Project number:	693729
Project acronym:	smarticipate
Project title:	smart services for calculated impact assessment in open governance
Instrument:	Horizon2020
Call identifier:	H2020-INSO-2015-CNECT
Activity code:	INSO-1-2015

Start date of Project:	01-02-2016
Duration:	36 months

Deliverable reference number and title (as in Annex 1):	D2.1- User requirements definition
Due date of deliverable (as in Annex 1):	Month 8 (delatyed to M9)
Actual submission date:	see "History" Table below
Revision:	see "History" Table below

Organisation name of lead contractor for this deliverable:
University of the West of England

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2013)			RESEARCH EXECUTIVE AGENCY (REA)
Dissemination Level			
PU	Public	X	
PP	Restricted to other programme participants (including the Commission Services)		
RE	Restricted to a group specified by the consortium		
CO	Confidential, only for members of the consortium (including the Commission Services)		

Title:
User requirements definition
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Working Group:
Work package 2: UWE, WLTC and City Partners
References:
A list of references has been provided at the end.

Short Description:
This document presents the requirements elicitation methodology and user requirements for smarticipate defined in conjunction with the pilot cities.
Keywords:
CoReS, Requirements, WP2

History Table:				
Version	Author(s)	Status	Comment	Date
001	Kamran Soomro (UWE)	New	Created template and initial table of contents for document	17-05-2016
002	Marek Vogt (WLTC)	Rfc	Developed urban stories in conjunction with RBKC, Rome and Hamburg	01-07-2016
003	Kamran Soomro (UWE)	Rfc	Finalised document	15-09-2016

Review:			
Version	Reviewer	Comment	Date
003	Veneta Ivanova, Joachim Rix	Review to final version	17-10-2016
004	Thorsten Reitz	Comments are Inline and use Track Changes	17-10-2016

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1 Introduction

Urban planning aims to manage the territory in order to address the key political concerns of European citizens, including climate change, greenhouse gas emissions, uncontrolled urban sprawl, urban health and biodiversity loss. As cities are extremely complex systems, and the various drivers of change, impacts and responses are strongly interrelated, support, alter or compete with each other, this presents major challenges for urban planners and politicians.

This urban complexity fundamentally undermines the effective governance of the cities and city regions of Europe today, whereby the high degree of interconnectedness and multiple interactions between socio-economic and environmental factors in a territorial context create major barriers to the effective implementation of sustainable urban development.

ICT enabled governance of cities offers substantial opportunity for the application of enhanced intelligence in urban management, to overcome barriers to sustainable development. This can be achieved by enhanced assessment of urban complexity, improved decision-making support, all facilitating the delivery of more sustainable compact cities. Moreover the wider potential of ICT enabled urban governance is evident in the ability to simultaneously achieve effective management of the complexity of the city, and engage citizens in defining their urban futures.

smarticipate is a data-rich citizen dialogue system, transforming public data into new intelligence, and transposing elements of intelligent ICT development to urban governance. The aim is to integrate bottom-up processes in the realm of city planning, using the full potential of citizens by sharing ideas in the co-production of decision making. smarticipate thereby:

1) transforms interaction between citizens, businesses and public administrations in the management of cities, providing a must-have tool that improves cities' performance,
2) leverages government- citizen relationships,
3) reduces burdens on government via co-production of tasks,
4) and saves money through increased efficiency of processes.

As a consequence, citizens get full access to public open data and provide feedback on their neighborhood-related and citywide ideas for city development. This is achieved in a playful, digital dialogue based on an open, easy accessible platform. Government, NGOs, businesses and citizens develop their own apps as producers and co-producers. As a result, citizens are empowered to play active roles in the public domain, to develop new tools and to generate new public services, thereby making major contributions to Europe 2020 strategies for smart, sustainable and inclusive growth in Europe's cities. The smarticipate platform contains two generic components and functions:

To create an interactive model for impact assessment with the ability to modify the modelled objects, to understand the impacts of citizen-centric urban planning;

To create a user interaction tool (web-server) that enables structured interaction with users

and communities.

smarticipate offers real world solutions developed and tested in Hamburg, Rome and London, that are fully effective and implementable, as well as sustainable in the long term. These three pilot city demonstrations are transferable to all cities throughout Europe, supporting a fully sustainable business model.

2 Methodology

In any IT project requirements gathering and management is an important aspect. Without requirements developers cannot understand user expectations and needs. Therefore, requirements must be properly managed and specified. For this purpose, we have adopted the Collaborative Requirements Engineering and Stakeholder engagement (CoReS) methodology in the smarticipate project [1]. This methodology was developed during the EC funded FP7 urbanAPI project and proved quite successful in fulfilling the aforementioned goals [1]. The urbanAPI project focused on enabling citizen participation through the development of three apps; the 3D Scenario Creator, the Mobility Explorer and the Urban Development Simulator. Each of these three applications focused on a different aspect of urban planning. The tools and techniques developed as part of the 3D Scenario Creator are being enhanced in smarticipate. More information about the urbanAPI project can be found at http://urbanapi.eu. In this section we present the CoReS methodology for requirements development in smarticipate. This method consists of the following five main components and performed in a specific order.

1. Groundwork and Context
2. Requirements Gathering Workshops
3. Scenario-Based Requirements
4. Requirements Specification Template and Validation
5. Requirements Management

The overall process is coordinated and managed by a "Requirements Expert" role. The five CoReS components are selected for the following prime reasons:

- to understand the environment where solutions will be applied, with the objective to identify existing problems, stakeholders needs, policy objectives and existing organisational processes;
- to understand stakeholders in order to develop user defined solutions by maintaining regular engagement with the stakeholders throughout the requirements development process;
- to gather, specify and validate application requirements within specific timeframes without affecting other stages of the project development life cycle;
- to accommodate the needs and requirements of multiple stakeholders in various

forms (i.e. urban stories, functional and non-functional requirements) with the objective to get better understanding of application requirements and to identify commonalities.

2.1 Groundwork and Context

The groundwork and context technique [2], [3] is used to elicit basic requirements and establish an understanding of city needs, in terms of policy goals, and constraints in order to establish the basis for effective participation in the requirements gathering workshops. In smarticipate, groundwork refers to the identification of stakeholder goals, conflicts, scope of the system and boundaries, associated risks and alternative scenarios.

Similarly, context refers to the rationale for development, for example the extent to which it is policy driven or market driven. In order to formally establish groundwork and context a questionnaire is prepared and distributed to city stakeholders, such as:

1 Representatives of different departments of the city administration including urban and transport planning, survey, IT and GIS departments and public communication;

2 Environment and regional agencies;

3 NGOs and policy makers.

The questionnaire primarily addresses "what" and "why" type questions, divided into general categories according to specific project needs, and which assist in structured requirement gathering and analysis. The questions are structured in relation to the following widely applied categories:

3.1.1 **Organisation Objectives**

This category of questions aims to identify objectives, goals and high level requirements that are relevant to local needs and which can bring benefits to the municipality/organisation in various forms. The following are selected examples:

"What are the city's sustainable development goals (e.g. strategic development/Master plan) related to the new public services based on novel e-participation solutions?"

