



# DIGITAL CO-CREATION METHODOLOGY FRAMEWORK

Mapping the Process for Smart Cities





## **DIGITAL CO-CREATION:**

### **Methodology Framework for Smart Cities**

Co-creation creates ownership of solutions. It creates new insights and knowledge by involving citizens and stakeholders in the design thinking process.

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# SME4SMARTCITIES

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## Introduction

As cities continue to grow, so does the number of challenges they are facing including environmental, economic or social issues that call for new and unproven urban solutions. This increasing need for urban innovation will result in the development of a significant number of smart cities initiatives, creating new business opportunities for Mediterranean SMEs.

The SME4SMARTCITIES project plans to make this possible by reinforcing the capacities of Mediterranean cities and SMEs and creating a much-needed collaboration between public authorities and SMEs to come up with the best technological solutions for all urban and city problems. The project hopes to also help cities to be the front-runners of innovation, in particular through the use of Public Procurement of Innovative solutions and support Mediterranean SMEs in order to guarantee that their products and services meet the expectations and needs of smart cities.

## Definitions

**Co-Creation:** it is a model of cooperative innovation. It is a shift in thinking from the organization as a definer of value to a more participative process where people and organizations together generate and develop meaning. Multi-faced problems —ranging from malaria to dwindling water supplies—are being reframed as “wicked opportunities” and tackled by networks of non-governmental organizations, social entrepreneurs, governments, and big businesses. Complex, intricate, multi-stakeholder challenges do not often present a single obvious solution. Co-creation—where the stakeholders share responsibility for the problem—can be an effective way to unlock solutions.

**Smart City:** is a technologically modern urban area that uses different types of electronic methods, voice activation methods and sensors to collect specific data. Information gained from that data is used to manage assets, resources and services efficiently; in return, that data is used to improve operations across the city. This includes data collected from citizens, devices, buildings and assets that is processed and analyzed to monitor and manage traffic and transportation systems, power plants, utilities, water supply networks, waste, crime detection, information systems, schools, libraries, hospitals, and other community services. Smart cities are defined as smart both in the ways in which their governments harness technology as well as in how they monitor, analyze, plan, and govern the city.



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**Internet of Things:** is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

**Additive Manufacturing:** uses data computer-aided-design (CAD) software or 3D object scanners to direct hardware to deposit material, layer upon layer, in precise geometric shapes. As its name implies, additive manufacturing adds material to create an object. By contrast, when you create an object by traditional means, it is often necessary to remove material through milling, machining, carving, shaping or other means. Although the terms "3D printing" and "rapid prototyping" are casually used to discuss additive manufacturing, each process is actually a subset of additive manufacturing.

**Data Analytics:** is the collection, transformation, and organization of data in order to draw conclusions, make predictions, and drive informed decision making.

**Autonomous Vehicles:** or a driverless vehicle, is one that is able to operate itself and perform necessary functions without any human intervention, through ability to sense its surroundings. An autonomous vehicle utilizes a fully automated driving system in order to allow the vehicle to respond to external conditions that a human driver would manage.

**Artificial Intelligence:** is intelligence demonstrated by machines, as opposed to the natural intelligence displayed by animals including humans. AI research has been defined as the field of study of intelligent agents, which refers to any system that perceives its environment and takes actions that maximize its chance of achieving its goals.

**Telemedicine:** allows health care professionals to evaluate, diagnose and treat patients at a distance using telecommunications technology.



## DIGITAL CO-CREATION METHODOLOGY FRAMEWORK for Smart Cities

Co-creation creates ownership of solutions. It creates new insights and knowledge by involving citizens and stakeholders in the design thinking process.

### Introduction and Relevance

Smart cities' needs are ever changing, and in many cases, no matter how well defined a solution seems at the beginning, co-creating requirements and solutions needs to be a part of the process. It can be a faster process when done well and done right. Co-creating means that stakeholders work together on the big picture and the details of the requirements. They work together to discover and uncover requirements. It's not about sitting at our desks, cranking out documents and hoping for approval. It's about co-creating the future together and then documenting what was discussed. Co-creating is a key skill for problem analysts. As it involves a mindset that embodies teamwork and collaboration in getting requirements done. The customer and the team create a shared understanding of what the vision of a solution is, why it's being built, what the goals are, the objectives and the rough scope. They discuss the outcomes, what the solution is looking to achieve and how it will be measured. After a big picture is understood, the details can be worked on. The analyst leads the process for the team to co-create this big picture and the details together. Co-creating is a skill in combining facilitation skills, conversation skills and coaching a team through the process of learning and discovery. When you get down to the details of co-creating, it involves things like defining goals and objectives, defining hypotheses and experiments, getting the team to have deep conversations about what's valuable and facilitating dialog about options and alternatives. Co-creating is a leadership skill analysts use to drive innovation in ambiguous and changing contexts, which are all too common today. Co-creating is all about maximizing the team and the individual contributions. It's key to the future as we continue to strive for excellence in an ever-changing landscape.

By 2050, more than 70% of the population will live in cities. But are those cities ready? Today, cities face complex challenges such as aging infrastructure, inadequate transportation, and



inefficient bureaucratic processes. It is critical to rethink how cities operate and deliver services effectually and efficiently and perhaps turn to digital tools, data, and intelligent connected systems when needed. Cities must become smarter—and we're going to need a whole new generation of human resources with entirely new skills to help.

The human migration from rural areas to urban areas will continue rapidly for decades to come. It is expected that we see another two billion people move to cities over the next 20 years. While cities have provided so many positive contributions to the human well-being, unfortunately they have created and are sustaining significant problems too. Many cities are near breaking point, and many are already failing in key areas and this can be seen with regards to public safety, environmental management, infrastructure decay, insufficient affordable housing, power outages due to inadequate energy supplies, rising crime rates, income inequality and overburdened healthcare systems. With most of the future centered in cities, together we must look to create new, sustainable, and resilient solutions.

City challenges differ widely on a global basis, but they can be categorized by some common themes. These include the environmental impacts of cities such as air quality and clean water. There are common issues with congestions on the roads caused by too many gas-powered cars and inadequate public transportation systems. Government services fail to deliver because of antiquated manual systems or old technology that does not support the changing needs and expectations of citizens.

Cities are the primary engines of our economies today. They have created enormous wealth and, in many areas, function remarkably well. But over the medium to long term, together we must address the systemic issues. If generations to come are going to enjoy a good quality of life in cities, together we must innovate at a scale and a pace incomparable to anything in history.

#### **Specific Objectives for co-creation**

- Dissemination level, if it will be public or restricted to partners or participants
- Create a community around the topic that facilitate applying technical solutions for societal challenges.
- Creating awareness for people who are interested in the topic but don't have all the knowhow on the technology.



