

TAMPERE.
FINLAND

The Smart City Cookbook

A Recipe for Successful Smart City Programs

Guidance for Smart City Program Managers and Developers,
with examples taken from the Smart Tampere program

Author
Nick Cotton

CONTENTS

1. Introduction	4
1.1 Approach and aims of this document	5
1.2 Defining a smart city ecosystem	7
1.2.1 Ecosystem Definition	7
1.3 Programs vs. projects	10
1.3.1 Return on Investment (ROI)	10
2. Program and project management	12
2.1 Program elements	13
2.1.1 Strategic Intent	14
2.1.2 Leadership and Governance	17
2.1.3 ICT Infrastructure	19
2.1.4 Effective Use of Data	21
2.1.5 Stakeholder Engagement	23
2.2 Agile methods	27
2.3 Continual improvement	28
2.4 Program maturity model	29
2.5 Pilots and scalability	30
2.5.1 ICT Infrastructure	30
2.5.2 Business and Partner Engagement	31
2.6 Smart City Communication	33

- 3. **Business models** 35
 - 3.1 Business model elements 36
 - 3.1.1 Collaboration and Innovation 37
 - 3.1.2 Platform Value Creation 40
 - 3.2 Innovative purchasing 40

- 4. **Open innovation platforms** 43
 - 4.1 Open innovation platform definition and value . . . 44

- 5. **Measurement frameworks.** 46
 - 5.1 Measuring program and project success 47

- 6. **Appendix** 51
 - 6.1 Program planning quick lookup checklist 52

- 7. **Document information** 53
 - 7.1 Glossary 54
 - 7.2 References 54

— 1 —

Introduction



1.1 — Approach and aims of this document

This publication is based on best practices through expertise gained working within the Smart Tampere Program, and benchmarking the smart cities and sources listed in [section 7](#).

It provides a guide and set of examples that smart city program managers and developers may re-use, in defining the operational framework for managing their smart city activities. This in turn gives the capability to build and deploy ICT and other smart city solutions as part of creating a sustainable and secure smart city.

It should not be quoted as a specification or code of practice, and claims of compliance cannot be made to it.

The scope here is internal program operations, as opposed to actual deployment and maintenance of initiatives in the urban environment.



Nick Cotton










Project manager, Smart city education and operational development, City of Tampere.

For further information on learning opportunities to develop smart city program and project management skills, provided by City of Tampere, contact: nicholas.cotton@tampere.fi

The author would like to thank the following persons from the Smart Tampere program ([REF 1.1](#)) for their valued contributions to this publication.

Persons

Responsibilities

	<p>Teppo Rantanen Executive Director, City of Tampere</p>	<p>Economic policy, competitiveness, innovation, smart cities, employment, education and city real estate assets.</p>
	<p>Tero Blomqvist Program Director, City of Tampere</p>	<p>Leading Smart Tampere program towards the goal of enabling economic growth and development of smart digital services.</p>
	<p>Jarkko Oksala Chief Information Officer, City of Tampere</p>	<p>Leading Tampere information technology and services.</p>
	<p>Pirkko Laitinen Marketing Specialist, City of Tampere</p>	<p>Brand management, communications and marketing.</p>
	<p>Niina Siipola Project Manager, Business Tampere</p>	<p>Daily operation of Smart Tampere program, project definition and business cooperation.</p>
	<p>Petri Nykänen Business Development Director, Business Tampere</p>	<p>Economic growth through collaboration between business and the city, towards smart digital services.</p>
	<p>Anni Joela Project Manager, City of Tampere</p>	<p>Smart Tampere operational capability, workshops and city guidance ecosystem project.</p>
	<p>Maarit Vehviläinen Project Manager, City of Tampere</p>	<p>EU Horizon 2020 Smart Cities project STARDUST, IoT reference architecture lead and business collaboration.</p>
	<p>Mia Vaelma Program Manager, City of Tampere</p>	<p>Tampere Digital transformation program.</p>

1.2 — Defining a smart city ecosystem

1.2.1 — Ecosystem Definition

A smart city innovatively uses information and communication technologies (ICT) and other means, to drive an innovative, sustainable and secure approach to improving quality of life, efficiency of urban operations and services, and competitiveness.

A smart city ensures that it meets the needs of present and future generations with respect to economic, social, environmental, and cultural aspects.

Successful Smart cities adopt a 'system of systems' approach to service delivery and develop collaborative service and ICT models focused on shared outcomes across organizational boundaries. Digital technologies are utilized to enhance openness and engagement with both businesses and citizens.

A city ecosystem consists of people, organizations, businesses etc. as shown in the example in *figure 1*. A smart city program uses technology and other means to transform this ecosystem for the benefit of the city and its citizens.

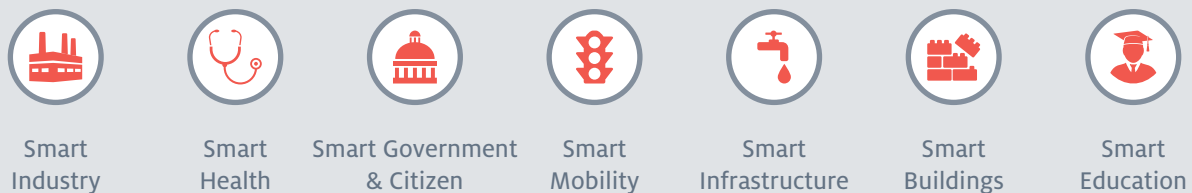


Figure 1. Typical smart city ecosystem elements.

From a business perspective an ecosystem can be seen as a group of partners performing as a value network. There may be competitors and partners, all dependent on the success of an ecosystem as a whole.

Depending on the need and context of the ecosystem, a city can play different roles as shown in *figure 2*. Therefore the approach required to be taken by the program to managing an ecosystem can be categorized into different types.

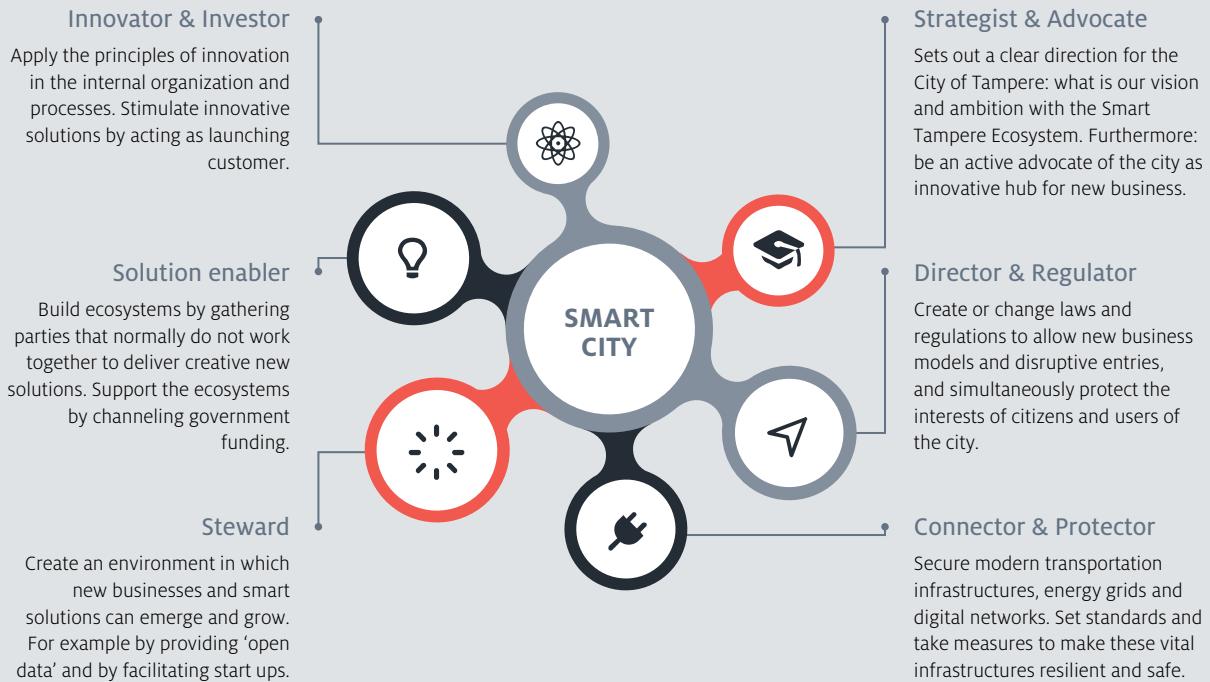


Figure 2. Smart city program roles in an ecosystem.

Ecosystem Program Management Types

The program types defined here, (REF 7) Performance Ecosystems, are typical of the different approaches that a smart city program should take to ensure its role in managing a smart city ecosystem is as effective as possible.

Centralized

- Clear organizer who strongly moderates activity to achieve the ecosystem's objectives
- Organizers plays a strong role in controlling the interactions that can take place between participants
- Any interaction between participants is via the central organizer

Sequenced

- Facilitated by a central organizer who assigns tasks
- Series of events or integration points
- Directional and sequential

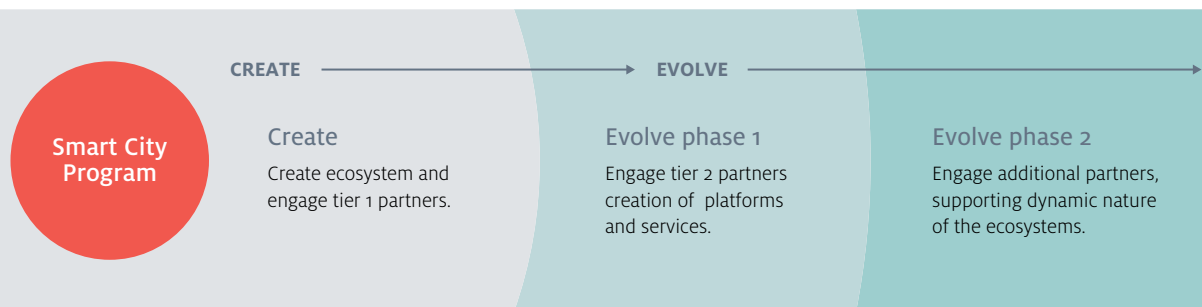
Facilitated

- Facilitator gently guides behavior or access
- Numerous routes of interconnectivity to fulfill participant objectives
- Organizer does not play a strong role in controlling the interactions that can take place between participants

Self-Organized

- Participant driven
- Participants are brought together in pursuit of a common objective
- Numerous routes of interconnectivity to fulfill various participant objectives

As a smart city program develops over time, then the role and the type of ecosystem program management required will need to change. A program should define a stakeholder map of its business ecosystem, both current and desired.