"Please identify any local scenario(s) in detail where new public services based on novel e-participation solutions (such as smarticipate) can be usefully applied?"

3.1.2 **Organisation Future Needs**

This category of questions aims to indicate high level system requirements, functions, features, scope, interfaces, policy and standards compliance, challenges, expected outcomes and their measurability. The following are selected examples:

"What are the current problems facing your organisation related to citizen participation solutions? And, what is needed to solve any of these problems by novel e-participation solutions?"

"What output do you need created by novel e-participation solutions that you don't have now and for which purpose would it be used? And, in which format is this information needed?"

3.1.3 Existing System

This category of questions aims to discover the limitations in the existing system, if they exist, and the required interface with the new applications. The following are selected examples:

"Do you have any previous experience with developing new public services? If so, what were your lessons learned? Please also mention who is responsible for deploying those solutions (public / private sector, NGOs, etc)."

"Do you have any existing ICT enabled citizen participation service? Please describe how does it work? and, what value smarticipate can add this existing service?"

3.1.4 Stakeholders and/or System Users

This category of questions aims to identify major stakeholders and their roles. The following are selected examples:

"Who is going to benefit most from the smarticipate applications?"

"Who are the main stakeholders for smarticipate tools and applications (and their expertise)?"

3.1.5 Assumptions and Issues

This category of questions aims to identify any known issues and assumptions regarding the development of the system. The following are selected examples:

"Are there any assumptions we have to make while developing smarticipate outputs?"

3.2 Requirements Workshops

The requirements gathering workshops were used as an instrument for face-to-face communication between tool developers and city stakeholders. The objectives were to gather detailed requirements, based on direct discussion with the local city stakeholders, in order to acquire fuller understanding of local needs, policy issues and urban management goals. Furthermore, the identification of smarticipate city-specific urban stories, and associated data availability assist in defining the feasibility of application development for specific cities.

In smarticipate, prior to these workshops, introductory material for the project was distributed to city stakeholders to allow them to become familiar with smarticipate project. Participants to these workshop were mainly experts from different departments of city administrations including urban planning, IT department and GIS experts and in the case of Hamburg citizens as well..

This process lead to the identification of city preferences for using smarticipate and also

created the opportunity for discussions to clarify complex issues. For example, these discussions included identification of more specific user needs, restrictions on availability of mandatory data for applications, site identification to build urban story descriptions, and other expected outcomes from smarticipate.

3.3 Scenario-based Requirements

In order to secure a common requirements development approach and attract wider stakeholder participation, a scenario-based requirements and design technique has been used. In the literature, scenario based requirements elicitation, analysis and design approaches are commonly used [4]–[8].

In smarticipate, an operational scenario is referred to as an instance of a task dealing with data handling (create, read, update, delete operations), described in a user-specific language without including technical and/or implementation details. A scenario refers to a concrete narrative, or story, that describes the hypothetical use i.e. one future possibility for tool application. A scenario may articulate information including: who uses the system, what are the users' roles and what are they trying to achieve – objectives and goals; what is needed in the application and why; the user-system interaction and the context in which the user will work with the system; the users' constraints and limitations; clarifies what is regarded as a successful outcome of the application. This approach is useful to perform retrospective analysis and derive urban stories to analyse and specify user requirements. Furthermore, it helps in presenting system specifications in user-specific terminology which can be more effectively validated by the end users. Two scenarios were developed for each city.

3.4 Requirements Specification Template and Validation

In the CoReS method, a structured template is defined for requirements specification, and mainly used to elicit, analyse, specify and validate city requirements. For each city, it includes application-based urban stories, user needs and goals, local stakeholders, functional and non-functional requirements. Each requirement in smarticipate consists of the following fields:

1. **Subject:** A short description of the requirement. Generally a single line.
2. **Description:** A more detailed description of a requirement including some context and any details that may be required by the developers to implement the requirement.
3. **Status:** This indicates the current status of the requirement. The value of this field can be one of the following:
    1. *Under Review:* A requirement is under review when it is newly created. This means that it needs to be reviewed by a representative of the city and validated.
    2. *Validated:* This status indicates that a requirement has been validated by a city representative and is ready to be reviewed by a developer next.
    3. *Accepted:* This indicates that a requirement has been accepted by the developers and will be implemented within the smarticipate project.
    4. *Rejected:* This indicates that a requirement has been rejected by the developers and will not be implemented within the smarticipate project. The reason will be noted in the Notes.
4. **Priority:** The importance of the requirement for the cities. It can be low, normal or

high.

5. **Owner:** What is the source of this requirement? Could be a city or technical developer.
6. **Type:** What type of requirement is this? Functional or non-functional? A functional requirement reflects a particular functionality that is required in the product whereas a non-functional requirement reflects other characteristics of the product. For example, the requirement that the product should send mobile notifications to users is a functional requirement since it reflects a particular functionality of the system. However, the requirement that the notification should be sent within 3 minutes is a non-functional requirement since it does not reflect a particular functionality.
7. **Rationale:** Some justification for why this requirement is needed.
8. **Parent task:** This field is a reference to another issue that can be a Requirement itself, or an Urban Story. It indicates a parent-child relationship.
9. **Assumption:** Are there any specific assumptions that developers must make when considering these requirements?
10. **Means of Validation:** How will this requirement be validated? Will somebody test it? Or will some other method be used?
11. **Acceptance Criteria:** What will make this requirement acceptable for users? How will they determine if it has been fulfilled in the final product?

In smarticipate we use the Redmine tool to gather and manage the requirements. Each requirement contains the above fields. The requirements are linked to the urban stories they are derived from for traceability purposes. Representatives of each city were asked to validate the requirements and provide additional details if necessary. A workflow was also defined in Redmine to indicate when a particular requirement had been validated by the city users and was ready to be reviewed by the developers. After the developers reviewed the validated requirements they either accepted or rejected them based on technical reasons as well as feasibility. If rejected the reason was noted in the comments.

4 City-based Requirements

4.1 Royal Borough of Kensington and Chelsea (RBKC)

The London Royal Borough of Kensington and Chelsea (RBKC) is one of the most densely populated local authority areas in the United Kingdom. RBKC, is situated in central London with area - 1,215 hectares, and is responsible for delivering a wide range of services to the Borough's residents including the overall goal to improve the quality of life in the Borough with residential population of 158,000. From a demographic perspective, more than one-fifth of all households have a first language that is not English and 48% were born in the UK. 53% of the residents have a level four qualification and nearly three-quarters of employed residents work in senior occupations. However, two wards are part of the most deprived areas in the country. There are 20,000 businesses with 10% of all businesses being home based. The overall economy is characterised by the number of small and unique businesses, with only 2% employing more than 50 employees. RBKC has third highest proportion of privately rented households, after Westminster City Council (WCC) and City London. The Royal Borough has a very large proportion of flats nearly 86%. There are over 18,000 rented social homes in the RBKC, which equates to about a quarter of all properties. In addition, 70% of the borough is defined as conservation areas and there are over 4,000 listed buildings

which make it difficult to take innovative planning actions such as installation of solar panels, building retrofitting, etc.