- Co-create a policy ecosystem with local, national and policymakers and industry.
- Co-creating a working model: help people to understand the foundations of technology in such a way, they will be able to ask critical questions regarding technical solutions initiatives and ideas.

### **How did we get here in the first place?**

One of the first achievements of the project was the participation of 34 MED cities in a study to better understand what are the main economic, social, and environmental challenges faced by them, and the possible solutions that could be adopted. Furthermore, despite Covid-19 limitations, more than 50 SMEs have already been engaged in solution development through a dedicated SME survey designed to capture their needs and opinions alongside an innovative solutions inventory.

From initial findings, a new Procurement Trends Guide was created to support both SMEs and cities. The guide is a straight-to-the-point public sector procurement overview designed to help small and medium-sized companies engage in innovative and green procurement. The guide provides information on trends, channels, and most importantly, practical advice on how to access public procurement processes for smart city services and solutions at an EU and National level. Dissemination of the guide is taking place across Mediterranean countries through several national and regional events linked to smart cities and entrepreneurship. Since the start of the project, events have taken place across participating Mediterranean countries, including the virtual events held by the smart cities support group. In addition a web platform to further support Mediterranean SME access to smart cities markets has been developed, including features such as webinar library, online training, and access to open project calls.

Now, more than 130 SMEs have registered in the training platform to have access to the project learning programme; 49 have been selected to take part of the 1<sup>st</sup> edition of this programme. The training program (WP4) was mainly an e-learning program completing the participant SMEs skills and knowledge improvement and preparing the technological and innovative MED SMEs to address the smart city solutions market and to go international. The co-creation and cooperation supporting actions (WP5) implemented in parallel to the 1<sup>st</sup> edition of the programme, have offered the pre-selected SMEs technological support and given them the chance to take part in the entrepreneurial missions and business meetings organized in all the





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project territories in April and May. During these events, SMEs got in contact with MED cities' reality and needs, and had the opportunity to know first hand what needs not only buyers, but also final users are willing to fulfill.

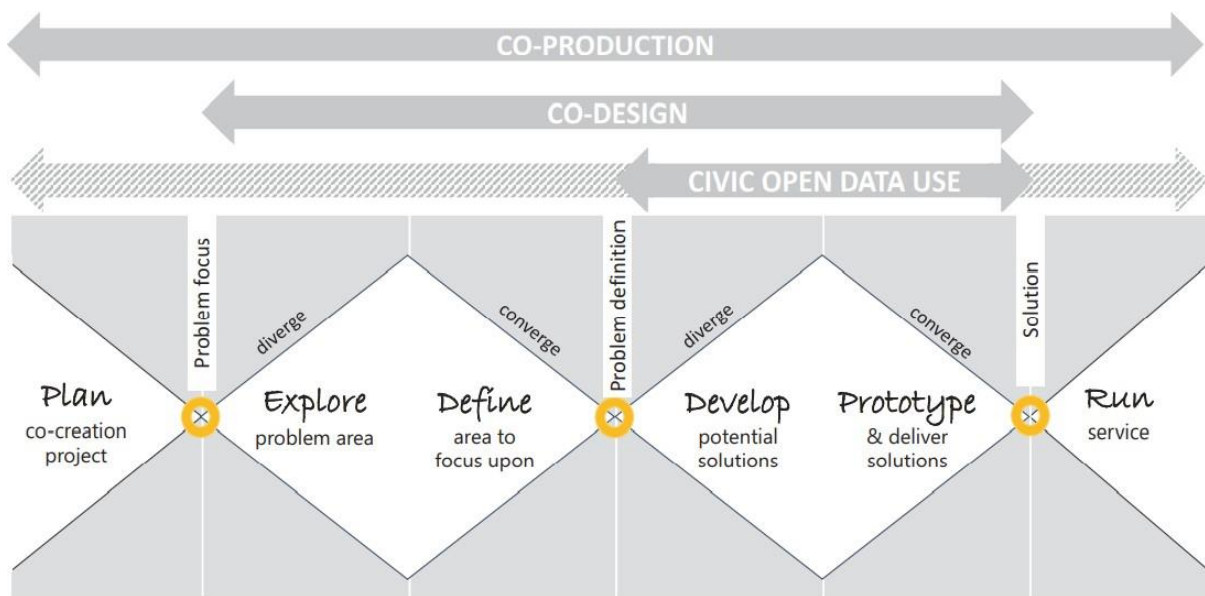
On the other hand, the project training and co-creation program assured the availability of experts coaching to the SMEs in developing solution ideas demand-driven to take the most of their current portfolio and establish cooperation procedures with their peers of the other side of the Mediterranean basin. These solutions ideas were presented as applications submitted to the call for sub-grants launched in 2 steps and currently in the final phase of evaluation.

Partners organized the co-reaction and co-innovation process, to have it ready at the same time that the training programme. Actions have been based on the results of WP3 (notably, cities challenges and SMEs needs) and WP4 (training program, SMEs selection and e-community creation). The programme promotes the direct contact between the SMEs and the innovation ecosystem of the project (cities, final users, academia...) to achieve a real cross-border collaborative approach for developing solutions to the urban challenges. TDs have not only participated of this co-innovation process but also supported partners in the organization of structured meetings between SMEs and between them and the rest of this ecosystem. The project platform has supported the online cooperative work.

On the other hand, entrepreneurial missions also helped to hold face-to-face business meetings among all the actors (city representatives, potential users, experts, etc.) and allowed SMEs to “get in touch” with the territories where their solutions will be applied and have a better knowledge of their markets.



We used the following framework to do make sure that all the stakeholders are engaged in the co-creation process:



For our project, the co-creation process was split into four phases (1) a planning phase in which a problem focus of the project was determined; (2) a phase in which the problem area was explored and co-creators decide on a joint problem definition and articulate a value proposition; (3) a phase that develops and evaluates possible solutions; and (4) the post-project phase in which the service runs.

Phase 1 and 2 of the co-creation process has culminated in the submission of 18 proposals to the project call by international consortiums of companies.

This methodology aims ultimately to support all the previous project activities including:

1. Prepare the SMEs to address the smart cities solutions market & to go international in the other project territories -Support SMEs in the establishment of crossborder cooperation relationships with other MED SMEs & cities
2. Build local capacity allowing to upscale the knowledge generated within the project & capitalize the project training tools



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3. Develop a programme of information & training to rapidly elevate SMEs tendering skills & win-rate & help them to adopt a strategic approach to tendering in terms of making good decisions on what to bid for.
4. Prepare SMEs for CBC & alliances development, namely to participate in co-creation & co-innovation under a demand-driven process with other MED SMEs and/or cities
5. Prepare SMEs to act in the MED market (improving their competitiveness & internationalization capacities as well as their skills to reach public procurement opportunities)
6. Support SMEs in the development of new products & services (smart cities solutions) & in the market place process -Create a local pool of trainers & experts to capitalize & replicate the training programme & tools
7. Provide information advice to SMEs to better understand market opportunities, international trends, etc.