A program should not lose sight of the fact as it evolves, that at the heart of a successful smart city, lies the engagement of its citizens through their understanding of the value that technological and other solutions can bring to their daily lives. ICT based solutions are merely a means to this end.

Therefore at the core of a smart city programs role is the need to fully engage with citizens at all phases of its development, and as far as is possible ensure their commitment to changes in a city's services, and its urban environment.

1.3 — Programs vs. projects

In the context of this document a program is seen a group of related smart city projects, driven by a single program strategy, managed towards achieving a common set of targets.

1.3.1 — Return on Investment (ROI)

The success of a smart city program lies not in the fact it delivered on time, but more in the impact it makes as a return on the projects that it has invested in.

Return on investment at project level can be expressed as; *total project investment vs. project impact*.

Impact can be shown as;

- environmental value
- economic value
- social and community value
- research and innovation value

Return on investment is a key criteria to be considered when planning a project and making the business decision to execute. This sets a clear value driven expectation and target for all stakeholders as to what they are investing in and the expected outcomes. See *figure 3* for examples of strategic value creation in the Smart City environment.

Return on investment can be seen as incremental through reviewing strategy vs. project road map progress, [see section 2.1.1](#), Strategic Intent. At a level below that, pilots and trials can indicate how a program may create impact with minimum investment and therefore support selection of longer term investments.

Project innovation and its re-use should also be carefully considered during project planning and execution, as a key value add element for a project. The re-use of innovative smart city solutions by other cities, both nationally and internationally, can be used to strengthen the brand of a smart city through traditional and social media attention.

This in turn can be used to attract further investment in smart city initiatives and stimulate business interest in a particular smart city.



Figure 3. Strategic value creation in the smart city environment

— 2 —

Program and project management



2.1 — Program elements

In order to create a sustainable smart city, a program needs to manage a number of existing city systems and the related organizations owning them, towards a single set of targets based on a smart city strategy. This can be described as a system of systems type of approach. The key elements to enable such a smart city program approach are defined in *figure 4*.

Here we start to see that the adoption of digital technologies alone will not create a sustainable smart city. Creating effective controls across the five program elements in *figure 4*, provides the capability to effectively plan and deliver sustainable smart city solutions.

It is therefore essential that there is leadership commitment and investment, enabling sufficient resources to create and maintain such a program framework.

Without such a framework in place it's possible that some digital innovations can be made on an ad-hoc basis. However a siloed approach will likely result with tactical improvement to some services, rather than a more strategic approach that will achieve smart city targets across a range of city systems.

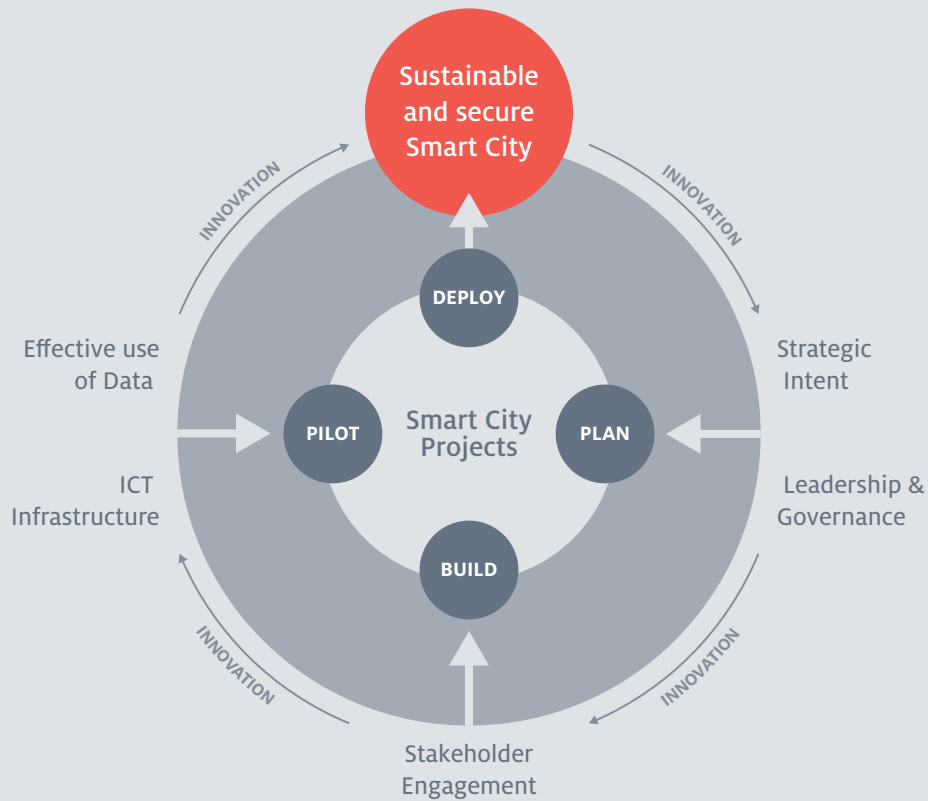


Figure 4. Smart city program elements

As can be seen in the framework above, program elements are focused on driving innovative solutions towards a goal of making the best use of technology, for provision of optimal smart city solutions and services. Strategic intent is the start point for planning a program and the following elements then align with this. The sequencing of these elements may vary according to specific program needs.

Within these program elements is shown a typical project lifecycle for a range of smart city projects. These projects and their related control mechanisms and partnerships are driven by the program elements as a system of systems.

2.1.1 — Strategic Intent

Strategy planning for a smart city needs to cover a complex landscape of organizations, both political and non-political. For example a city may

have an existing strategy with values targets. There will likely be a number of city organizations with their own service improvement programs and related control mechanisms, as well as business stakeholders and other partner organizations. All of these organizations very probably have their own goals and targets related to some kind of city level strategy. This means that setting clear long term strategic goals for a smart city program is all but impossible.

In [section 1.3.1](#) Return on Investment *figure 3*, a set of values and related impacts is shown. So it is values such as these that can be used as the basis of a smart city program strategy. This approach enables a cohesive focus and decision making across a complex landscape of stakeholders. BSI publication PAS-181 ([REF 3](#)) contains further information on this, defining the usage of “*guiding principles*” as a means for driving a clear smart city vision.

The result is a smart city program vision aligned to a city’s strategic vision that can be used by multiple stakeholders. This smart city vision can then be driven forward incrementally by a roadmap, at both strategic and tactical levels.

Figure 5, illustrates how smart city program values and their impacts can be aligned to city level targets and also indicates:

- Strategic understanding of ROI - based on number of projects delivering against values over time
- Tactical understanding of ROI - based on each projects expected completion date and deliverables
- A smart city vision - based on goals taken from the city’s overall strategic vision

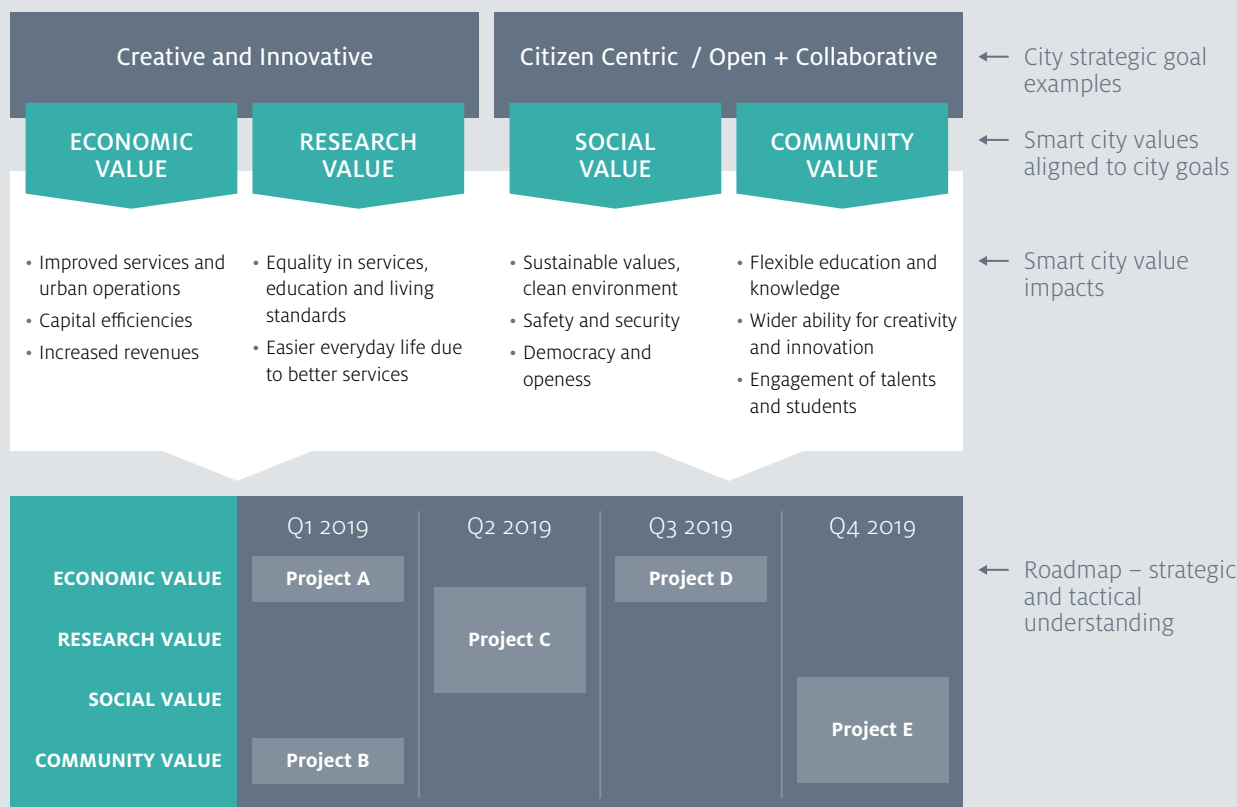


Figure 5. Smart city values driven strategy and roadmap example

A smart city strategy should be created by program leadership early in the programs development. Program leadership need to develop it together with stakeholders, and through reviews ensure their commitment to it. A key element of the strategy should be ICT transformation, see [section 2.1.3](#) ICT Infrastructure. The strategy can then be used as a guide for understanding if a specific project is a good fit for the program, based on alignment to a values based program roadmap and a projects expected impact.