Figure 1: The Royal Borough of Kensington and Chelsea (RBKC)

RBKC is interested in increasingly engaging citizens in the planning processes of the city. In this regard they have adopted several approaches in the past including engaging primary school kids in the early planning process. However, these initiatives have not had much success. On the one hand RBKC has some of the richest citizens in the country and on the other hand they also have some of the poorest. Due to this disparity engaging citizens effectively is a major issue. Wealthy citizens are technically capable and have access to technologies such as smart phones. However, they usually lack the time to get involved in community planning proposals. Moreover, RBKC currently employs conventional methods to inform citizens about new planning applications in their area, partly due to financial reasons. Current methods include newspaper ads and flyers and notices posted around the local area. These methods are not very effective in creating awareness among the citizens about new planning proposals and many go unnoticed. Another problem is that citizens regularly fail to understand exactly what issues the council has control over and what issues it doesn't. Therefore, the feedback is often not useful. Lastly, the planning proposals under consultation are often very complex and difficult to understand for lay people. This also reduces the usefulness of the feedback received.

In light of the above challenges smarticipate can contribute to the RBKC planning processes in several ways:

1. By enabling pre-consultation; allowing citizens to contribute to planning applications

at an early stage, even before they are submitted to the council.
2. Helping citizens to understand the implications of the planning applications through 3D visualisation. Citizens can visually see the projected impacts of a particular planning application and make informed decisions about it. This would improve the quality of the feedback received by the council.
3. By notifying citizens of planning applications in their vicinity automatically. Citizens can receive notifications via a mobile app and also explore the proposal as well as leave feedback.
4. By facilitating communication between the council and citizens/developers.
5. By enabling the council to efficiently acquire an overview of citizen sentiment regarding a specific proposal based on statistical reports generated by smarticipate.

In order to understand how smarticipate can achieve the aforementioned and how it fits into the RBKC planning processes, it is necessary to get an overview of said processes.

4.1.1 RBKC Planning Processes

RBKC has three different types of planning processes that involve input from citizens: a) planning applications, b) planning policy and c) neighbourhood planning[1]. Out of these only planning applications and neighbourhood planning are considered here since they afford possibilities for smarticipate to contribute.

4.1.1.1 Planning Application Process

The process of dealing with planning applications is called Development Management in RBKC. The Council's Development Management service handled over 7,000 applications and related pieces of work in 2012 and since then it has only increased. Planning applications are the most common form of application that the Council handles. But planning permission is not always needed. Some changes are not 'development' and fall outside of the scope of planning, such as painting a house that is not in a conservation area. Other changes benefit from 'permitted development'. These are changes that the Government believes will not be harmful, or that it wishes to encourage as it sees them as beneficial. For example, a garden wall or fence can normally be erected between back gardens up to 2m high without the need for permission. Small extensions can also be built.

The Government sets a time period within which planning applications must be decided. For most applications this is 8 weeks, and the Government target is that 80% should be made within that time. Major applications have a 13-week target. Other types of applications have different timescales. In addition to planning applications there are other types of applications. Applications relating to advertisements and listed buildings are dealt with under a different legal and regulatory framework to standard planning applications. Applications relating to trees and telecommunications use an approach called 'prior approvals'. For these applications the Council can only consider and only control the issues specified in the relevant regulations. This is a form of application that is becoming more common. It means that if the Council does not make a decision within a fixed time frame, the work can be carried out in any event.

[1] Involving People in Planning. Available online: https://www.rbkc.gov.uk/planning-and-building-control/planning-policy/involving-people-planning-ipip

Although there may be different types of application, they all follow the same basic process. There are four main stages:

i) Pre-application
ii) Application
iii) Decision
iv) Implementation

Within these four stages, different applications have different statutory requirements over consultation. Taking these variations into account, the Council has identified six opportunities for engagement in the application process. These are shown in Figure 2 and discussed subsequently.

Pre-application

This is the stage before a planning application is submitted, when the applicant is drawing up their proposal. There is no requirement for the applicant to consult neighbours or other parties who may be affected at this stage. However, the Council advises applicants to have early discussions with neighbours and other interested people because it is easier to accommodate their views before a scheme is finalised. Comments made at this stage may well avoid objections being received when the application is submitted: people do not like to be invited to comment when it seems that the decisions have already been made. smarticipate can facilitate this stage by allowing proponents of development proposals to consult the community without involving the council. The system can also notify interested and/or affected parties automatically of the planning application so as to make them aware. Being invited to be involved at this stage does not rule out the opportunity to comment again once a planning application is submitted. The comments received at this stage can be submitted to the council as part of the planning application.

Application

This is the stage when an application is submitted to the Council. At this stage it is the responsibility of the Council to ensure people have an opportunity to comment (sometimes called notification), and to take any comments received into account in assessing the application. Citizens can also get involved at this stage by submitting their comments as the council is legally required to advertise planning proposals for at least 21 days and invite participation. smarticipate can also help in these regards. Matters to consider should include:

1) effect on daylight or privacy
2) the effect on the character of the area;
3) effect on trees or open spaces;
4) flood risk;
5) noise and disturbance (whether from people using the building or from permanently installed machinery); air pollution or smells (such as from a restaurant); traffic or road safety problems.

Decision

This is the stage when an application is decided: when it is granted permission, or when permission is refused.

Implementation

This stage is when work is close to, or is starting on site.

4.1.1.2 Neighbourhood Development Planning Process

The other planning process in RBKC that is relevant to smarticipate is the neighbourhood development planning process. A Neighbourhood Plan is produced by local people, not the Council. This gives people the opportunity to deal with planning issues local to their areas that may not be a priority for the Council. A Neighbourhood Plan has the same status as the Council's Local Plan. It therefore has to go through a rigorous process, and can only address planning issues. Just as the Council is required to consult people when preparing its plans, the same is true of Neighbourhood Plans, so that they reflect the views of the whole community. The process for preparing a Neighbourhood Plan goes through four stages, shown in Figure 3:

1. Set up,
2. Preparing the plan,
3. Examination and
4. Referendum.

Set up

In order to prepare a Neighbourhood Plan, local people need to set up a Neighbourhood Forum, and propose the boundaries of a Neighbourhood Area. smarticipate can help mobilise a neighbourhood so that they may organise in support of a particular plan. A citizen can develop a proposed plan. The system could notify other citizens in the neighbourhood of the proposed plan, thus allowing them to collaborate in developing the plan further as well as getting together to form a Neighbourhood Forum. smarticipate can also help define the boundaries of a Neighbourhood Area.

Preparing the Plan

The Neighbourhood Forum is responsible for preparing the plan, and gathering any evidence that is needed to justify the policies of the plan. Again smarticipate can help here by allowing citizens to collaborate on the development of a neighbourhood plan.