### **Actors involved and their Roles:**

The project implementation had allowed for an increase of knowledge about the different entrepreneurship & cities management culture across the different partner countries. This knowledge was gained through a series of different conversations and activities across international consortiums of SMEs, city representatives and other stakeholders along the way.

One of the main roles of these stakeholders was identifying cities' challenges. It was possible to identify as a common trend the relevance of sustainability and climate change for the urban policies as part of the smart cities strategy. It was also possible to better understand the difficulties, needs and opportunities SMEs faced when addressing the smart cities market.

The main shared challenges (both for cities and SMEs) were identified: to fully understand each other's

needs and language (cities are used to a bureaucratic and legal language and requirements when launching public procurement procedures and SMEs are used to be assertive and profit-driven when offering their products/innovation).

MED cities are an indispensable stakeholder in the project, by hosting the entrepreneurial missions and by exchanging with SMEs relevant information for the presentation of successful solutions. In fact, urban challenges were detailed to become the base of the call requirements.



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Technology developers and Product Development Coaches were another stakeholder along the project implementation journey. They acted as coaches not only supporting the SMEs in their quest to provide smart city solutions to the challenges identified, but also fostering their development under a cross-border cooperation approach.

The stakeholders also had a role in reshaping the activities of the project under a major change procedure which allowed it to include more activities targeting MED SMEs (supporting them to be smarter) and overcome the delays generated due to COVID19 pandemic.

Actors also had a hand in redesigning the project to accommodate (in an efficient way) all the activities pending due to COVID pandemic, notably to assure that SMES have the time needed to complete all the steps of the training programme and to present good applications to each of the sub-grants' call.

To conclude this sector, it is vital to point out that several interested parties were invited to the regional presentation of the project in all partner countries. All of them have shown their interest in participating in the project activities (SMEs, Large companies, different public administrations – especially local administrations – and NGOs).

During the time of the project implementation it was possible to:

- Be in permanent contact with the associated partners to keep them informed about the project evolution
- Interact with other national/regional agents to produce the procurement guides
- Present the project (project activities and objectives) in different forums to raise the awareness of the project main beneficiaries
- Publish several articles (in the traditional and digital media and in scientific journals) about the project activities and main findings achieved so far
- Contact with different stakeholders to get support for the definition of the challenges to be launched within the SME4SMARTCITIES call for solutions, seeking synergies with national/regional/local initiatives and projects.
- Organize local presentation events and direct contact with

1. MED cities - to identify the main challenges they are facing



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2. MED SMEs - to better understand their specific needs when addressing the smart cities market and to acknowledge the innovative solutions already existing in the market

Overall, partners had assured a strong participation of SMEs and cities in the different data collection activities



## A. Rethinking City Functions with Urban Innovation

Where exactly do city functions start and end? It's not a straightforward question to answer. Cities are highly complex, with lots of players and participants. For example, in modern economies, the private sector plays a large role. Over the past few decades, privatization has moved functions of government into private hands, sometimes entirely. Today, for example, the private sector plays a sizeable role in providing education from kindergarten to college. It provides many security services. It runs clinics, and large parts of health care. The private sector dominates in transportation options, and in providing energy solutions. Many of these have historically been part of city and government services.

It must be noted that the parts of cities run by governments differ greatly across the world. This is an important context as we think about the future of our cities. It is extremely important that when we consider urban innovation, it must be in the context of a specific region, culture, and country. We risk getting it wrong if we overly generalize and ignore the context. While not exhaustive by any means, here are nine common municipal areas that represent core city functions. In no particular order, first is buildings. Cities care deeply about the design of buildings and architecture. It is important that they are safe, and that they meet certain codes, like environmental, plumbing, and electrical. Second, data and networks. Today, it almost goes without saying, that telecommunications are vital in any modern urban environment. Most cities need, and many require, universal access to telecommunications and almost all aspire to high-speed internet access and connectivity. Third is economics. Cities and their local government units (LGUs) recognize the need to help create the economic environment for job and wealth creation. This is often done through tax incentives, making available grants and loans, and special zones set aside for encouraging industry development. Fourth is energy. Cities expect energy to be delivered safely, without interruption, and at affordable prices and costs. In this regard, there are many roles a city must play from regulation to safety. In some cases, a city will be the sole provider of energy. Fifth is government services. This is a broad category, and includes domains like issuing permits, and birth certificates. It includes support for the election systems, and city planning. It is a vast number of services that simply do not get provided by any other sector in the economy. Sixth is public safety. Most cities take police, fire, and emergency services for granted. But these are expensive and complex services. They are increasingly supplemented by the private sector, but largely remain core city services. Seventh is transport. This area is also broad. It includes areas



such as the regulation of taxes, the functioning of traffic signals, the construction of new roads, pedestrian and bike paths. It includes trains, buses, and street signs, and services such as parking lots, and parking enforcement. Eighth is waste management and disposal. As we all know, today we generate an enormous amount of waste. How is it collected and transferred? Where does it go? And how is it then finally disposed of? It is a big, messy business that cities cannot avoid. They either take the lead, which is mostly common, or they work with private businesses, which is becoming more popular. And finally, number nine, water. Without this, there is no life. For many of us, we simply turn on a tap, and water flows. There is a massive and complex infrastructure to support this. Getting abundant, clean, and low-cost water to everyone cannot be taken for granted. Whether because of drought, environmental damage, or leaks in the system, water management remains one of our most important city responsibilities, and challenges ahead. When we think about this list, we are reminded about the diversity and complexity of our urban environments. Each one of these nine domains requires special skills, process, and technologies. Each one of these areas can be experiencing unfortunate duress, as demands and expectations increase. While it is easy to be overwhelmed, we should be optimistic by our ability to step up to the challenges ahead and co-creation can be a viable mode to help.