Strategy should be reviewed as part of program portfolio management to ensure continued alignment with city goals and agree any required changes. The program strategy and roadmap should be openly shared to ensure feedback from potential partners, helping to create further smart city opportunities.

2.1.2 — Leadership and Governance

Leadership and governance covers program management, decision-making and delivery of smart city projects and services as a city wide approach. An overall program governance model should be created that covers the elements defined here.

Program Management

The program manager is accountable for the success of a smart city program, reporting into a city's leadership. This city leadership maybe administrative, but must have clear links to a city's political organization and its decision making mechanisms.

— Program Leadership Team

The leadership team supports the program manager and needs to be able to create suitable operational program controls, as well as manage the program portfolio together with relevant stakeholders.

City leadership representation is required, ensuring effective city leadership involvement in a smart city program on a cross-city organizational basis. City leadership representation is needed from both political and administrative city organizations, by persons who are empowered to make decisions related to; city investments, support and resources.

The program leadership team should also contain:

- ICT skills, supporting effective planning of a smart city ICT approach
- communication and marketing skills to ensure best possible impact nationally and internationally
- strong links to educational establishments and business (both local, national and international), enabling collaboration and partnerships

— Program Portfolio Management

Mechanisms are required for managing both strategic and delivery based program decisions together with city organizations, stakeholders and partners.

Portfolio management and the related content decisions, are about ensuring the greatest value for a city. So portfolio management needs to

look at the program, its mechanisms and projects as a whole, to guide the program towards doing the right things right.

Portfolio management ensures alignment with both city and smart city strategies. In practice this means ensuring the program roadmap has the correct content to deliver the best digital transformative value for a city. The review of a smart city portfolio should involve program as well as city leadership in order to ensure a continued city commitment to program focus, and guide the program regarding any changes in a city’s direction and needs.

Figure 6 defines a typical portfolio management process. There it can be seen that portfolio management can be used for both creation and managing of a smart city strategy and roadmap, as well as steering projects through a series of reviews. These reviews ensure continued alignment of projects with strategic direction, as well as making investment and deployment decisions.

To make this work then the leadership team may need to change shape, such that the right persons are present for different activities. For example when reviewing strategy, then city leadership would need to be involved. When reviewing roadmap content or project go / no go decisions, then stakeholders and partners relevant to project content would need to be present. When reviewing the communications strategy then city level communication and marketing leadership should be involved.

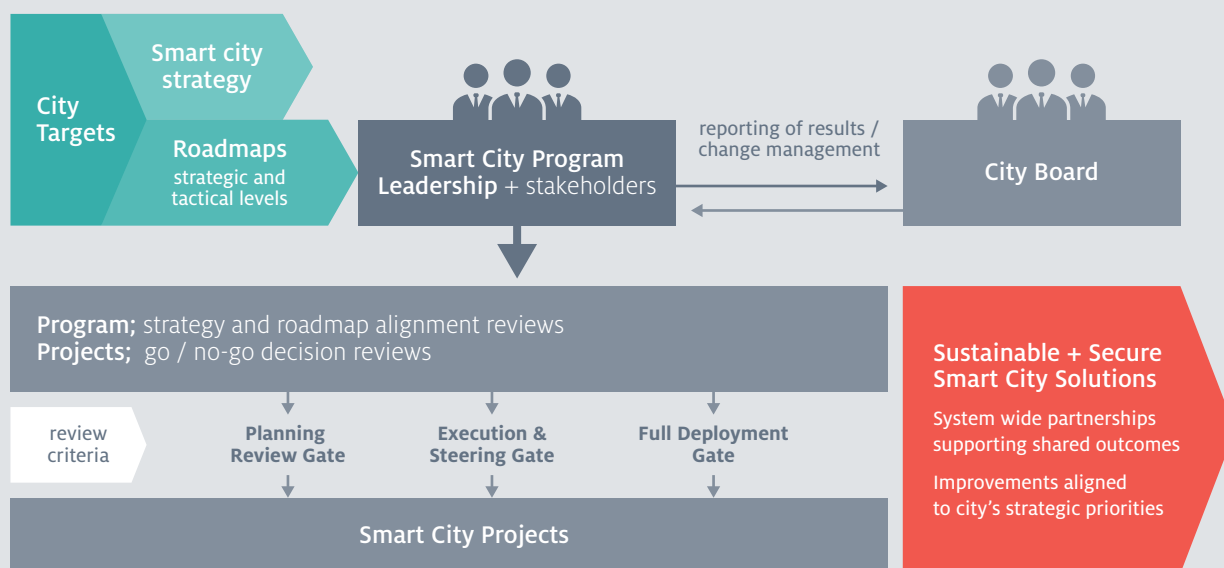


Figure 6. Program portfolio management process

Project Management

Smart City projects and the overall program will be more effective in terms of their execution and results, if managed through a well-defined project management framework and related set of tools. The Capability Maturity Model Integration or CMMI (REF 2) is a good example of such a framework.

In Smart City projects there can be many stakeholders and partners involved. Because of this projects will perform more effectively where there is a single owner for a project.

The owner takes full accountability for the success of the project as well as;

- builds and supports a project team
- plans and reports project progress and risks
- presents project status at portfolio reviews

— Project Progress Review

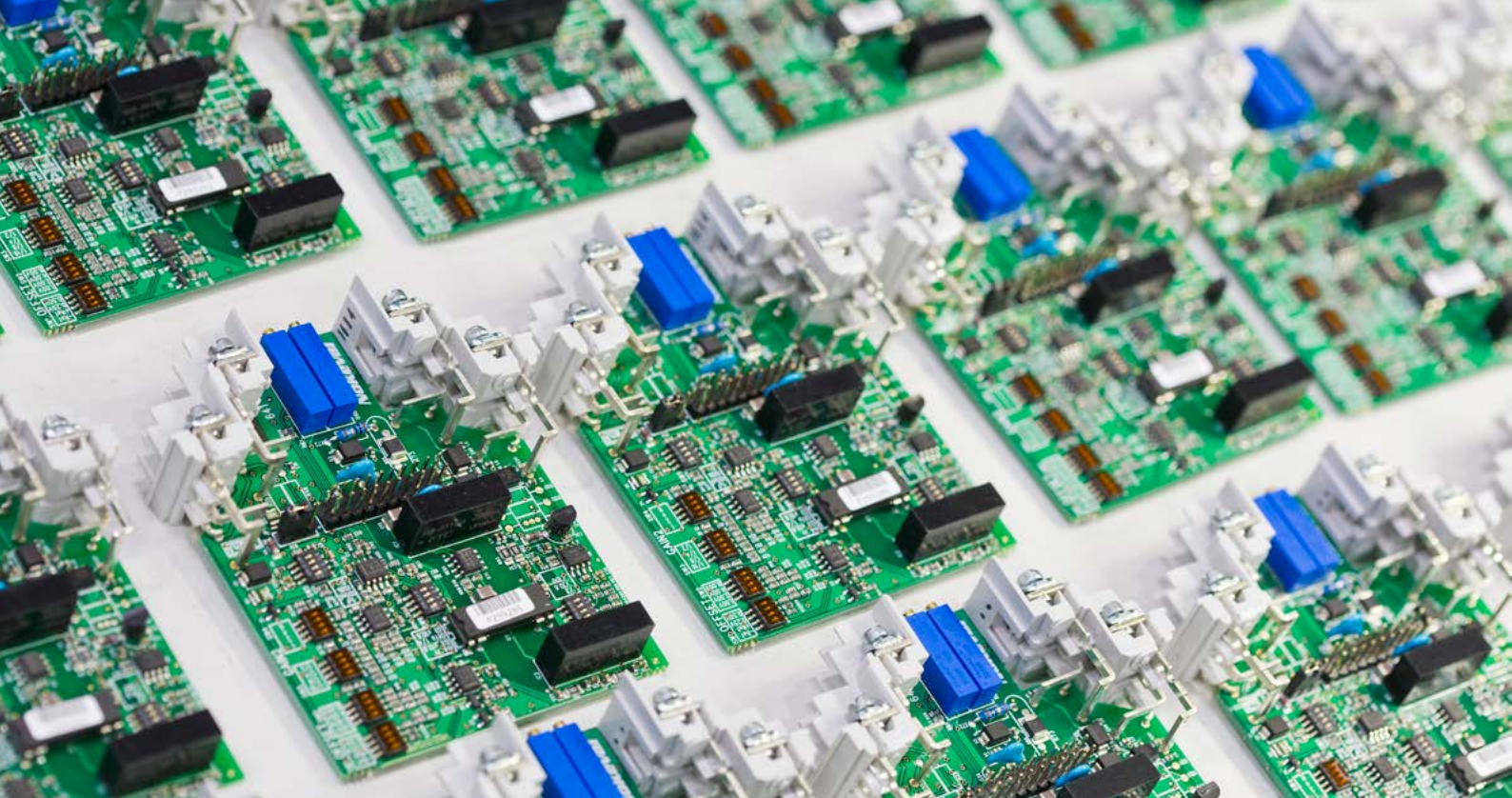
At project level then there should be an effective project review and reporting mechanism for making decisions at a tactical level across a range of projects, as well as informing stakeholders of progress and risks. Again such reporting should be made visible outside of the program to city organizations, partners and citizens.

2.1.3 — ICT Infrastructure

The goal of a smart city is to have an open, service-oriented, city-wide ICT architecture. However given the often complex organizational structure of a city and therefore ownership of various ICT systems, this can be very challenging. Added to this is the likelihood that many ICT systems are of a legacy nature, with ineffective architecture and definitions.

So in this case there needs to be smart organizational focus and strategy towards establishing collaboration and commitment for incremental creation of an effective city-wide IT architecture as a system of systems. This requires that the program team has strong ICT skills to support such a transformation. As well as this there needs to be strong links with city ICT decision making mechanisms.

There also need to be an effective purchasing process in place (see section 3.2, innovative purchasing). In many cases purchasing laws and organizational boundaries make it difficult to undertake complete



replacement of legacy ICT systems. Therefore it's vital that purchasing takes into account the need for open data and interfaces and the capability for them to be combined with other systems across city domains. As well as this a city should be able to decide access rights for data within services provided by external service providers.

The following should be addressed as part of an overall smart city architecture ICT strategy:

- open ICT architecture and platforms supporting service development and innovation (encouraging partner convergence towards a smart city ICT architecture)
- rules for handling of personal data
- public (non-personal) data open for reuse and innovation
- roadmap of how incremental changes towards a smart city ICT architecture can achieve cost, productivity and user experience improvements
- roadmap of how changes towards a smart city ICT architecture can support new business models and related business opportunities
- an effective purchasing approach ensuring open data that can be combined at a system level

Such plans and decisions should be realized through portfolio management (2.1.2), ensuring alignment with a city's ICT plans and capability. *Figure 7* illustrates an example of a strategic incremental

approach to digital transformation, and the benefits of the related ICT infrastructure improvements.