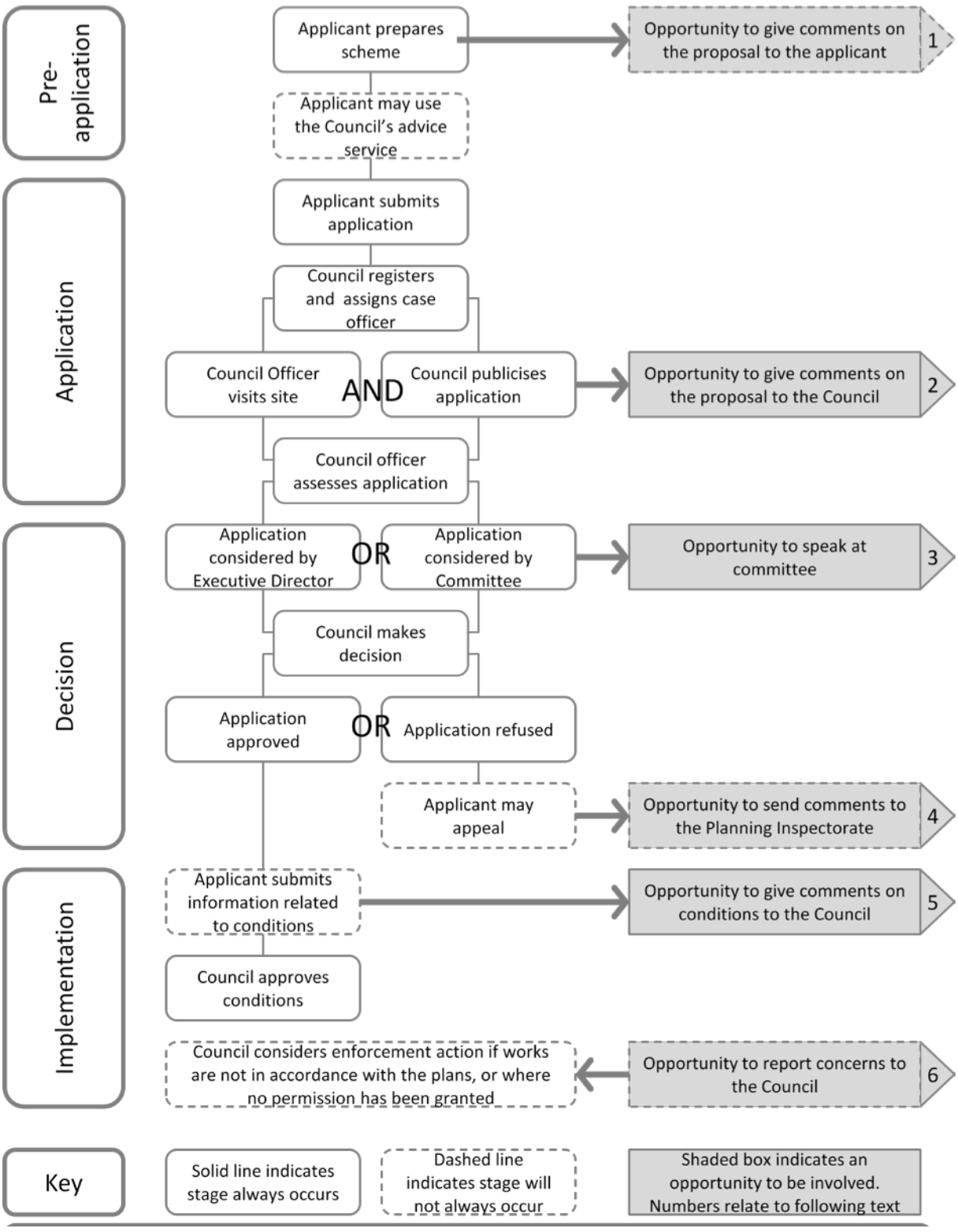


Figure 2: Opportunities to engage citizens in the RBKC planning application process [9]

Examination

Before the examination can take place, the Forum must submit the plan to the Council, and the Council must make it available for public comment for six weeks. Once again this presents an opportunity for smarticipate to support citizen participation by exploring the publicly available 3D visualisations of the plans and leaving their feedback. Citizens may also suggest modifications to the plan.

Referendum

Unlike plans that the Council prepares, a Neighbourhood Plan has to be approved in a referendum before the Council can adopt it as policy. Those people on the electoral roll living in the Area will be able to vote, just like an election. The electoral role contains a list of all the people who are registered to vote in a particular area. However, with the availability of smarticipate, a referendum might not be necessary as people could indicate their support for the plan by voting on the proposal through the smarticipate system.

4.1.1.3 Assets of Community Value (ACVs)

Another process that is relevant and where smarticipate can contribute effectively is the process of nominating ACVs. An ACV is usually a building or a piece of land which furthers the cultural, social or leisure interests of the local community. Any eligible voluntary or community organisation can make a nomination. If the nomination is accepted and the asset has been declared an ACV, and the owner decides to sell the asset the community group is notified and given time to raise funds to buy the asset. If the community group expresses an interest in buying the asset, a moratorium on sales is placed for six months, during which time the community group may raise the necessary funds. This remains the case until the asset is on the ACV Register, which is usually for five years.

smarticipate can contribute to the identification and nomination of ACVs by allowing citizens to mark an asset as an ACV in a 3D model. This could trigger notifications to all those who may be affected by this, allowing them to vote for or against the nomination. In this manner smarticipate can help to mobilise the community in order to nominate an asset an ACV. Moreover, citizens can leave their comments providing justification for the nomination. In this aspect smarticipate would contribute to facilitating communication among the citizens, and in turn between the citizens and the council.

4.1.2 Urban Stories

A three-day requirements development workshop was organised in RBKC on 22 March, 2016. Approximately 10 attendees participated, representing the various partners in smarticipate. The workshop was also attended by representatives of various departments of the RBKC municipality who presented about the work their respective departments were doing. This helped us identify opportunities for smarticipate to contribute and also to clarify any questions we had. As a result of this workshop two urban stories were identified in RBKC, described subsequently.