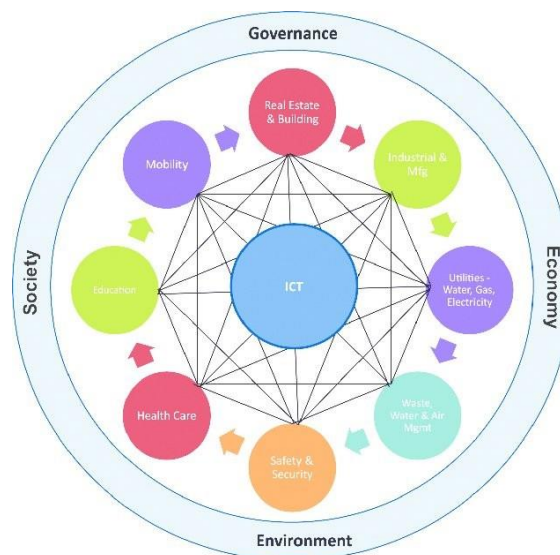


Figure 1: Field components of sustainable smart cities and position of ICT<sup>1</sup>



## **B. Emerging Technologies, Smart Applications and Smart Cities**

We now live in an era where cars can drive themselves. Where chatbots can mimic humans. Where homes can connect, and disconnect from the electrical grid and generate their own energy from the sun. We live in an era where the world's knowledge is available on demand on a wireless device that we can fit in our pocket. We are quickly digitizing the analog world. We are rapidly connecting everyone together through complex networks. Facebook alone provides a platform that connects over a billion people every single day. Gradually we are beginning to connect billions of devices in something we are now referring to as the internet of things (IoT). Soon our refrigerator will order food that might be delivered within a few minutes by a drone. All done between devices with little (and sometimes without) human intervention. We live in a truly spectacular time. There are many reasons for this acceleration in technological innovation. It ranges from the increased availability of internet connectivity to more global freedom, and the easier flow of capital to rising living standards around the world to more access to education. Just the overall exponential effect of knowledge and capability that builds on itself and is so now available to so many.

It appears that every sector of the global economy is being affected by these technological shifts from retail to entertainment, from finance to automobiles and from manufacturing to energy production. No doubt our optimism must be cautioned by the disorienting disruption that all this change brings, but it is in this context that we must now also think about the future of our cities. City services now have an opportunity to reinvent how they are delivered in the hope of better and faster and cheaper outcomes. This will require investment, risk taking, open minds, co-creation, new skills and a generation of leaders ready to embrace the future.

Several emerging technologies are poised to have considerable impact in cities through 2025 (see Table 1). They are predicted to have particularly strong implications for urban development and

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<sup>1</sup> Haidine, Abdelfatteh & El Hassani, Sanae & Aqqal, Abdelhak & El Hannani, Asmaa. (2016). The Role of Communication Technologies in Building Future Smart Cities. 10.5772/64732.





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management such as additive manufacturing (3D printing), the Internet of Things (IoT), big data analytics, artificial intelligence (AI), advanced energy storage technologies, civic technology, unmanned aerial vehicles (drones) and Blockchain. In the intermediate future, autonomous vehicles (AV) are also primed to have a strong impact on cities.

In addition, many smart applications are already being used in infrastructure-based services in the areas of security, healthcare, mobility, energy, water, waste, economic development, and housing. To name a few: smart grids help manage energy consumption; smart meters and pipes help track water quality and detect leaks; smart sensors improve traffic flow, transport efficiency and solid waste collection routes; mobile applications enable citizens to report problems in real-time and engage directly with city services; platform companies like Airbnb, Uber, and Careem are now a mainstay in cities worldwide; low-cost mobile-messaging, telemedicine and video-consultations improve health outcomes and lower healthcare costs; self-driving cars and car-sharing platforms alleviate pressure on land use; e-career platforms boost local jobs and cross-generational bonds; lastly, smart cities also provide opportunity for start-ups, service providers and consultancies related to digital innovation and attract skilled workers.

Security	Healthcare	Mobility	Energy	Water	Waste	Economic Development and Housing	Engagement and Community
Predictive Policing	Telemedicine	Real-time Public transit information	Building automation systems	Water consumption tracking	Digital tracking and payment for waste disposal	Digital business licensing and permitting	Local civic engagement applications
Real-time crime mapping	Remote patient monitoring	Digital public transit payment	Home energy automation systems	Leakage detection and control	Optimization of waste collection routes	Digital business tax	Local connection platforms
Gunshot detection	Lifestyle wearables	Autonomous vehicles	Home energy consumption tracking	Smart irrigation		Online retraining programs	Digital citizen services
Smart surveillance	First Aid alerts	Predictive maintenance of transportation infrastructure	Smart streetlights	Water quality monitoring		Personalized education	
Emergency response optimization	Real-time air quality information	Intelligent traffic lights	Dynamic electricity pricing			Local e-career centers	



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Body-worn cameras	Infectious disease surveillance	Congestion pricing	Distribution automation systems			Digital land-use and building permitting	
Disaster early-warning systems	Data-based public health interventions : sanitation and hygiene	Smart parking				Peer-to-peer accommodation platforms	
Home security systems	Online care search and scheduling	E-hailing car sharing					
Data-driven building inspections	Integrated patient flow management systems	Bike sharing					
Crowd management		Integrated multi-modal information					
		Real time road navigation					
		Parcel load pooling					
		Smart parcel lockers					

Table 1: Smart applications and emerging technologies poised to have effect on cities through 2025<sup>2</sup>

<sup>2</sup> McKinsey Global Institute (2018), Smart Cities: Digital Solutions For A More Livable Future, Executive Summary



### C. The Role of Data and Open Data in Driving Urban Innovation in Smart Cities

Our increasingly connected, digital world is creating enormous volumes of data. According to IBM, every day, we are creating 2.5 quintillion bytes of data. We call one quintillion bytes an exabyte. An exabyte is 10 to the power of 18, or put another way, one with 18 zeroes to the right of it. One exabyte could hold 100,000 times the printed material, or 500 to 3,000 times all content of the Library of Congress. Every computer, every smartphone, machines in factories, cars, sensors, social networks, they all generate data. It is an enormous amount of data – and that is why it is called big data. Organizations of all types have begun to recognize that there is value in this data. That value is often beyond its original intent. Here is a simple example. If someone posts feedback on a product website, the business gets the customer feedback, but they also potentially get the customer's location. This data can therefore inform the product company more about its customers. In more complex situations, data is informing organizations about vast sets of behaviors. It is helping to predict when machines will malfunction. It is helping airline pilots make course corrections so passengers have a less bumpy flight. It is enabling cars to drive themselves, and it is helping farmers have more productive crops. The power of data is enormous, and it is quickly changing our world.

As we might imagine, cities and their governments create, collect, use, and store data too. In fact, data is one of the very few things that cities have in abundance. Depending on a city's size, it may generate millions or billions of transactions a year, merely based on interactions citizens have with city services. With cities using more technology to run systems that range from power grids to traffic lights, and from libraries to public safety record systems, cities and their governments are collecting what seems like exponential volumes of new data every month. As cities use more devices to manage their operations, the movement and management of data between these devices becomes really important. Imagine, for a moment, all of the data that might transfer between connected cars and city infrastructure such as rail crossings and traffic signals. In a city context, data is a really big deal. And even more so in a smart city context. Using data to innovate and create new, more efficient, less costly solutions, does seem highly appealing and essential.

