with citizens and other stakeholders, citizen-driven innovation
   - ☐ Public private partnerships, finance, businesses, procurement
   - ☐ Transformation of internal organisation, across silos, political leadership
   - ☐ City visions, long- term territorial transformation plans, agile piloting, widespread roll-out

- ☐ Regulatory frameworks, law
- ☐ Other, namely: ……

d. Which effects do these changes in governance (structures) have? What are their pros and cons?
e. Would you consider these changes as systemic?
f. Which (systemic) changes in governance would be needed to achieve complete transition to climate-neutrality in your city? If so, in which field and which form?
   - ☐ Communication, participation and co-creation with citizens and other stakeholders, citizen-driven innovation
   - ☐ Public private partnerships, finance, businesses, procurement
   - ☐ Transformation of internal organisation, across silos, political leadership
   - ☐ City visions, long- term territorial transformation plans, agile piloting, widespread roll-out
   - ☐ Regulatory frameworks, law
   - ☐ Other:……

Regarding:
   - ☐ Roles, mandates and responsibilities: who does or must do what?
   - ☐ Processes & procedures: written and unwritten conventions on how things are done, political decisions, use of specific tools and methods, IT
   - ☐ Organisational: interdepartmental collaboration, specific expertise
   - ☐ If relevant, legal frameworks
   - ☐ Other:……

g. What are the key barriers to implement these changes, what is holding cities back?
h. Does piloting help?
i. Which competences are missing in local governments? What should they get better at?

3. Specifically on stakeholder engagement

a. How do you evaluate stakeholder engagement in the SCC-01 project?
b. Were any stakeholders missing, and if so, why?
c. If stakeholders were missing, what impact did that have on the project?
d. How can more stakeholders contribute, for instance by lowering thresholds for participation?

4. Replicable lessons and examples

a. Are there any specific lessons or examples you could provide for other cities as an inspiration? (approaches, measures, methods, models, tools).

5. Learning in SCC1 projects

a. What were the key lessons generated by the project? What did you learn?
b. How did you learn these lessons?
c. How did the SCC-01 community facilitate this learning for your local government?
d. What would be your heartfelt recommendation on needed governance changes for others to learn?

6. To wrap up

- Any more advice for us?
- Any websites or reports you recommend?
- May we quote you?

MANY THANKS!

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