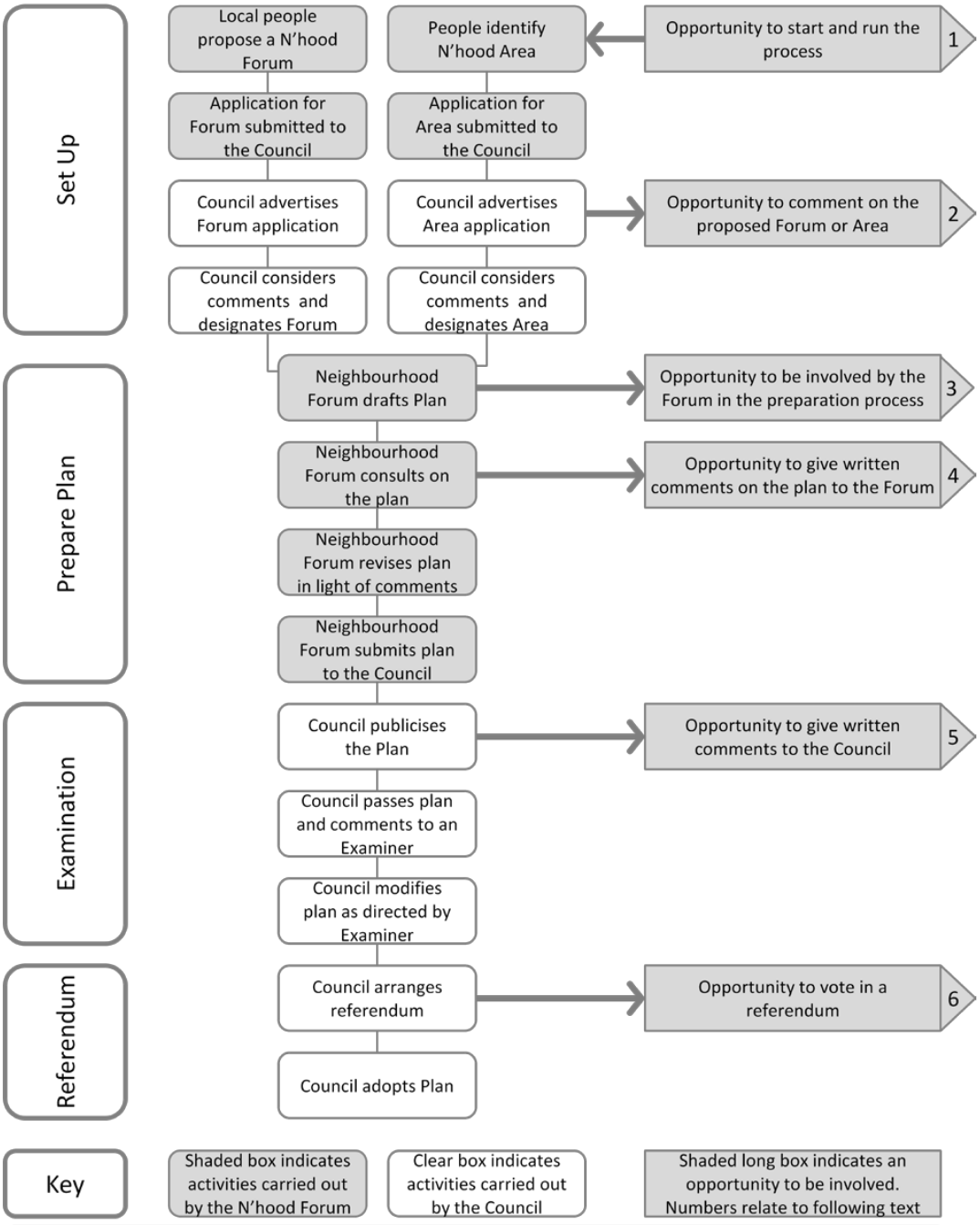


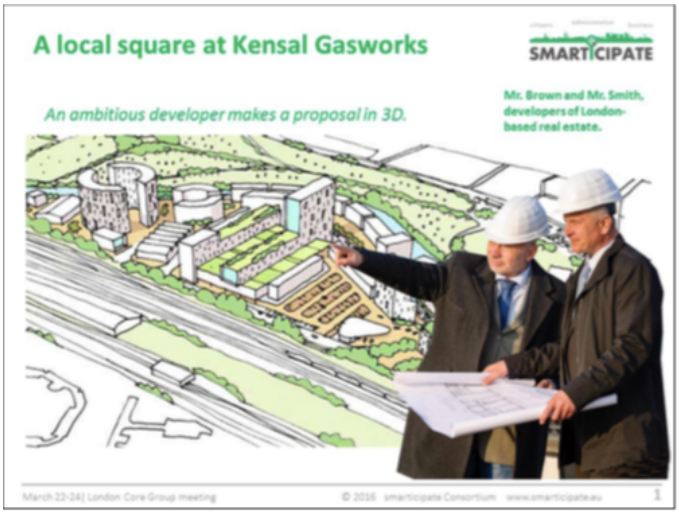
Figure 3: Neighbourhood Development Planning Process [9]

4.1.2.1 Urban Story 1: Planning Applications

An ambitious developer makes a 3D proposal for a brownfield location in the northern part of the borough. This proposal is disseminated via smarticipate using RBKC's postal code notification system for planning applications. Neighbourhood residents receive the message and come into action. They use the design feature of smarticipate to produce alternative proposals. The system provides automatic feedback that they use to improve their proposal. This even includes a check to ensure that their proposed building shape is affordable to construct. Their ideas are published via the postal code notification system, through which subscribers can see the new proposals alongside the developer's original proposal. The borough and the developer - who are also part of the mailing list - invite residents to a face-to-face workshop where the developer's architect presents a compromise. The revised design is republished and continues through the planning application procedure.

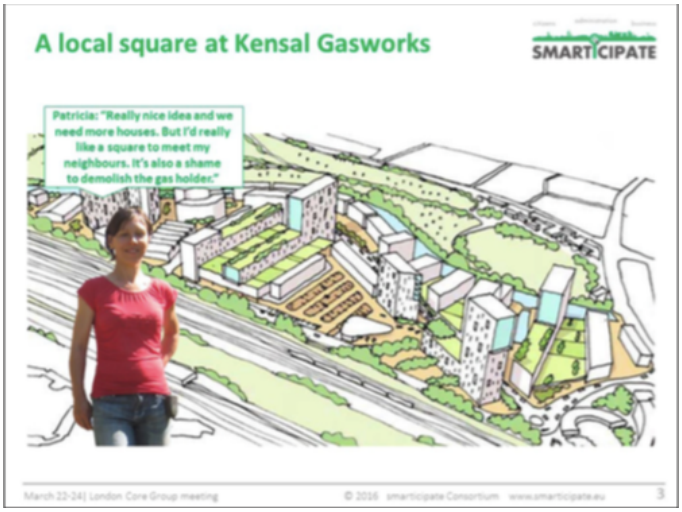
Scene 1

An ambitious developer makes a 3D design proposal and uploads it in the 3D model of the borough.



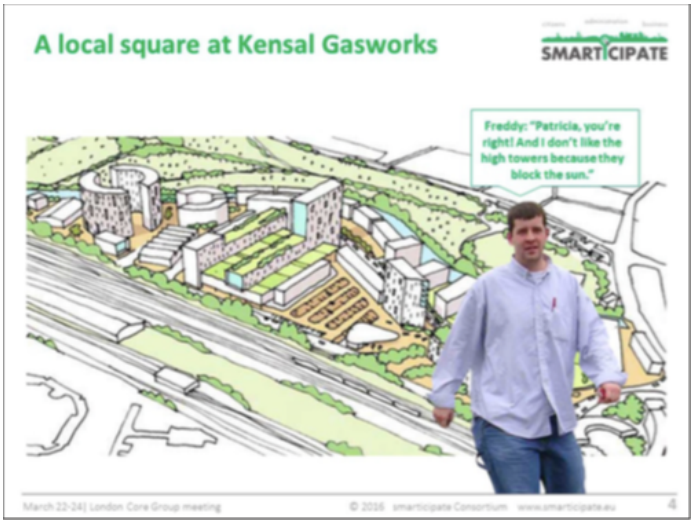
Scene 2

The proposal is circulated via smarticipate using RBKC's postal code notification system for planning applications. Residents within 500 meters of the site receive a message.