With so many needs and problems to solve, cities are going to need a lot of new ideas and innovators. Even the biggest mega city does not have enough staff, money, and resources of its own to address every challenge ahead. To build smarter cities, we will need to engage a much bigger cohort of stakeholders. When Procter & Gamble, the American consumer products giant



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with annual sales over 80 billion dollars, wanted to grow its products' portfolio, it already had its own sizeable staff of researchers, innovators, and inventors, but realized even their own staff would not be enough to grow the business in certain areas at a desired rate. The company therefore embraced open innovation, a way to bring in external ideas from anyone outside the company. In other words, one of the world's biggest companies realized that in order to continue to succeed and solve more challenging issues in the future, they would have to co-create with lots of people and organizations outside their business.

Similarly, in order to build smarter cities, governments are going to have to embrace a form of open innovation. It is going to take expanding traditional public-private partnerships to engage all the talent and capital necessary to confront the smart city challenges ahead. Open data presents a unique and compelling opportunity for problem solvers to be engaged. Many governments are therefore making their large and varied repositories of data easily accessible on open data portals. We are talking about data related to crime, pollution, economics, libraries, finance, infrastructure, and more. Remarkably, today the US federal government has over 190,000 datasets available on its data.gov website.

What stories and ideas reside within this data? What problems and challenges can be solved with this data? Connecting innovative ideas with open data is creating thousands of new solutions for smarter cities all over the world. Some of it happens because individuals choose to use government data to do good social work. It happens because some governments create incentives through competitions and events that promise prizes and recognition for good ideas and solutions. It also happens because individuals see an economic opportunity. Using freely available (open) data gives innovators a platform of content to build commercial solutions that can be sold in the marketplace. As was discussed before, the current and future needs of cities cannot be addressed by cities alone. Meeting the expectations of communities will require many more participants. Data is the easiest pathway to engaging talent in urban innovation. As a consequence, this also means that data and open data must be core to any smart city strategy.



## Co-Creation for Smart Cities: The Framework

Co-creation is understood differently across domains of application and research fields. For example, in the management and business literature co-creation is often described as a business model that allows responding effectively to changing consumer demands: Instead of companies creating or influencing a demand, customers co-create innovative solutions and value. In contrast, in research fields such as (collaborative) learning, co-creation is mostly related to the co-creation of (shared) knowledge. Overall, the role of technology in co-creation differs: Whereas in some domains, technology is understood as an enabler of co-creation (e.g., knowledge or value co-creation enabled through digital platforms), in others technology is the goal of co-creation (e.g., co-creation of digital artefacts). There are 3 traditional participatory approaches that provide the basis for the co-creation of smart city services: (1) co-production of public services, (2) co-design of technology and (3) civic open data use.

**Co-production** refers to the long-term involvement of citizens in the planning, building and provision of public services. It aims to increase efficiency, effectiveness and user/customer satisfaction of a service. Co-produced services can be substitutive for or additive to existing services.

**Co-design** refers to the tradition of user involvement in the design and development of information systems.

**Civic open data use** is a new mode of government-citizen collaboration that emerged as part of the open government movement and the provision of open government data for civic use. Many public administrations and governments provide part of their data under open licenses, so that technology-savvy citizens may use and re-use it. While the role of public administrations is somewhat reduced in this approach, civic tech organizations and individual activists design and develop digital tools (“civic technology”) to solve particular civic/social problems.

### A. Co-Creation and Design Thinking



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Wicked and nested problems, with no obvious single root cause, can contain infinite potential solutions with an infinite number of possible activities, none of which can be tested prior to implementation. No solution is right or wrong—only appropriate or less appropriate. In other words, a wicked problem is a design problem, meaning that the problem is only understood through its solution design. Here’s where design thinking can be applied to aid the co-creation approach.

Design thinking at the outset focuses on human beings. So, the lens of viewing wicked problems changes from an organization’s resource perspective or the system’s perspective to an experience perspective: How is the problem perceived by the users, clients, customers, managers, leaders, and other stakeholders? Through design thinking, by creating empathy with users (such as patients), reframes the challenge in a way that enables other participants to contribute to a shared solution.

This design approach contributes to co-creation initiatives by creating a foundation that ensures dialogue, transparency, and risk assessment between the actors in the initiative, as well as providing a structure for the micro-, meso-, and macrolevels of co-creation.

Figure 2 below situates the above three approaches (co-production, co-design, and open civic data use) along the different phases of the design thinking process. The first white triangle (left) depicts the scope of activity in the planning phase (from general idea to a problem focus). The last (right) is the provision of a service (from the roll-out to the provision of a service). The design phase has been given more room in this figure because it is the heart of co-creation activities and user engagement. It starts with a general problem focus and spans over four steps: exploring a problem area, defining an area to focus upon which leads to the developing of potential solutions and prototyping.

Therefore, a co-creation project can be roughly split into four phases (1) a planning phase in which a problem focus of the project is determined; (2) a phase in which the problem area is explored and co-creators decide on a joint problem definition and articulate a value proposition; (3) a phase that develops and evaluates possible solutions; and (4) the post-project phase in which the service runs.



## B. Co-Creation Framed in a Business Model Canvas

When considering and planning a co-creation project (phase 1) there are a number of aspects to consider which frame and determine the project. Similar to a business model canvas, one can depict the key dimensions of a co-creation project in a canvas (see Figure 3). Initially, there needs to be a general idea about the problem focus and target audience. As the co-creation project proceeds, the problem focus will become more refined (phase 2—find the right problem) and a solution is being developed (phase 3—find the right solution). This process is at the heart of co-creation and shaped by those engaged from the target audience and by key partners. The role those co-creators assume in a co-creation project depends on the relationship they have to the problem area and their willingness and ability to become engaged. Another relevant aspect are the communication and engagement channels (e.g., how citizens are approached and recruited to the co-creation project; how the service will be delivered). In addition, it is important to consider the existing resources (e.g., of a neighborhood of a city) that may support a service and what kind of activities are suitable and required in order to engage with the target audience and key partners in a meaningful and targeted way. For the sustainability and maintenance of the proposed so solution (phase 4), the revenue streams and cost structure need to be evaluated.