It's vital that such an ICT strategy and related roadmap is integrated into ICT planning for the city and its services lines at the earliest opportunity ensuring:

- economies of scale are achieved through early planning and investment in required ICT infrastructure
- smart city pilots are scalable, based on city services are fully committed and ready for a planned city wide change

Without this forward planning there is a risk that even if a pilot is successful, it will be difficult to gain traction after the event for wider deployment.

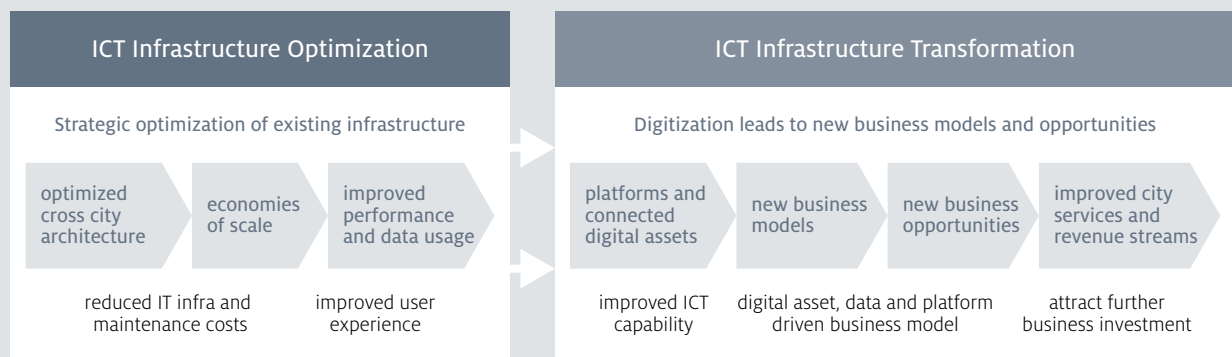


Figure 7. ICT Infrastructure strategy example

2.1.4 — Effective Use of Data

Data assets should be used to provide actionable information supporting analytics that drive improved services. As well as this they provide a valuable asset for new services to be developed and for citizens to make informed decisions using real time data, e.g. providing real-time traffic flows.

Open data should be a key element of smart city purchasing so ensuring incremental change towards a system of systems ICT capability. Therefore

the creation and usage of open data channels should be at the heart of a smart city strategy.

The following should be considered as input:

- citizen understanding of data usage; its benefits, as well as the controls built around it
- data usage in driving service improvement
- creation of open data channels and overcoming existing data siloes
- how open data drives new business opportunities, as well as improvement of existing city services
- ownership of open data by the city and how this will be maintained across business partners
- effective usage of real time data, as well as analyzed data as a saleable asset

There should be clear rules defined for usage and ownership of city data assets. Usage of data is further covered in [section 5.1](#), Measuring Program and Project Success.

SMART TAMPERE PROGRAM EXAMPLE

Open Data

The City of Tampere has opened its data sources since 2012. The opening process started with smaller experiments and has then gradually evolved towards procurement guidelines and open data as default principles. Open data related to: transport, building infrastructure and finances, has created new services, improved transparency and usability of the city service portfolio. Apps, visualizations and new services are created by companies, private citizens and NGOs.

The city itself has been able to test new services in a more agile way by using open data as an ingredient for pilots, hackathons and innovative procurements. Open data is available for everyone at data.tampere.fi which is a new open source, open data portal, co-created with the six largest cities in Finland. Through understanding gained by interviews conducted by the Smart Tampere program with local businesses, the city will focus in the future on opening more real time data.

2.1.5 — Stakeholder Engagement

To facilitate effective stakeholder engagement there needs to be a clear definition of the vision for a smart city program's aims clarifying what a smart city will look like, communicated to all stakeholders. To support understanding it should contain visualizations of any already planned services, as well as the city's vision of change towards becoming a smart city.

It needs to define a smart city approach which is focused around citizen, partner and business needs, and not just the city's organizational needs. It should also define how stakeholders can engage with a program and how they may benefit from it.

This message will need to be tuned for different audiences such as; citizens, business, suppliers, partners. It should be communicated using multiple channels such as; social media, traditional media, web pages and other technology. As far as possible technology should be used to enable public participation and feedback.

Citizen engagement and understanding of value proposition

Its citizens are the most important asset of a city, smart or otherwise. So for city improvements their full engagement needs to be ensured and as far as can be ascertained, their understanding of the value of improvements in a related change.

When changes impacting citizens are being made "*for the better*" to city services, then the value of change needs to be transparently citizen centric to ensure commitment.

Many smart city projects fail as they don't involve citizens, taking full account of human needs and behaviour and so do not drive a citizen-centric approach to service design and delivery.

Social media channels, mobile apps and crowd-sourced data should be used to better understand citizen's needs and attitudes to new services, as well as promoting their benefits. More traditional media can also be used (face to face, web, news media etc.), however a smart city program must always be looking for new and enhanced ways to engage with its citizens.

A city will also have a wealth of historic data from its existing systems and services. This can be analyzed to understand user behaviours, service usage and trends, as input to understanding opportunities to improve



service performance through digitization. Examples of such data are; traffic movements, energy usage, crowd movements.

As mentioned in [2.1.4](#) Effective Use of Data, then it's critical that citizens understand that a city has clear controls around data usage and that these are well communicated to citizens, as well as those using the data.

Business and partner engagement

The following are typical of business and partner organizations that smart city programs engage with:

- city administration and service lines
- business (large scale enterprise, SME's and startup business's)
- utilities (e.g. power, water, heating)
- non-governmental organizations (e.g. associations)
- knowledge institutions
- city to city with other cities, nationally or internationally

Effective business engagement is a critical element of a smart city program. This can be seen to work on two levels:

- working with business as a partner on specific projects within a smart city program
- helping business understand opportunities to invest and grow within a smart city's ecosystem

Enabling a city ecosystem that creates opportunities for business to flourish is the first step towards success through:

- A business model to manage value creation from concept through to pilot and upscaling, see Business Model Elements, [section 3.1](#)
- Opening up public data creating business potential through its usage for new services
- Creating platforms that provide opportunity for business to develop and operate new services, see Platforms Definition, [section 4.1](#)

Business and partner engagement should be managed as a project in itself, creating opportunities for partnership and investment, through helping business to understand growth opportunities within a smart city ecosystem. There needs to be communication of a clear understanding of how business can engage with a smart city program and the opportunities and benefits that it presents. A set of engagement tools as defined in [section 3.1.1](#) can then be used to support collaboration.

Talking Robots Piloted in Pre-schools

The City of Tampere piloted talking robots for practicing math's as well as English and German in pre-schools and in first and second grade education. This technology is now being studied by local universities as to the impact on student learning opportunities at degree level.

The technology for the language teaching Elias Robot was developed together with Utelias Technologies Oy as a startup business, and usage of effective collaboration agreements with the startup partner enabled the its smooth development. As well as this math teaching robots resembling Owls, called Ovobots have been developed by AI Robots Oy, also a startup business.

The aim of the project is to enrich children's language and math skills, and utilize technology to support a more effective education experience at different levels of learning.

Both teachers and pupils were consulted during the projects development regarding the robots performance, colors and speech.

Through this effective engagement with both teachers and pupils during its development, it was ensured that there was a greater level of understanding and commitment to the new technology.



2.2 — Agile methods

Agile methodologies can provide an effective set of tools for managing the development and delivery of digital services in a lean and cost effective way. Methods such as Scrum (REF 5), using iterative and incremental development methods, can shorten project development time and lead to continuous quality improvements.

As the scrum methodology is based on the principle of co-location, it's an ideal tool for managing smart city program and project activities. Although a city business decision model may be in place for managing programs, scrum tools such as backlog and sprints may still be used to manage projects in an agile way.

Figure 8 defines an example of using scrum based sprints to manage iteration of project content, within a city business decision framework. The product backlog (set of requirements) used to drive this can cover multiple projects. Daily scrum meetings can be held either at project or program level.

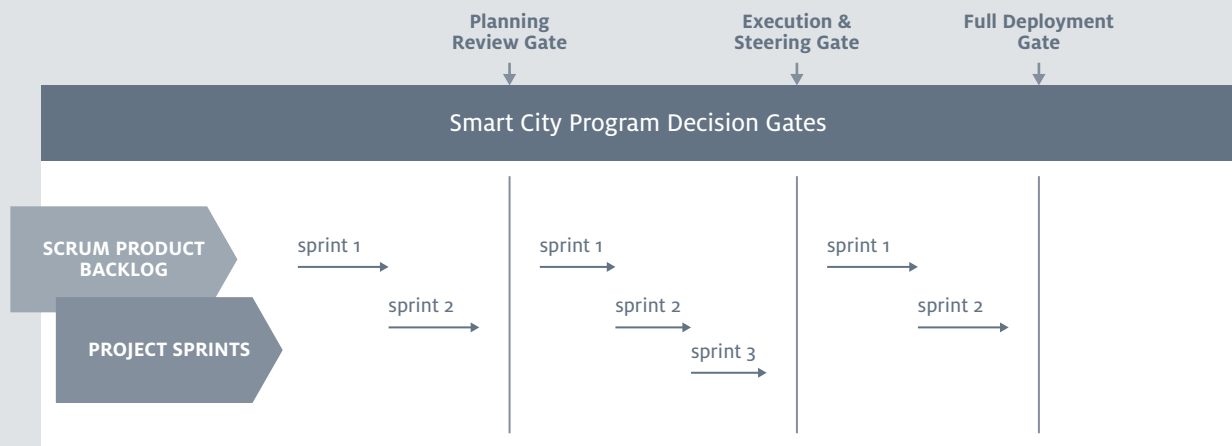


Figure 8. Scrum usage example

The benefits of such an approach are; greater flexibility to adapt to changes, earlier delivery of functionality and improved quality.

2.3 — Continual improvement

At program level there needs to be a mechanism to use learnings from project experiences to improve program and project practices. Equally where best practices have been seen, these should be deployed across a program to drive improvement.

In many cases lessons learned and experiences are only shared informally and so there is a risk of repeating the same mistakes, leading to a lack of project success. Therefore it is recommended that programs have a systematic knowledge sharing mechanism, for redeploying best practices, as well as actions to prevent previous mistakes.