Scene 3

Patricia, a resident living nearby, receives the message. She likes the proposal because the area needs more housing. But she'd really like a community square where she can meet her neighbours. She also disagrees with the proposed demolition of the gas holder.



Scene 4

Patrica forwards the proposal to her friend Freddy, as she wants to know his opinion. He supports her and sees immediately that the high towers cast too much shadow.

Scene 5

Freddy discovers the design feature of smarticipate. It enables him to add a 100x100 meter public square to the 3D model, to maintain the gas holder as an asset of community value and to reduce the housing by 50%.

Scene 6

He receives automatic feedback on his proposal. The addition of green space and the retention of the industrial monument are the goals of the borough. But his proposal to reduce the number of houses from 1.000 to 500 and to transform them from market rate housing to social rent, conflicts with the starting point of the borough for the development.

Scene 7

Freddy shows Patricia the feedback of the Smarticipator. She sees the chance to add extra houses in the gas holder and a smaller square that isn't so reminiscent of Moscow. Freddy adds this to this to the volume and cost calculator, with the result that the proposal is financially reasonable.

Scene 8

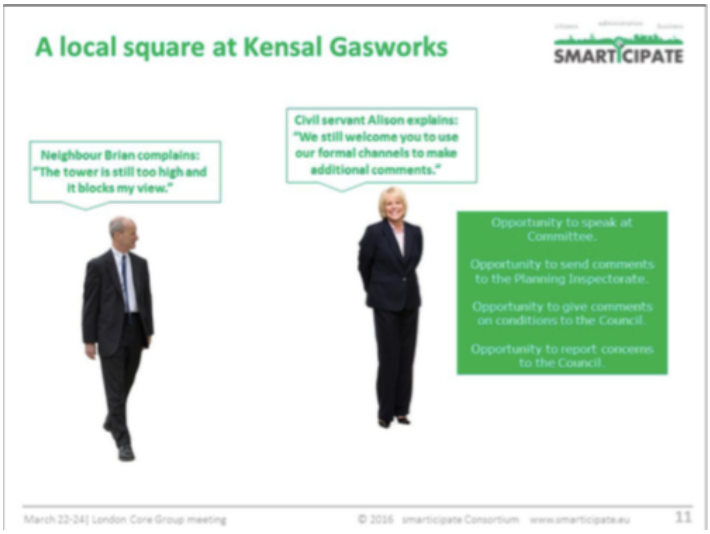
Freddy publishes his idea via the postal code notification system in which subscribers see his proposal alongside the developer's original proposal. Responders respond very enthusiastically.

Scene 9

The borough and the developer see the positive reactions and invite residents for a face-to-face workshop. At the workshop, the developer's architect presents the combination of the two plans and adds an additional idea: a water square inspired by the high ood risk in the neighbourhood. That gives the square an extra value.

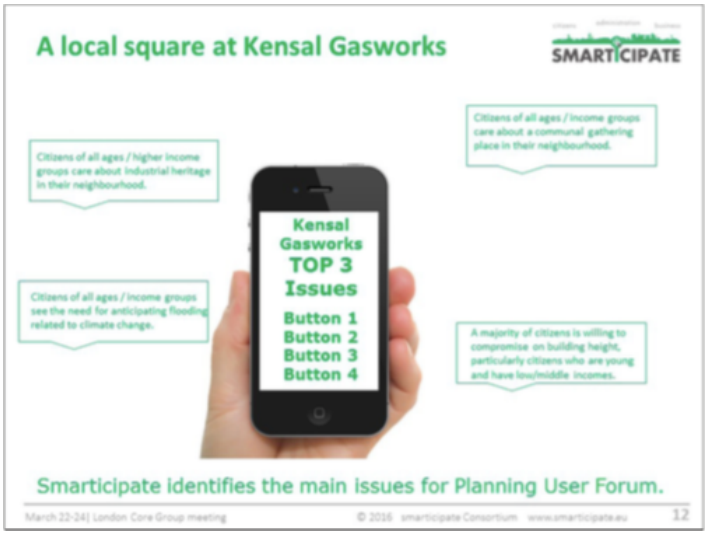
Scene 10

The co-creation version of the proposal is published via the postal code notification system. A lot of reactions come in via social media. The majority are positive.



Scene 11

However a small minority is still against one of the high towers. Brian is one of them. Allison, a civil servant, invites Brian and other concerned residents to use formal channels to communicate their opinions. That information is published via the postal code notification system.



Scene 12

smarticipate identifies issues out of the entire interactive process and plugs them in step 1 of the planning policy (to Ward Councillor and/or the Planning User Forum). This is the crucial link between the Planning Application steps and the Planning Policy steps.

4.1.2.2 Urban Story 2: City Living, Local Life

A group of active citizens have a great idea for their neighbourhood: a football eld. Smarticipate provides automatic feedback by outlining the basics: who is the owner of the site, what are environmental restrictions, etc. Smarticipate provides feedback that it's not possible to develop on the site and proposes alternative locations. It then links with the project veri cation function of the Spacehive crowdfunding platform to conduct a pre-check of the project idea before co-funding begins. There is negative feedback: girls must be included in the sport proposal. The RBKC's postal code noti cation system helps the group reach and activate more residents in order to nd female supporters. After the elaborated project is added to Spacehive and fundraising is successful -including co- nancing from the Borough- construction begins. In addition, Smarticipate identi es main issues from the entire process, and links them to the Planning Policy steps.

Scene 1

Football is life. That's why a group of passionate fathers and sons in this superurbanized part of London founded the Kensington Lions football team. Currently there's hardly any space on the street to play. They therefore come up with an idea to build a football field.

Scene 2

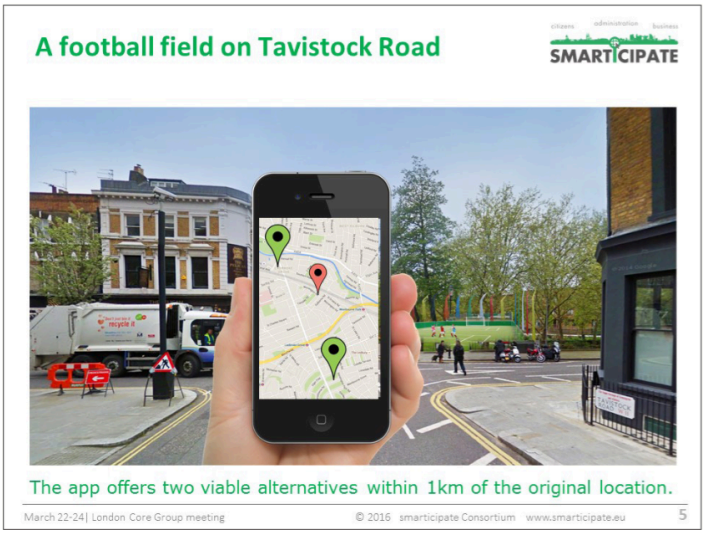
Igor and his son Serge live in front of an abandoned plae where a garage once stood. They both agree that it's a perfect place for the field because a lot of other football-loving fathers and sons live nearby. It's also close to the subway, making it easy for footballers further away to reach it.