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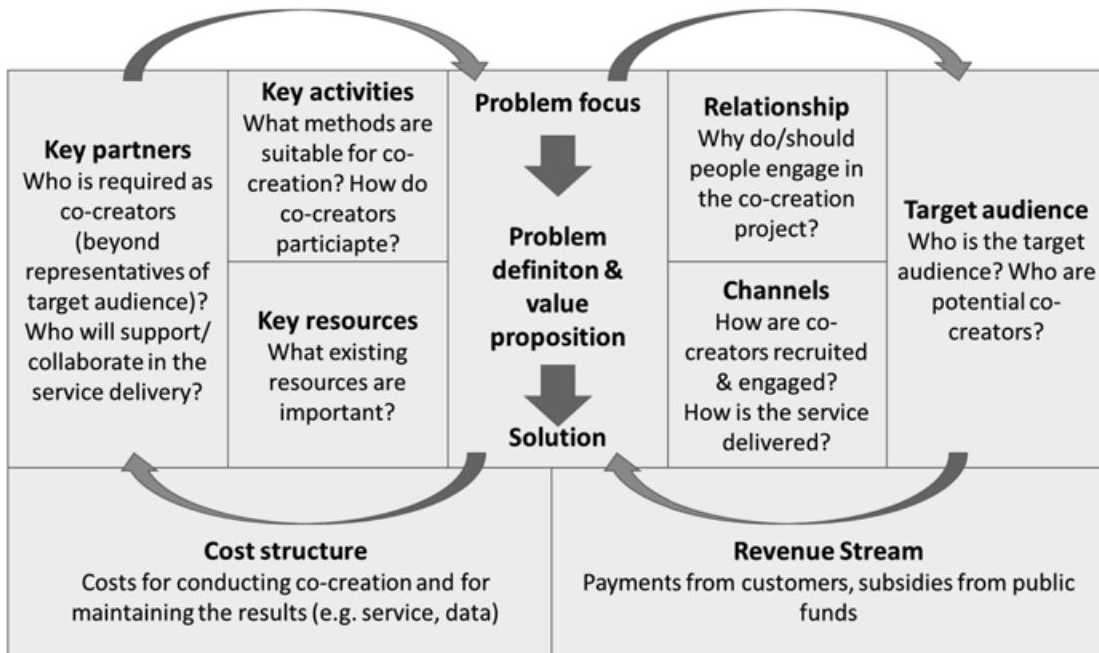


Figure 3 Adapted business model canvas to describe co-creation process and output





### C. Role of Citizens in Smart City Development Through Co-Creation

Citizen engagement is now commonly central to smart city definitions and is said to be essential to address urban challenges. Information and communication technologies (ICTs) offer unprecedented opportunities for expanding public participation. Europe’s manifesto on citizen engagement towards inclusive smart cities accentuates the importance of co-creating solutions. We can argue that smart city projects are commonly, in practice, top-down through their application of ICT to manage city infrastructure such as transportation, traffic control and monitoring of energy and pollution monitoring. However, grassroots, citizen-driven (bottom-up) smart city projects can deliver better value and success that can also be aided by ICT tools.

In spite of this shift, it is still common for smart city strategies to be void of meaningful engagement in the design of new services or interventions. While policymakers and planners generally understand, and often aspire toward enabling more inclusive participatory strategic planning processes, there is far less consensus as to how to make this a realization even with the addition of digital tools. Indeed, even though citizens are theoretically the beneficiaries of smart city projects, traditionally they are rarely consulted about what they want and their ability to contribute, which is often the fundamental flaw leading to failure.

In theory, there are three benefits to citizen engagement (as part of the co-creation strategy). Besides the obvious benefit of empowerment in decision-making processes, advantages are two-way when citizens add value as “nonexperts” with higher sensitivity to important ethical components, while also becoming increasingly likely to accept change, having been involved in its design. Of course, the extent and nature of citizen engagement can vary markedly in different contexts. Many of the new models of smart cities shift the whole emphasis of engagement from an active choice that citizens have to make to an integrated one in which citizens are providing feedback. A useful typology for explaining the levels of citizen engagement is Arnstein’s ladder of citizen participation (Figure 4) that has particular popularity in policymaking and planning. It illustrates stages of involvement, ranging from the lowest category “manipulation”, a form of nonparticipation which is top-down and one-way, up through increasingly meaningful forms of engagement. While “consultation” seeks opinions, it is still classed as “tokenism”. The highest step is “citizen control”, where participants not only influence outcomes but make decisions.

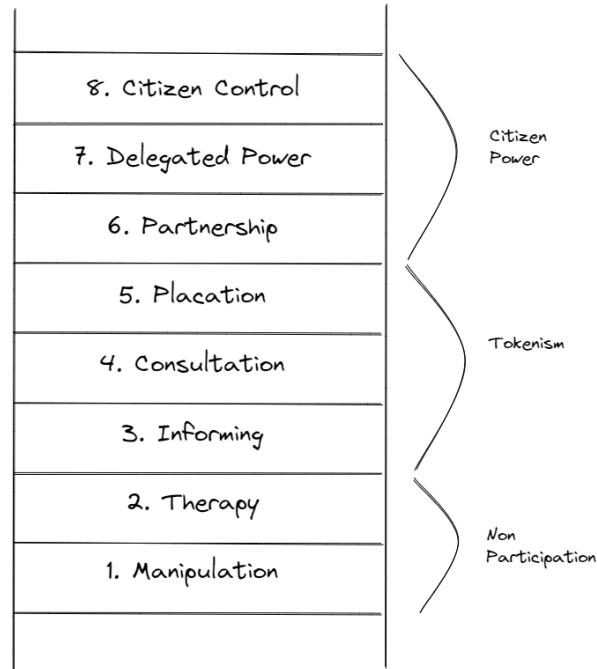



Figure 4: Arnstein’s ladder of citizen participation<sup>3</sup>

Therefore, the role citizens plan within their smart city can range from using or giving feedback within integrated systems, so that they can become live data points – to playing a more meaningful role in the design of new smart city development through co-creation or co-design approach.

**D. The Engagement Ecosystem of Co-Creation**

The smart engagement ecosystem consists of four components: community engagement, smart cities, engagement channels and governance. The smart engagement ecosystem has the potential to support a variety of stakeholders – communities, government, infrastructure, transport, creative industries, technology and many more. All of these components contribute to each other as part of a dynamic, non-linear, iterative process. The smart engagement ecosystem incorporates

<sup>3</sup> Arnstein, S.R. A ladder of citizen participation. J. Am. Inst. Plan. 1969, 35, 216–224.



various forms of community engagement discussed above that can employ physical, digital, online and hybrid approaches.