To ensure effective understanding of problems where things have not gone well, root cause analysis should be used as a tool for ensuring improvement actions will prevent reoccurrence of a problem. *Figure 9* indicates the process flow for undertaking an effective root cause analysis, as per the DMAIC approach within the Six Sigma methodology (REF 4).

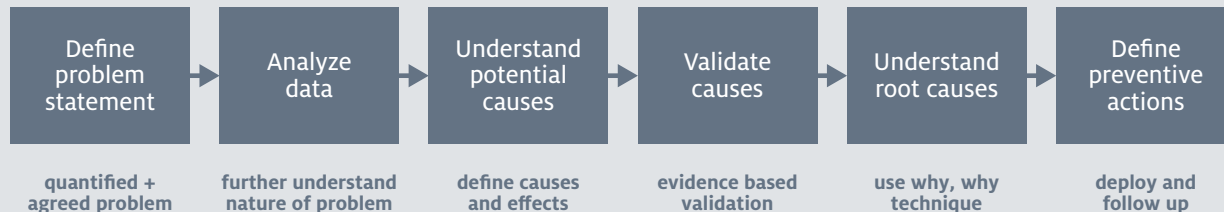


Figure 9. Root cause analysis process flow

2.4 — Program maturity model

The maturity model in *figure 10* defines smart city program elements in relation to maturity status and expected outcomes.

This illustration is based on the maturity model developed by the Scottish Cities Alliance (REF 1.2), for assessing the maturity of smart city programs. As well as a useful assessment tool, it may also be used for planning of the structure and controls within a smart city program.

SMART CITY MANAGEMENT MATURITY LEVEL	Level 1 Ad Hoc	Level 2 Opportunistic	Level 3 Purposeful & Repeatable	Level 4 Operational	Level 5 Optimized
	SILOED	SYSTEM COLLABORATION	SYSTEM INTEGRATION	MANAGED SYSTEM	SUSTAINABLE AND OPEN
PROGRAM STATUS	Operation focused digital and data driven service improvement	Holistic system thinking and emergent sharing of data.	Strategy led and outcome driven. Enabled by system-wide technology investment.	Technology and data enabled dynamic sense and response systems.	Continuously adaptive city-wide 'smart' deployment.
EFFECT ON PROGRAM OUTCOMES	Capturing evidence and building business case.	Cross boundary partnerships emerging to focus on shared outcomes.	Shared accountability for outcomes and joint system-wide investment programme.	Improved prediction, prevention and real-time response delivers improved outcomes.	City-wide open 'system of systems' approach drives innovation that enhances city competitiveness.
STRATEGIC INTENT	Successful smart cities have a strategy and roadmap setting out how investment in data & digital technologies enables service reform and partner collaboration. An effective strategy focuses on delivering improved outcomes aligned to the city's strategic priorities.				
LEADERSHIP & GOVERNANCE	Successful smart cities adapt traditional organisational models of delivery to realise the opportunities of data and digital technologies. Investment is made in system wide partnership models enabling shared outcomes				
ICT INFRASTRUCTURE	Successful smart cities invest in open, flexible, integrated and scalable ICT architectures. Enables accelerated service innovation such as provision of automated and real time dynamic response capabilities.				
EFFECTIVE USE OF DATA	Successful smart cities make effective use of their data assets to secure better outcomes. They invest in system wide data capture, integration and analytics capabilities. Open data underpins their commitment to transparency and innovation.				
STAKEHOLDER ENGAGEMENT	Successful smart cities make best use of data and digital technologies to invest in enhanced openness and transparency. Stakeholder engagement and stakeholder ownership of service reform is central within a smart city. Smart cities are proactive in improving take up of digital services supporting the digitally excluded.				
PROJECT IMPLEMENTATION	Successful organizations make systematic usage of a defined project management model leading to increased efficiency, performance benefits, and customer satisfaction.				

Maturity status and related outcomes across smart city elements

High level success factors per element to achieve a sustainable smart city

Figure 10. Smart city program elements as a maturity model

A full maturity model definition, with criteria to achieve each level of maturity per program element, can be found at Scottish Cities Alliance web (REF 1.2).

When assessing smart city program maturity the following should be taken into account:

Assessment sponsorship is needed by leadership empowered to make decisions related to investments and resources.

The approach should be towards providing a reference point for internal improvement, rather than simply aim for a level of maturity. In practice having run an assessment and understood the gaps related to the assessed level of maturity, then leadership need to define actions required to close relevant gaps, rather than simply aim for a desired level of maturity.

Assessment can be undertaken as a formal independent and so objective assessment by a qualified assessor. Where formal assessment is undertaken, "*Guidelines for auditing management systems BS EN ISO 19011:2011*", should be followed.

Alternatively the maturity model can be used by a program for self-assessment, giving a structured internal view of improvement opportunities.

2.5 — Pilots and scalability

In order that a pilot can be successfully scaled up to full city or countrywide deployment, then some forward planning is needed regarding ICT infrastructure, as well as business partner engagement.

2.5.1 — ICT Infrastructure

ICT Infrastructure must be scalable such that when user load increases by an order of magnitude a service is able to cope with increase in user load and locations. As well as this there needs to be a clear understanding of architectures and ownership of data sources to enable wider deployment.

A checklist for ICT needs should be used to ensure that during creation of a service, scalability is designed into it at various phases of design and piloting. These may cover criteria such as:

- help desk and user support
- security and privacy needs and related testing
- server capacity and service availability needs
- hosting, maintenance and support needs

- knowledge transfer for replication of a service
- service deployment strategy

As mentioned in ICT Strategy [section 2.1.3](#), ICT needs should also be planned for strategically to support the possibility to successfully scale up pilot projects.

Without this strategic and scalability planning, although a pilot has been successful, the technical challenges and associated costs can prevent it from being deployed on a wider basis.

2.5.2—— Business and Partnership Planning

Funding for pilots can come from a number of sources such as the city itself, start-ups, knowledge institutions, business etc. To support wider deployment of successful pilot projects, then a second stage of partnership needs to be planned for to ensure smooth rollout of a service.

So the following will need to be considered during piloting phase; new partnerships required, legal agreements, ownership and maintenance of service infrastructure and data.

Tampere Events App

The Tampere Events App was launched at the July 2018 IAAF World U20 Championships in Tampere. The app provides information about the event itself, as well as routes and services.

Events can be published on the app anywhere Google maps is available,

and its open data interfaces support scalability across a number of mobile device platforms. It's now planned to use the app for future events in both Tampere and Helsinki and the app will be further developed on the basis of user feedback.

Employment Services Chatbot Co-creation

A chatbot solution for employment services support was developed by Tampere City employment services, and Osaamisbotti Oy. The partner here was a startup business who were able to scale their business based on the success of this pilot. Smart Tampere program managed joint development of the bots and deployment of the service as a pilot for jobseekers.

The team developed the tool based on feedback from users. The same chatbot technology was trialed in other city

services enabling understanding of further use case opportunities. The usage of effective collaboration agreements with the startup partner, enabled the continued development of the solution towards these other usage opportunities. Currently, the platform is being scaled up in employment services for personal coaches in job seeking in other cities as well as job seeking services in the private sector.

2.6 — Smart City Communication

Smart cities are about making better decisions based on data, offering better services that are easier to use and make efficiency and economical improvements. To achieve this a smart city program needs to collaborate with a wide range of stakeholders and partners as defined in [1.2.1](#)

Ecosystem Definition.

To reach out across this ecosystem, and ensure optimal impact, there needs to be communications and marketing know-how in the program management team, as stated in [2.1.2 Leadership and Governance](#).

Communications and marketing is not to be seen as a separate function managing media visibility, but as a vital part of strategic planning. A program's brand is about the performance of the program as a whole, for example, how valuable the partners feel the collaboration to be or how beneficial the citizens feel the program has been.

City organizations tend to run projects and development plans in silo mode and this can be the same for marketing efforts. Therefore marketing needs to be involved across all areas including a city's communications and marketing department, in creating a smart city vision and communications and marketing strategy. The best results are gained if a smart city programs communications are included in an overall city communications and marketing strategy.

It's vital that the plans and decisions realized through portfolio management are fully transparent. This means transparent to; city organizations, partners, stakeholders and citizens. This supports full understanding and commitment, leading to effective collaboration.

Therefore a program needs to create effective communication channels to disseminate information such as; program strategy and plans, project focus and status, success stories, and other current news, as well as contact information for those involved in the program.

A smart city web page should be created and social media channels used to promote discussion and feedback on the overall program aims, as well as for specific initiatives. These channels can then lead to further opportunities through promoting a smart city's brand towards potential partners, both with business and through collaboration with other smart cities.

Overall a smart city program provides a great opportunity for a city's branding and marketing. Presentations in international events, visibility

at expos, sharing success stories and building visibility by further sharing media hits, can be used to attract further investment, talent and tourism. Effective smart city marketing can help in opening up international markets for local companies, leading to significant increases in business revenues and other related opportunities.

SMART TAMPERE PROGRAM EXAMPLE

Smart city marketing practices

1. Media Releases. Making joint launches and media releases together with our Letter of Intent partners created high levels of media attention. As an example, when Nokia Oyj announced its partnership with the Smart Tampere program, there was 92 national and international media hits, and a potential visibility of 23 million readers worldwide.

2. International Events. Speaking at international events. In the first year alone the program attended and presented program activities at over 60 national and international events. Advance sharing of materials by an event can generate additional interest (remember to include hashtag and speaker's twitter handle in every slide). These event presentations brought new partnerships, social media visibility, requests for video interviews, articles and further speaker requests.



— 3 —

Business models



3.1 — Business model elements

Developing a sustainable business model supporting funding and value creation for a city and its partners is critical to ensuring a sustainable smart city program.

Section 2.1.5 defines typical business and partner organizations. So an effective business model needs to be capable of managing these partners from initial engagement, through to collaboration and creation of innovative smart city services. Such a model needs to ensure new businesses and partnerships flourish, supporting sustainable economic growth within a city.