Scene 3

Tony's son is not only a talented midfielder but also knows a lot about the latest technology gadgets. He discovers the Smarticipate tool that shows if an idea is possible on a given site. He therefore uploads the football field proposal to the city's 3D model.

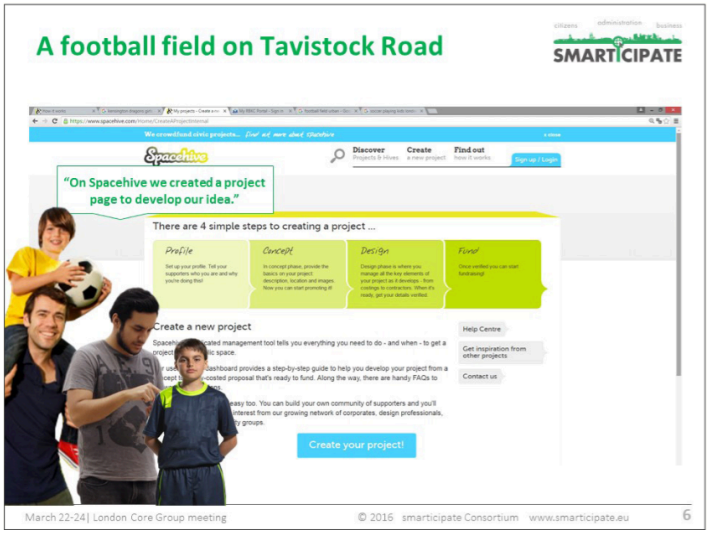
Scene 4

The automatic feedback from Smarticipate is disappointing. Although a sport field is needed in the area and the land is available and owned by the city, the area's air quality is a problem - particularly the high levels of NO2. That means the site isn't suitable for functions like primary education and outdoor sport.



Scene 5

Happily, smarticipate proposes two alternative locations. The group is immediately happy with Travistock Road because their famous pub, where they always gather to wathc Premier League games, is on the other side of the street.



Scene 6

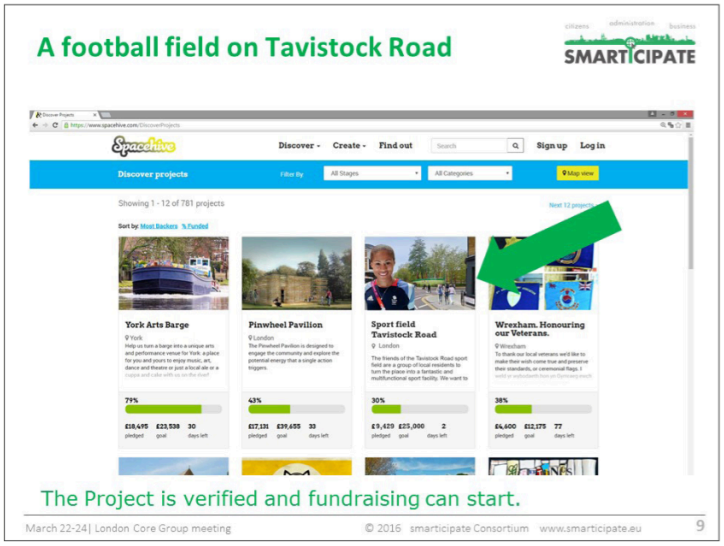
Peter works at a construction company. He uses his software to make a first cost calculation, which totals £50.000. The group then requests this amount from the RBKC. It's too much for the City Living Local Life programme. However the program officers and ward councillors agree to support the idea if the first £25.000 is pledged via Spacehive. The team is very enthusiastic and presents their idea on Spacehive.

Scene 7

The feedback of the verification system of Spacehive is to the point: it's a perfect location, but since when do only men and boys play football? More politically, the group should broaden the group of participants, future users and supporters. Otherwise, they will not be able to access the crowdsourcing platform. nisl libero, tincidunt quis, ornare sodales,

Scene 8

Smarticipate offers the possibility to pitch the idea via the notification tool from My RBKC. The group uses that in combination with Facebook to mobilise women and girls for football. A team of girls from the nearby high school respond that they want to join, in addition to a number of local boys.



Scene 9

The group of football lovers is now very mixed and also much bigger! They submit the initiative to Spacehive, where it is verified so that fundraising can begin on the crowdfunding platform. With the famous football player Rachel Yankey as their ambassador, they hit their funding goal in only 48 hours.

Scene 10

"Get to work!". With the help of the construction company, the entire new team agrees to help construct the football field. They determine to use the money save on construction costs to inveset in new football uniforms and a small tribune with lighting.

Scene 11

Thanks to the co-financing of the Borough the realisation begins and the football field opens with its first game.

Scene 12

Smarticipate identifies issues out of the entire interactive process and plugs them in step 1 of the planning policy (to Ward Councillor and/or the Planning User Forum).

4.1.3 Requirements

Based on the identified urban stories as well as user workshops, a number of functional and non-functional requirements were identified for RBKC, shown in Table 1. The IDs are automatically assigned by Redmine to each requirement. We have used the same IDs here for simplicity and traceability. More details for these requirements can be found in Annex A.

Table 1: Functional and Non-functional Requirements - RBKC

ID	FUNCTIONAL REQUIREMENTS
7	System should be able to calculate and show financial cost of building e.g. higher vs wider
8	As a user the system should allow me to agree or disagree with a proposal
9	User should be able to select whether to publish a development proposal to wider community or not
10	User should be able to select target audience when publishing a development proposal with wider community
11	Council should be able to specify a budget for a specific development proposal
12	Users should be able to specify estimated cost for a proposal as an attribute
13	System should export the 3D model in a standard format such as CityGML for perusal by the council along with relevant statistics
14	System should send mobile notifications to relevant/interested users when a proposal is published
15	System could be able to export the developed 3D models in formats acceptable to 3D printers
21	System should allow users to create 3D models of proposed development plans
22	The system should allow users to import 3D models which are available in standard formats
23	Users should be able to explore (or navigate through) the 3D model
24	System should allow users to define permissions for other users on a proposed 3D model
25	System should provide automated feedback to the user about the constructed 3D model
27	System should perform a planning policy check to verify if the development would be permitted under existing policies and regulations
28	System should calculate estimated cost of a proposal
29	System should allow users to leave feedback on a 3D model
30	System should allow users to share the proposals via social media and to receive comments

31	Users should be able to toggle (or enable) commenting for specific proposals
36	System should allow users to designate a specific site as an Asset of Community Value (ACV)
37	Users should be able to specify specific goals to be achieved by a proposal
33	The system should provide feedback to users about the suitability of a proposed development
26	System should allow users to create development proposals using mobile phones and other media
34	The system should be integrated with crowdfunding initiatives such as SpaceHive
35	The smarticipate app should be available via publicly accessible app stores
ID	**NON-FUNCTIONAL REQUIREMENTS**
18	The system should be intuitive and user-friendly
19	Developers should provide training documentation to learn about the system

4.2 Hamburg

Hamburg is a State in the Federal Republic of Germany, with a population of 1.8 million, making it the second largest city in Germany and seventh largest in Europe. Hamburg covers an area of 755 km², 10% of which belongs to the harbour. The city is divided into 7 boroughs shown in Figure 4**Error! Reference source not found.**.