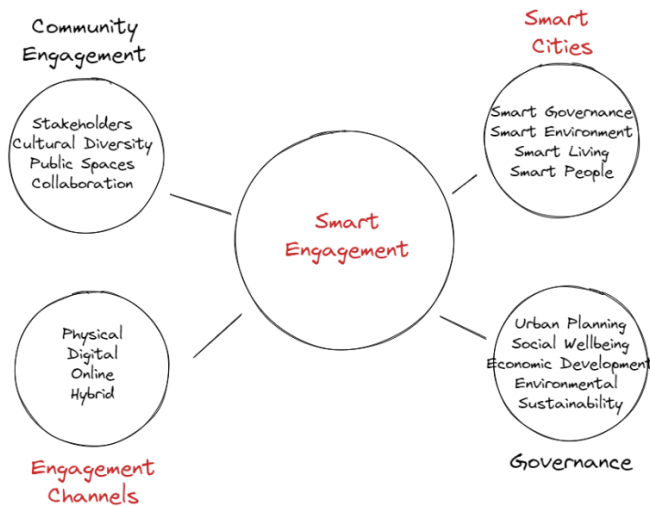


Figure 5: Smart engagement ecosystem<sup>4</sup>

As shown in Figure 5, interactions within the ecosystem do not happen in a specific order, therefore interactions can be initiated by various sectors and stakeholders.

The community engagement component of the ecosystem is the process of collaborating with a variety of top-down (governments, private enterprise) and bottom-up (community organizations, everyday citizens) stakeholders from the outset of the urban planning process. This provides an opportunity for people to articulate their thoughts, opinions and concerns; to create an open dialogue around the pros and cons – because every bit of feedback and input is valid; and aim to bridge the gap between existing hierarchical positions generally driven from the top to form partnerships with people from the bottom. Therefore, there can be different combinations of participatory methods. These can be employed during various phases of the engagement process, which can further contribute towards understanding the engagement objectives; designing the

<sup>4</sup> Fredericks, J., Tomitsch, M., & Haeusler, M. H. (2020). Redefining Community Engagement in Smart Cities: Design Patterns for a Smart Engagement Ecosystem. In C. Silva (Ed.), *Citizen-Responsive Urban E-Planning: Recent Developments and Critical Perspectives* (pp. 13-53). IGI Global. <https://doi.org/10.4018/978-1-7998-4018-3.ch002>



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most appropriate engagement channels; and to obtain feedback from experts and participants. This can be achieved through the following methods:

- Informal meetings and interviews with a variety of top-down and bottom-up stakeholders – to gain an understanding of each party’s objectives, needs, wants and concerns.
- Design focus groups with industry professionals (subject-matter experts) and community members around the community engagement objectives, including the design of the engagement channels.
- Exit interviews with participants after their interactions– to obtain feedback around their experience, interactions with engagement channels and recommendations for improvement.
- Post-deployment focus groups with top and bottom stakeholders, in order to obtain feedback around the engagement process; how people interacted with the engagement channels and the data collected; the types of behaviors observed; and proposed improvements for future deployments

Smart cities’ initiatives are being rolled out by governments and cities around the world with the key objective to create efficiency, foster a smart economy, smart mobility, a smart environment, smart people, smart living and smart governance. The smart cities component of this ecosystem is to create ‘smart approaches’ in order to advance regional competitiveness, enhance urban planning outcomes, improve transport networks, boost information and communication technology (ICT) economics, streamline public services and augment human and social capital for greater participation of urban dwellers. It is important that this component within the ecosystem will foster a more integrated and collaborative approach within the smart cities arena – which involves a greater cross-section of society – as opposed to top-down, techno-centric methods.

As discussed earlier, community engagement can incorporate physical, digital, online or hybrid approaches to engage communities. Despite the increasing digital opportunities for people to connect, communicate and interact in today’s society, there remains a need and desire to interact in face-to-face settings with people. Smart engagement channels strike a balance between the needs and desires of using smart technologies, and the familiarity of physical interactions, whilst at the same time including the human factor – where people can converse in open dialogue



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around a particular topic. The physical, digital, online and hybrid engagement channels can include novel technologies and unusual analogue interfaces, and thus can play a significant role in sparking interest and encouraging people to interact. They act as a potential mediator for social communication; a mechanism to provide constructive feedback; and they can be used as a ‘beacon’ to attract people and prompt them into starting a conversation around localized community matters. Engagement channels consisting of physical, digital, online or hybrid mechanisms, which match the context of the engagement, can address the needs and behavior of people, instead of limiting community engagement approaches through one form of media. Notably, this approach has the ability to:

- Raise awareness of the engagement process.
- Encourage community discussion around localized matters.
- Involve greater cross-sections of the community.
- Allow communities to submit through the mechanism they feel comfortable with.

To sum up, cities around the world are continuously evolving, as the process of planning and urban renewal are never complete – as social, political and environmental issues escalate, and the application of technologies evolves. Adopting a smart engagement approach can facilitate engagement, collaboration, and knowledge-sharing, in order to empower all stakeholders, and to inspire forms or degrees of change across communities. The engagement design patterns in conjunction with the ecosystem should be dynamic, and they should avoid a ‘one-size-fits-all’ approach, but more specifically provide a clear outline for designing, developing and deploying smart engagement. Additionally, such design patterns can be used as a reference guide for built environment practitioners and researchers, when addressing a design brief for urban planning projects, initiatives and policies. Specifically, they are aimed at providing guidance on spatial and social features, creating activity within a public space and balancing physical, digital, online and hybrid interactions.

### **E. Considering Context in the Digital Co-Creation Process**



Through the three dimensions of technology, people and institutions, the strategic principles of smart city development can be laid out: integration of infrastructures and technology-mediated services, social learning for improved human infrastructure and governance for citizen engagement. There are three key factors to a smart city’s success: human capital, citizen empowerment, and human interaction and involvement. We can also set out an integrative framework casting organization, policy and technology as the main pillars of a smart city, built upon with secondary factors including governance, people, economy, infrastructure and natural environment.

In this document, it has been discussed how citizens should be engaged in the development of the smart city services. For instance, at the context level, citizens contribute their ideas for developing new service applications. At the information and technology level, various platforms and technologies can provide assistance in obtaining their feedback and in designing new services based upon the requirements of the citizens. It should be highlighted that feedback at the service layer could further guide smart city stakeholders in designing better quality of services. Different cities provide various digital platforms to support citizen’s feedback in the design of the smart city services. However, there is a lack of understanding how those feedbacks are utilized to design effective services for them. Therefore, in this document we are highlighting how their feedback could be incorporated into more structured format at architecture level (Figure 6).