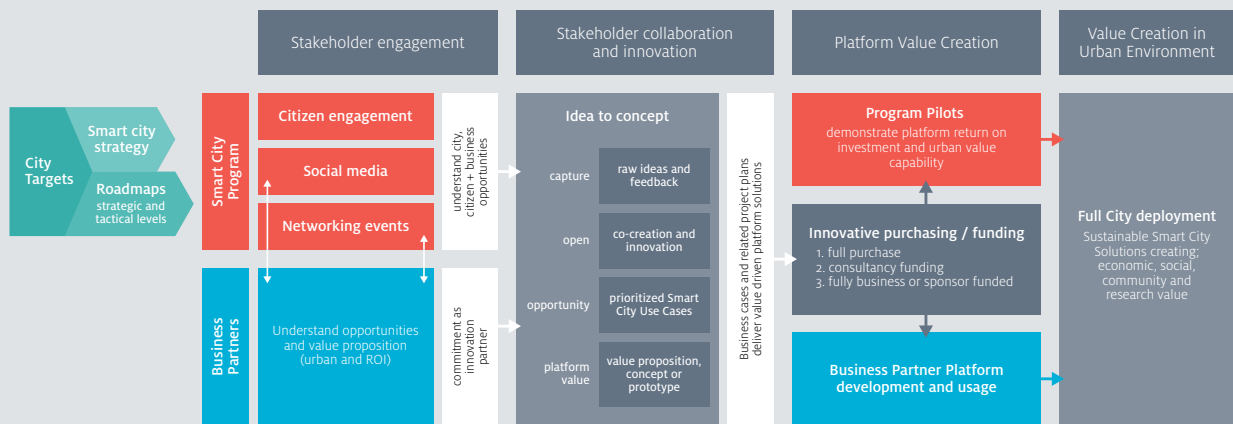


Figure 11. Business model elements

Key elements within a typical smart city business model are shown in Figure 11. Stakeholder engagement creates the attraction that pulls in potential partners and collaborators. It's critical at this phase that there is effective citizen engagement to ensure understanding of a smart city program and its strategic aims and objectives.

3.1.1 — Collaboration and Innovation

The set of engagement and co-creation tools defined here support collaboration with business and other partners, leading to innovation and investment opportunities.

Figure 12 illustrates some basic co-creation principles that support innovation and so deliver value creation.

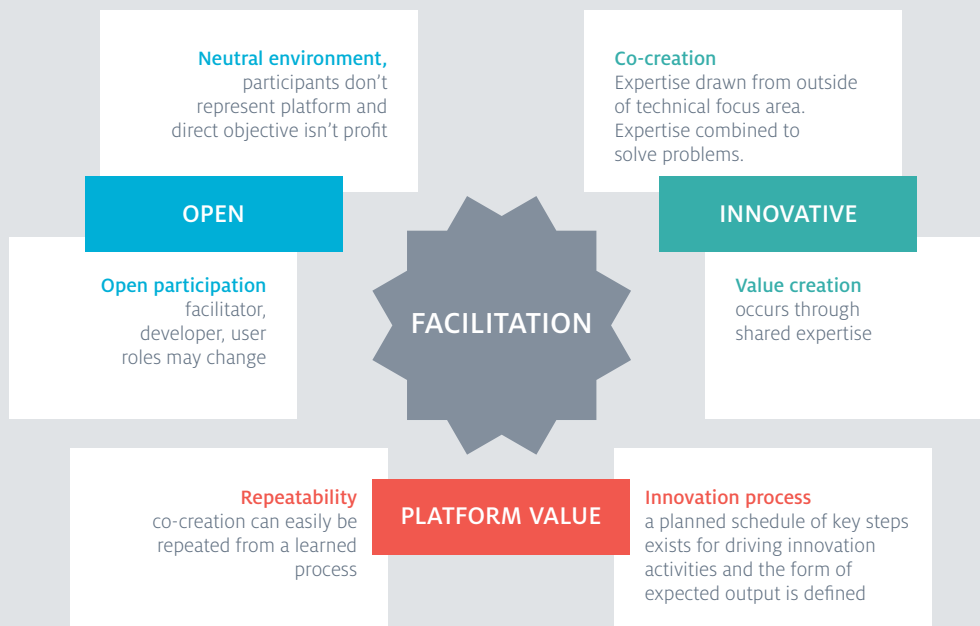


Figure 12. Co-creation innovation principles as per [ref 1.6](#)

Hackathons

A hackathon is a facilitated event, working towards solutions for predetermined challenges. The objective is to define a viable concept for such challenges.

Hackathons may be organized around a city platform, and challenge participants to propose development ideas and business solutions that build on and enhance a platform's capability. A city's partners can also bring their own challenges to a hackathon. There needs to be an effective

business model that manages outputs from a hackathon towards a managed business case. Such an approach is ideal to encourage the growth of start-up businesses.

To support effective co-creation, expertise drawn from outside of a technical focus area can lead to true innovation. As an example if looking at solutions to be developed on an electric bus transportation platform, then inclusion of expertise from diverse fields such as medical and education can lead to out of the box, innovative ideas.

Living Labs and Fast Experiments

In living labs business, public sector and citizens can collaborate together, with new services, business ideas and technologies in a shared environment. This maybe for example a designated space such as a shopping mall, where business can pilot a number of smart city digital solutions together in a real time environment.

Fast experiments are where an initial idea or concept is tested with users at the earliest possible stage. Effective co-creation here involves testing of a prototype over a short period of time, to understand what works well and what doesn't.

Crowdsourcing

To solve complex problems that are beyond a programs capability, a crowd sourcing campaign using digital crowd sourcing tools can be effective. The aim is to find valuable solutions and contributors in the crowd. A frequently used approach is the crowd contest. This is where a challenge is set, leading to a winner and related prizes. There may also be an opportunity for the winner to continue with their solution as a pilot. Such an approach is ideal for start-up businesses to grow with the success of a solution as it is piloted and then scaled up across cities and countries.

City to City Collaboration

Collaborating with other cities to exchange learnings to drive improvement is an effective approach. This can be done on a national and international basis. Such an approach enables cities to experiment in a larger context than just one city and share costs of related projects. However to support this approach it's recommended that there is an open agreement in place for sharing of information and experiences.

This also enables greater scalability opportunities for pilots to be fully deployed at a national level, which in turn can lead to:

- improved ICT interoperability and common standards
- shared platforms and costs
- increased potential for startup business's to grow with national deployment opportunities

Examples of city to city collaboration are:

- Finnish Six Cities initiative (REF 1.6)
- European Innovation Partnership on Smart Cities and Communities (REF 1.7)

SMART TAMPERE PROGRAM EXAMPLE

Collaboration and Innovation

1. SmartMile vending machines. The SmartMile vending machines service has been developed in collaboration with SmartMile Oy, Kesko and Konecranes. . Effective facilitation by the program led to an innovative solution utilizing a new type of robotics technology. The service allows online buyers to have parcels from web stores from across the globe to be shipped to a designated automatic parcel terminal at a local store.

2. IoT Guide. During 2017 Smart Tampere conducted interviews across the city of Tampere to understand needs for gathering and using data. It became clear there was a need for guidance across the city in this area. "The city developer's quick guide into the

world of IoT" was the result. It meets the needs of the city for specifying a city wide IoT platform and also covers the needs of companies' and universities.

The guide aims to make data management more straightforward in the areas of; open data, user-specific data authorization, sharing of analyzed data by companies, business development and research by universities and other partners. It was created following an Open Requirements process defined by the Smart Tampere program, in which there were approx. 100 participants from the city, business and education and research institutions.

3.1.2 — Platform Value Creation

It's vital that the business model clearly addresses value creation in a way that makes clear how all parties may benefit through platform creation and usage. It needs to address:

- how revenue is generated and shared across the value chain
- innovative purchasing and funding approaches
- how a smart city can act as; partner; enabler or customer

3.2 — Innovative purchasing

A smart city when viewed from platform and customer perspectives requires differing approaches to funding and purchasing.

The purchasing process needs to take into account ICT needs ensuring the need for open data and ownership of access rights by a city. To achieve this, usage of a frame agreement for smart city purchasing with standard clauses covering the need for open data and open interfaces can be used. Within a purchasing or partner agreement there can then be requirements for certain data or interfaces to be open to a specific user group only. For example a traffic data solution is purchased and interface open to developers only.

There can be different approaches to purchasing and partnership as follows:

1. **The city as a customer** – A city requires to purchase ICT services or other services to support its smart city transformation from various suppliers. Here innovative purchasing techniques should be used to ensure the most cost effective and innovative outcomes that are a best fit for smart city needs, rather than simply procure off the shelf solutions. The program operating mode may be centralized or sequenced. Open pitching and open requirements specifications ensure that suppliers deliver innovative services to a level required by a city.
2. **The city as a platform and services enabler** – Companies create and develop platforms and related services. Here the city is acting as a services facilitator, using a business model and open requirements specifications and open pitching. The program operating mode may be facilitated or self-organized. The business model needs to attract business to a city through

opportunities to build and deliver platforms and related services of such a scale that they create sufficient ROI for business to invest in them. Open Requirements Specifications ensure that business delivers innovative services to a level desired by a city.

3. **The city as a platform partner** – A city may create a platform such as city tram, which may then be utilized by business for development and operation of city services. There is unlikely to be direct purchasing costs involved, just the costs involved in facilitation and collaboration activities. The program operating mode may be facilitated or self-organized. Again the business model needs to attract business to a city through opportunities to build and deliver services onto an existing platform.



Open Requirements Specifications can be used to specify needs and objectives together with business and other stakeholders as part of an innovative public purchasing approach. It takes into account the openness and non-discrimination principles of purchasing law. Its definition supports future purchasing and formal agreements, but at this stage does not bind any parties involved in the process.

Companies can bring potential solutions to meet a logical city services need, focusing on what is needed and why, rather than the how or technical solution. For example focus on architectural needs rather than the actual solution itself for a services need. This can encourage a more innovative solution from suppliers, where the customer has not been overly prescriptive in terms of what's need to meet their needs. The process is public and the resulting definition document is shared openly.

Supplier types can be seen to fall into the following categories:

- **Smart city vertical solution provider**, provides generic / tailored platform market independent platforms specific for city needs
- **Smart city horizontal solution and platform provider**, provides off the shelf platform ICT solutions that cover a single operational domain e.g. IoT or healthcare
- **Smart city technology vendor**, providing equipment's such as sensors and analytics components

Working with vertical solution providers can give most value in terms of platform solutions that are capable of supporting multiple operational domains.

SMART TAMPERE PROGRAM EXAMPLE

Innovative partnership for home remote care

Smart Tampere program received public funding for provision of a home remote care platform, and rather than procure an off-the-shelf solution, a new solution is being created in cooperation with companies and research facilities. The requirements of the home and remote care integration platform were specified in the spring of 2017, led by the City of Tampere and FinnMedi Oy. The specification was developed with more than 50 companies, following an Open Requirements process defined by the Smart Tampere program.

This innovation partnership model makes it possible to develop and test an integration platform based on open standards and related services, such as centralized

monitoring, alarms, register management, etc. The purpose of the technological entity is to integrate hospital care and home care into one service chain, and to improve the utilization of data collected from a wide range of already existing home based technologies. When the platform is ready, the customer is not forced to give up a technology with which they are already familiar.

The platform approach here could enable wider adoption of remote monitoring and wellbeing technologies at a national level, and may save millions of euros through the integration of several different services onto a single platform.

Open innovation platforms



4.1 — Open innovation platform definition and value

“An open innovation platform organizes different practices of the open innovation process and co-creation in order to create value. The owner and/or facilitator of the platform do not necessarily participate in producing the actual solution or content”, (INNOVATION PLATFORM HANDBOOK REF 1.6).

Open means opening a platform for usage by a number of organizations or developers, rather than a single partner or business. The co-creation tools defined in [section 3.1.1](#) are most effective for managing activities with these various organizations when used in a platform environment.

A platform environment can be defined in a number of ways:

- a specific environment requiring improvement of its services through technology e.g. public health monitoring
- an urban environment in which services (digital and other) can be developed e.g. sports arena
- a technology platform for development of digital services e.g. 5G network

A platform approach creates value in a number of ways:

- clear focus area for engagement of stakeholders, partners and citizens for services development
- encouragement for startups, providing a rich environment for them to develop new ideas
- attractor for business to develop and maintain platform infrastructure

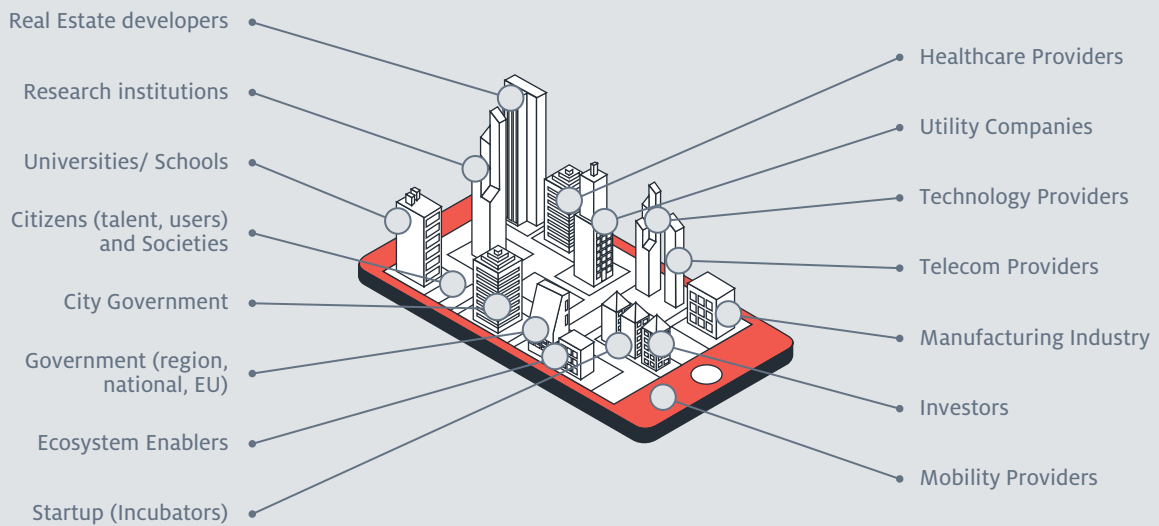


Figure 13. Ecosystem contributors

The creation of a platform begins with a clear target defining its value to a city, its citizens, business and the expected ROI. *Figure 13* defines typical contributors within an ecosystem. Using a platform approach provides a clear focal point for bringing together these different contributors towards a common purpose through an overall strategy and then related project planning.

See Innovative Purchasing [section 3.2](#) for definition of platform supplier types.

— 5 —

Measurement frameworks



5.1 — Measuring program and project success

A program should define a set of set of performance indicators (KPI's) as a scorecard, to indicate strategic goal focused progress and the related improvement opportunities. This should be based on a scorecard framework definition such as the example shown in *figure 14*.

As can be seen this ensures alignment of program KPI's with program drivers and city goals. There is also alignment with the City Keys indicators for smart city projects and smart cities (REF 6).

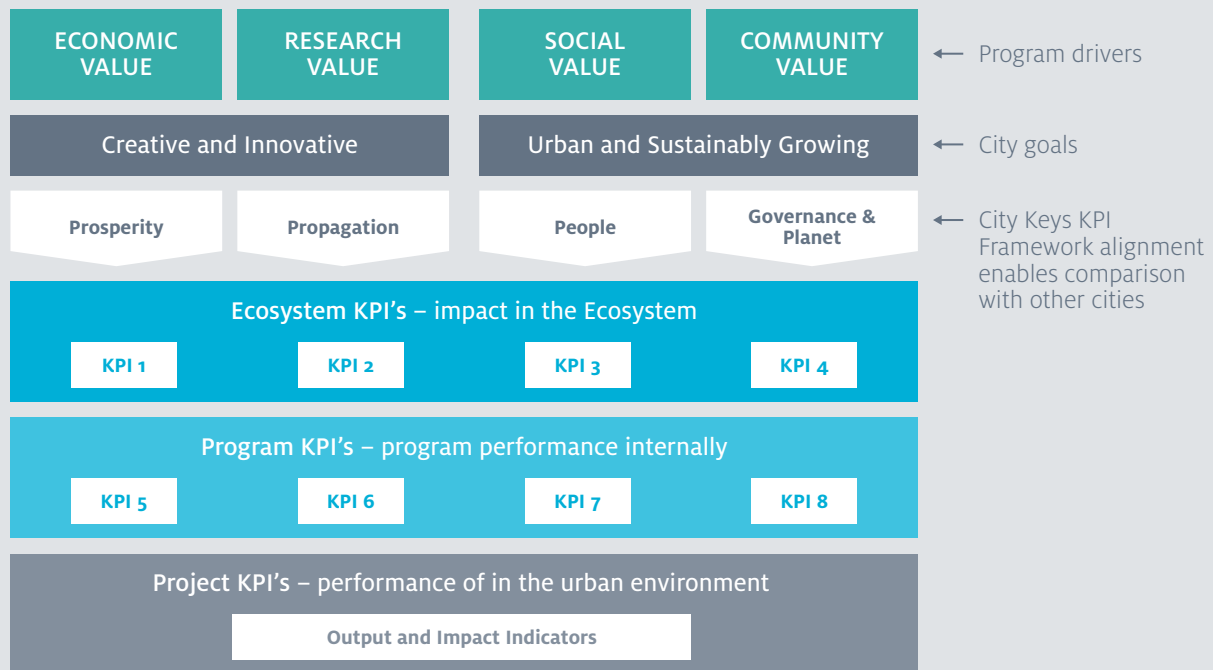


Figure 14. Program scorecard framework example

KPI's may be defined within 3 categories:

Ecosystem KPI's measure the impact a program makes externally.

Examples are:

Innovation reuse	The number of innovations created by a city that have been adopted / reused by other cities and business (can be concept, app, etc.)
Number of platform users	The number of new companies using platform compared to previous reporting period, counted as : engaged as user, development initiated, fully operational
ROI across the program and its projects	Total project investment vs. expected or actual impact. Impact can be shown as; cost / energy savings, efficiencies, revenue increase, social value
Domain digitization coverage	Planned level of digitization for a given domain (e.g. health, education transport) vs. actual level of digitization
Domain digitization satisfaction	Citizen or user satisfaction with old service vs. satisfaction with new service. Net Promoter type of metrics can be used here.
Media visibility	Number of web page hits, social media reach and traditional media coverage

Program KPI's measure the effectiveness of a program internally. Examples are:

Project deliverable accuracy	Planned vs. Actual number of project tasks / deliverables completed as per project plan
Projects completed per roadmap	Planned vs. actual number of projects completed as per smart city roadmap

Project KPI's measure the impacts of a project within the urban environment. Types of indicators are:

Input indicator	Resources needed for the implementation of an activity or intervention, measuring the quantity, quality, and timeliness of resources. Policies, human resources, materials, financial resources are examples of input indicators (ref 6).
Output indicator	Output indicators add more details in relation to the product ("output") of the activity, e.g. the number of smart meters distributed, the area of roof that has been isolated, and the number of electric busses in a system (ref 6).
Impact Indicator	Measuring the quality and quantity of long-term results generated by program outputs e.g. measurable change in quality of life, reduced energy use, reduced air pollutant emissions (ref 6).

City Keys indicators for smart city projects and smart cities (REF 6), defines five themes for categorizing smart city project measures as per figure 15.

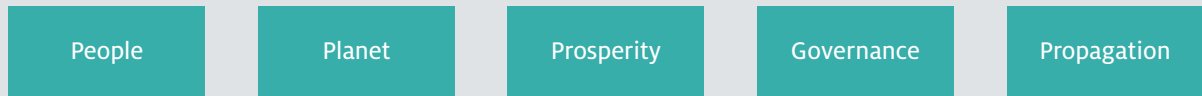


Figure 15. City Keys themes for categorizing smart city project measures

See (REF 6) for further definition of measurement types within the above themes.

Creating an ecosystem program scorecard

The Smart Tampere scorecard was developed using the programs values and Tampere city strategic goals. The traffic lighted version shown here and consolidation of related program data, gave a clear picture of the value

the program had created over a 12 month period. This proved useful in communicating the programs overall value proposition to stakeholders within the city and to business partners.