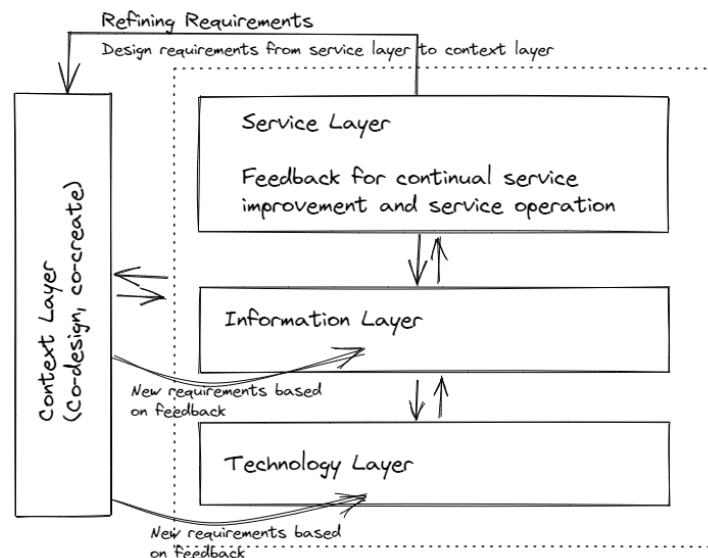


Figure 6: Conceptual model represented by the different architectural layers5



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## F. Expected Results/Outcomes

- Diagnostic about the opportunities for SMEs in the market of smart city solutions
- Diagnosis of the existing and needed support services for innovative and technological SMEs
- A platform for providing consultancy services to SMEs in idea generation, concept definition, concept development, market testing and access to new markets
- A co-creation, co-innovation programme to foster cooperation among Mediterranean SMEs
- SME4SMARTCITIES Training programme
- Smart Cities solutions
- Support innovative and technological SMEs Manual.

## G. Specific objectives related to this particular project and resources available.

General objective of the project	Specific objectives
To support the entry of MED SMEs in the market of smart cities involving MED cities in the creation of new solutions under a demand-driven approach which will be prepared to buy “green innovation”	1. To support the MED technological and innovative SMEs in the development of new products and services that answer in a more efficient, smart and sustainable way to the urban challenges faced by the MED cities.
	2. To improve MED SMEs’ competitiveness, their internationalization opportunities and their capability to create new knowledge resulting from cross-border cooperative processes (between SMEs and with their potential buyers – the cities).



	<p>3. To improve MED Cities competitiveness and the efficiency of their governance and use of resources through the improvement of their skills and knowledge for developing innovative and sustainable responsible procurement and through their involvement in innovation processes.</p>
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### Co-Creation Challenges and How to Measure the Development of the Work

Before we talked about the co-creation challenges, we propose the following 4 steps that help to measure the work development as follows

- i. Mapping all relations and stakeholders in many scenarios corresponding to the co-create methodology
- ii. Integrating all relevant activities including business development with the all the stakeholders, managing and arranging for friction through meetings and modelling
- iii. Describe the co-creation methodologies that will lead to case by case templates to be co-created with all stakeholders and end-users from the very beginning of asking the first questions as to why a specific tool should be introduced.
- iv. Follow up the work development in many stages from early beginning of the project implementation

Regarding co-creation challenges, in sum, there are six challenges to co-creation that can be identified across the process.

- i. There is a target fit with respect to the definition of a co-creation's target audience in relation to its problem focus. As a co-creation project progresses, the target audience becomes more and more refined and may lead to the exclusion of those citizens who are not represented in the co-creation process.
- ii. This is based in a representational fit: Do those people who participate in a co-creation project represent the target audience adequately?





- iii. Depending on the representational fit of co-creators, this may lead to a problem shift, which means that the specific concerns of those included in the process, overlay the needs of a wider population.
- iv. A fourth challenge is a resource fit and relates to the abilities of those older adults participating. A co-creation process requires an adaptable and continuous recruitment strategy in order to allow for the engagement of additional cocreators whenever skills or specific knowledge are required that go beyond (the capabilities of) the core participants.
- v. A fifth challenge is an impact fit and relates to the match between the original problem focus and the co-created solution.
- vi. A final challenge relates to an access and usage fit: A lasting social change and impact may only be achieved, if the take-up of the resulting service by its target audience is actually accomplished.

All of these challenges are framed by the public information infrastructures as part of which the digital public services are being co-created.

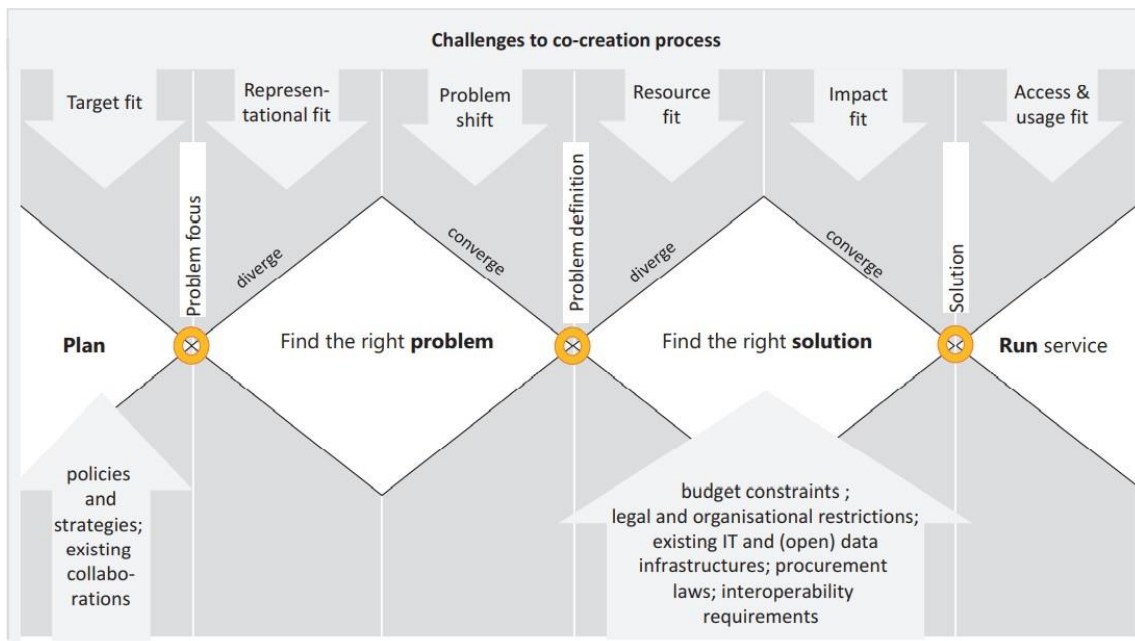


Figure 7: Challenges to the co-creation process