PROGRAM VALUES		Economic value	Research value	Social value	Community value
TAMPERE CITY STRATEGY		Creative and Innovative		Urban and Sustainably Growing	
<div style="display: flex; justify-content: space-between;"> on target below target </div> <div style="background-color: #f0e68c; padding: 2px;">below target actions in place</div>	<div style="background-color: #f0e68c; padding: 2px;">platform use; companies + researchers</div> <div style="background-color: #008080; padding: 2px;">ecosystem pilots fully deployed by city</div>	<div style="background-color: #008080; padding: 2px;">national / international events</div> <div style="background-color: #f0e68c; padding: 2px;">innovation re-use</div> <div style="background-color: #008080; padding: 2px;">social media visibility</div>			
ECOSYSTEM					
PROGRAM			<div style="background-color: #f0e68c; padding: 2px;">projects completed per roadmap</div> <div style="background-color: #008080; padding: 2px;">project deliverable / task accuracy</div> <div style="background-color: #f0e68c; padding: 2px;">stakeholder activations</div>	<div style="background-color: #008080; padding: 2px;">project ROI</div>	
PROJECT	buildings & district			<div style="background-color: #d3d3d3; padding: 2px;">smart street lighting</div>	<div style="background-color: #d3d3d3; padding: 2px;">building information model</div>
	emobility			<div style="background-color: #d3d3d3; padding: 2px;">no. charging points</div>	<div style="background-color: #d3d3d3; padding: 2px;">traffic light control</div>
	ICT			<div style="background-color: #d3d3d3; padding: 2px;">eBUS, city beat applications</div>	
	energy				<div style="background-color: #d3d3d3; padding: 2px;">district cooling by lake energy storage</div>
	business models	<div style="background-color: #d3d3d3; padding: 2px;">demand response as service</div>		<div style="background-color: #d3d3d3; padding: 2px;">local innovation ecosystem city app</div>	<div style="background-color: #d3d3d3; padding: 2px;">open governance via city platform</div>
	citizens engagement				

— 6 —

Appendix



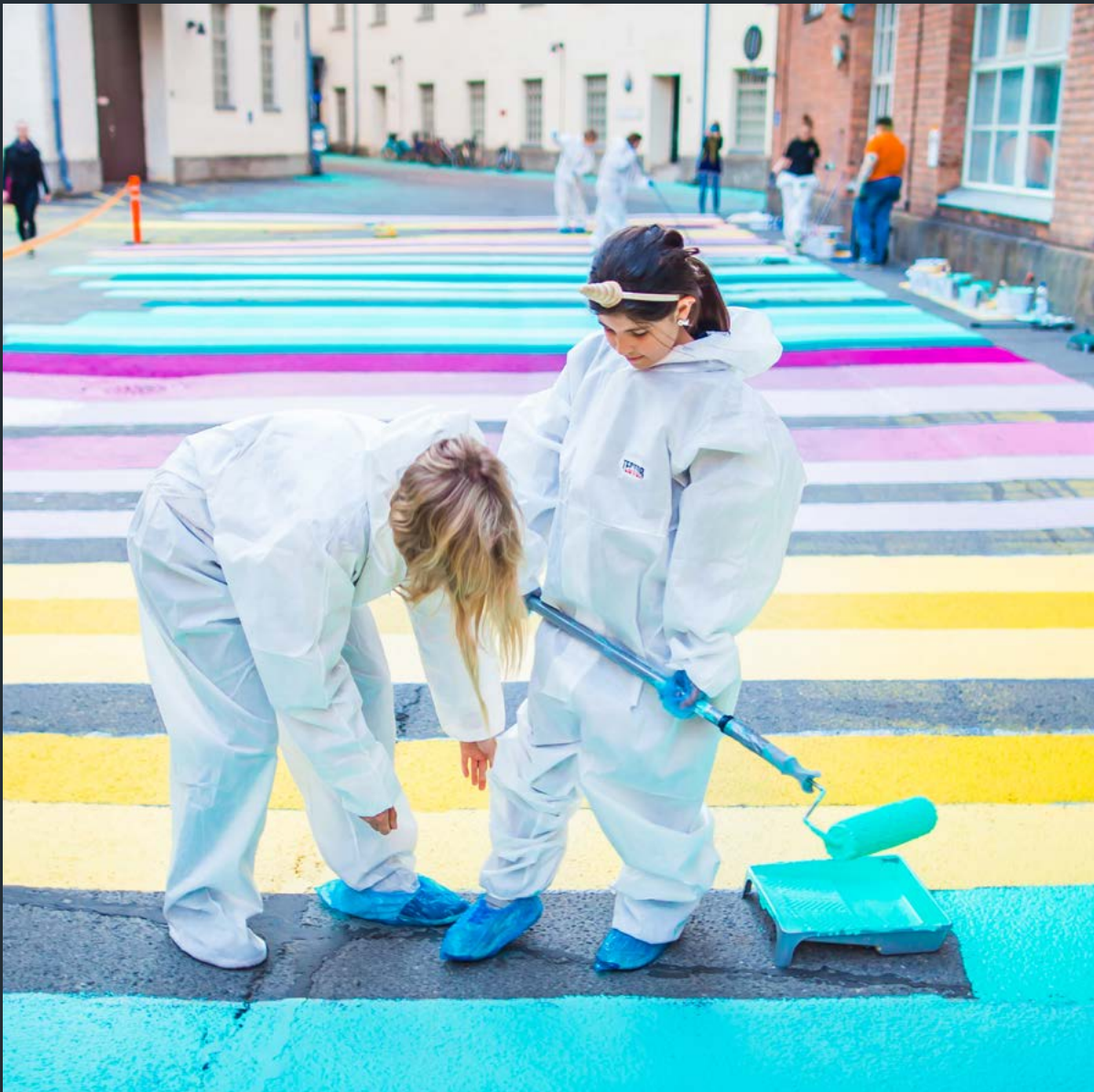
6.1 — Program planning quick lookup checklist

The following table provides a quick reference to the key elements for smart city program management that are defined within this publication.

Program Maturity Elements				
Strategic Intent	Leadership and Governance	ICT Infrastructure	Effective Use of Data	Stakeholder Engagement
value driven program strategy	city political + admin persons in leadership team	ICT skills in leadership team	key element of program strategy	clear smart city vision defined
program strategy aligned to city targets	strong links to education + business in leadership team	transformative ICT strategy in place	define how open data drives new business opportunities	communicate vision through digital + traditional channels
program roadmap aligned to program value drivers	strategic and delivery based program portfolio mechanisms	open, flexible, integrated and scalable ICT architecture	actionable information supports analytics that drive improved services	ensure citizen understanding of value of change
define city urban ecosystem	governance of strategic + tactical / project roadmaps	public (non-personal) data open for reuse and innovation	creation of open data policy + channels supported through innovative purchasing	business model and set of engagement tools drive effective engagement
define a stakeholder map of business ecosystem, both current and desired	program plans fully transparent to all stakeholders and citizens	innovative purchasing supports open data and interfaces	usage of real time data, as well as analyzed data as a saleable asset	ensure citizen understanding of data usage
reviewed as part of program portfolio management to ensure continued alignment with city goals	project management model for planning and tracking / reporting	rules exist for handling of personal data	rules defined for usage and ownership of city data assets	
Other Program Criteria				
Project Planning	use agile and continual improvement methods to improve speed and quality	ROI to be considered when planning projects	effective innovative purchasing methods in place	project planning and reporting model in place
Pilots and Scalability	use ICT checklist to ensure scalability and ICT infrastructure needs are met	ICT needs planned for strategically to ensure economies of scale	plan for new partnerships and funding to ensure scalability	
Collaboration and Innovation	business model capable of managing partners from engagement, through to value creation	define how revenue is generated and shared across the value chain	define innovative purchasing and funding approaches and how a smart city program acts as; partner; enabler or customer	effective innovation model and engagement and co-creation tools in place
Open Innovation Platforms	define clear targets for platform to a city, citizens, business and its expected ROI	plan for supplier applicable type and purchasing approach according to type of platform	open requirements specifications support an innovative approach	co-creation tools used to drive platform innovation
Measurement Frameworks	define scorecard framework + set of KPI's, to indicate strategic goal focused progress	ecosystem KPI's measure the impact a program makes externally.	program KPI's measure the effectiveness of a program internally	Project KPI's measure the impacts of a project within the urban environment

— 7 —

Document information



7.1 — Glossary

DMAIC – Define, Measure, Analyze, Improve, Control

ICT – Information and communications technology

IoT – Internet of Things

KPI – Key performance indicator

NGO – Non-governmental organization

SME – Small and medium scale enterprise

7.2 — References

1. Smart Cities and their resources benchmarked in support of understanding best practices:
 - 1.1 Smart Tampere <http://smart tampere.fi/en>
Smart Tampere ecosystem overview,
<http://smart tampere.fi/en/materials>
 - 1.2 Scottish Cities Alliance, <https://www.scottishcities.org.uk/>
Smart Cities Maturity Model and Self-Assessment Tool (October 2014), <https://www.scottishcities.org.uk/media/publications>
 - 1.3 Trondheim City, <https://www.trondheim.com/>
Successful Programs framework,
<https://www.axelos.com/best-practice-solutions/msp>
 - 1.4 Smart City Amsterdam, <https://amsterdamsmartcity.com/>
Smart City Academy (Amsterdam University of Applied Science),
<https://amsterdamsmartcity.com/themes/smartcityacademy>
 - 1.5 San Sebastián, <http://www.fomentosansebastian.eus/en/donostia-smart/proyectos-de-ciudad-donostia-smart>
 - 1.6 Six Cities initiative, <https://6aika.fi/in-english/>
Open Innovation Platforms Handbook for Developers (2016),
Raunio, Nordling, Saarinen, Ketola, Heinikangas ISBN 978-951-590-337-2 https://avoimetinnovaatioalustat.files.wordpress.com/2016/02/kc3a4sikirja_eng.pdf
 - 1.7 The European Innovation Partnership on Smart Cities and Communities, http://ec.europa.eu/eip/smartcities/index_en.htm

- 1.8 EU Smart cities Information System
<https://smartcities-infosystem.eu/>
2. Capability Maturity Model Integration (CMMI), https://en.wikipedia.org/wiki/Capability_Maturity_Model_Integration
3. PAS181:2014 Smart city framework – Guide to establishing strategies for smart cities and communities (2014), ISBN 978 0 580 81856 1, <https://www.bsigroup.com/en-GB/smart-cities/Smart-Cities-Standards-and-Publication/PAS-181-smart-cities-framework/>
4. Six Sigma, https://en.wikipedia.org/wiki/Six_Sigma
5. Scrum Software Development, [https://en.wikipedia.org/wiki/Scrum_\(software_development\)](https://en.wikipedia.org/wiki/Scrum_(software_development))
6. City Keys indicators for smart city projects and smart cities (21.4.2017), Bosch, Jongeneel, Rovers, Neumann, Airaksinen, Huovila, http://www.citykeys-project.eu/citykeys/cities_and_regions/Performance-measurement-framework
7. Performance Ecosystems (2011), Hagel, Seely-Brown, Kulasooriya, Deloitte University Press
8. Photographs: Visit Tampere picture bank
<https://visittampere.fi/en/professionals/photo-bank-and-materials/>

TAMPERE.
FINLAND

The Smart City Cookbook

A Recipe for Successful Smart City Programs

ISBN 978-951-609-922-7 (pdf) - first edition
City of Tampere
Department of International Affairs
P.O. Box 487, FI-33101 Tampere, Finland