Figure 4: City of Hamburg

The combination of a history of progressive policies and ambitious climate protection goals led to Hamburg being awarded the title of European Green Capital in 2011. Hamburg is committed to reducing its CO2 emissions by 40% by 2020 and by 80% by the year 2050. CO2 emissions per capita have been reduced by about 15% compared to 1990, with annual

energy savings of some 46,000 MWh, a significant achievement for a metropolitan city with considerable trade and industrial activity.

Urban planning plays a key role. There are major urban redevelopment projects in Hamburg which incorporate climate change actions. These include Europe's largest waterfront re-development, Hafen City, as well as the restructuring of older more disadvantaged parts of the City such as Wilhelmsburg. As a member of EUROCITIES Hamburg shares its experience with European cities and regions and works actively in several forums and workshops. In general Hamburg achieves a major part of its performance from international cooperation, using the best "dos" and trying to avoid the "don'ts". About 55 INTERREG and some 10 FP7-projects with urban development-elements are the basis for permanent improvements.

The city of Hamburg is the main partner in providing open data (geo data, contracts, regulations, official statistics, public plans, results of public measurements and investigations, budgets etc.) in a "transparency portal" since October 2014 as a result of transparency legislation, which was initiated as a law proposal co-drafted by citizens in an online process. Various public data are available on Hamburg's open data platform (http://transparenz.hamburg.de/). Based on this data, Hamburg has already implemented a tool for digital (informal) participation within the city. An off the shelf portal is the base for the generic participation portal. With this portal citizens get the chance to comment and vote on planning processes. Within the smarticipate project this tool will be used, extended and refined. The main aim is to use the potential of open data to increase the number and quality of bottom-up initiatives in order to boost economic growth and reduce the burden of bureaucracy. When citizens and entrepreneurs have equal access to shared data, they can better prepare themselves and make more informed development proposals. That means proposals are more likely to match with governmental intentions, which in turn makes review of proposals more efficient. The generic platform will integrate/interlink various data (open, crowd sourced) and generate informative feedback (real time, enhanced information) for citizen und city administration (for better participatory results to support the decision process). The feedback will be based mainly on public open data provided by the city administration. Part of the piloting should be in which kind also crowd sourced data provided by citizens can be used. A municipal approach for participation processes benefits different target groups as citizens, experts and investors.

4.2.1 Planning Process in Hamburg (and Germany)

In Germany the federal structure with 3 levels is decisive for the system of spatial planning: federal, federal state, and local government. Spatial planning is decentralised. There are two planning instruments for local urban land use planning: **The legally-binding land-use plan** and the **preparatory land-use plan**.

The **preparatory land-use plan** (http://www.hamburg.de/flaechennutzungsplan/) is prepared for the entire municipal territory. It outlines the use to which land is to be put to meet the foreseeable needs of the community in keeping with the spatial planning and development goals of the municipality. This is the plans' particular role in urban development. Its content is regulated in the Federal Building Code.

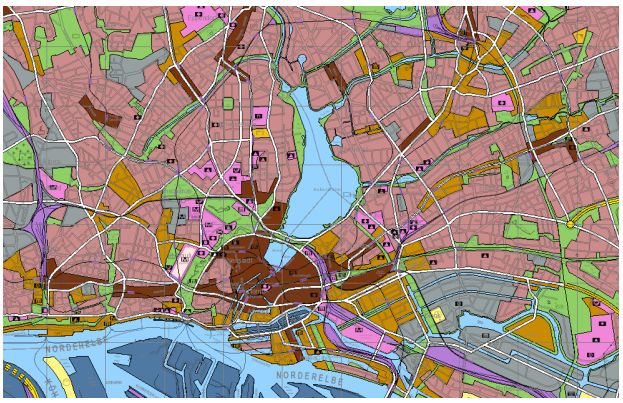


Figure 5: Preparatory land-use plan

There are several possible representations of the Federal Building Code within a preparatory land-use plan, e. g.

1. Areas designated for development in terms of general types of use (e.g. residential, mixed, industrial and commercial, special uses), specific types of use and the general density of built use
2. Areas for transport
3. Areas and facilities for public infrastructure
4. Areas for utilities
5. Areas for green spaces,
6. Agricultural land and woodland
7. Waterbodies, ports and harbours, as well as areas for water management, flood control and drainage
8. Areas for measures for the protection, preservation and development of the natural environment and the landscape

Figure 6: Landscape programme

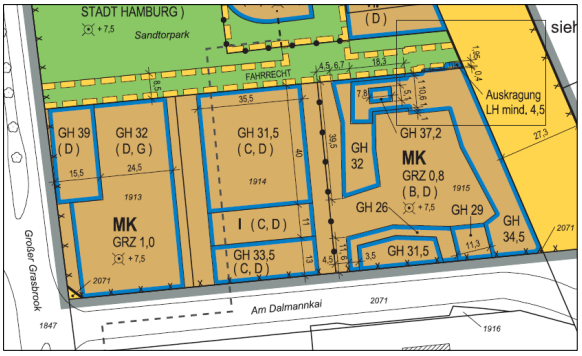


Figure 7: Legally binding land-use plan

151 changes have been made in the preparatory land-use plan since 1997, to correlate new aims of urban planning in Hamburg.

Another preparatory plan to be considered in developing binding land-use plans is the landscape programme and its supplement (species and habitat conservation programme), which are based on the Hamburg Nature Conservation Law (HmbNatSchG). Both are drawn in 1: 20 000.

The **binding land-use plan** (http://www.hamburg.de/bebauungsplaene/) is drawn up for a section of the municipal territory, and consists of a map in 1:1000 and textual regulations. It must be developed on the basis of the preparatory land-use plan. The binding land-use plan sets out the legally binding stipulations for urban structure. On the basis of the Building Code, local authorities can adopt binding land-use plans in the form of bye-laws.

The Federal Building Code provides a catalogue of possible designations for a legally-binding land-use plan. The section refers in particular to

1) Specific category (e.g. small residential estate area, residential-only area, general residential areas, special residential areas, village areas, mixed areas, centre area, commercial areas, industrial areas, special areas) and intensity of built use (e.g. occupancy index, plot coverage rate, floor space index, floor area, cubing ration, building volume)
2) Type of development, lot coverage, and positioning of physical structures
3) The coverage type, plot areas which may or may not to be built on and the location of physical structures
4) Traffic areas and special purpose traffic areas
5) Designations relating to common facilities and public infrastructure
6) Designations on green areas and open space areas and relating to conservation
7) Waterbodies
8) Agricultural and forest areas
9) Planting and care of trees

The city of Hamburg is working on about 20 binding land-use plans per year.

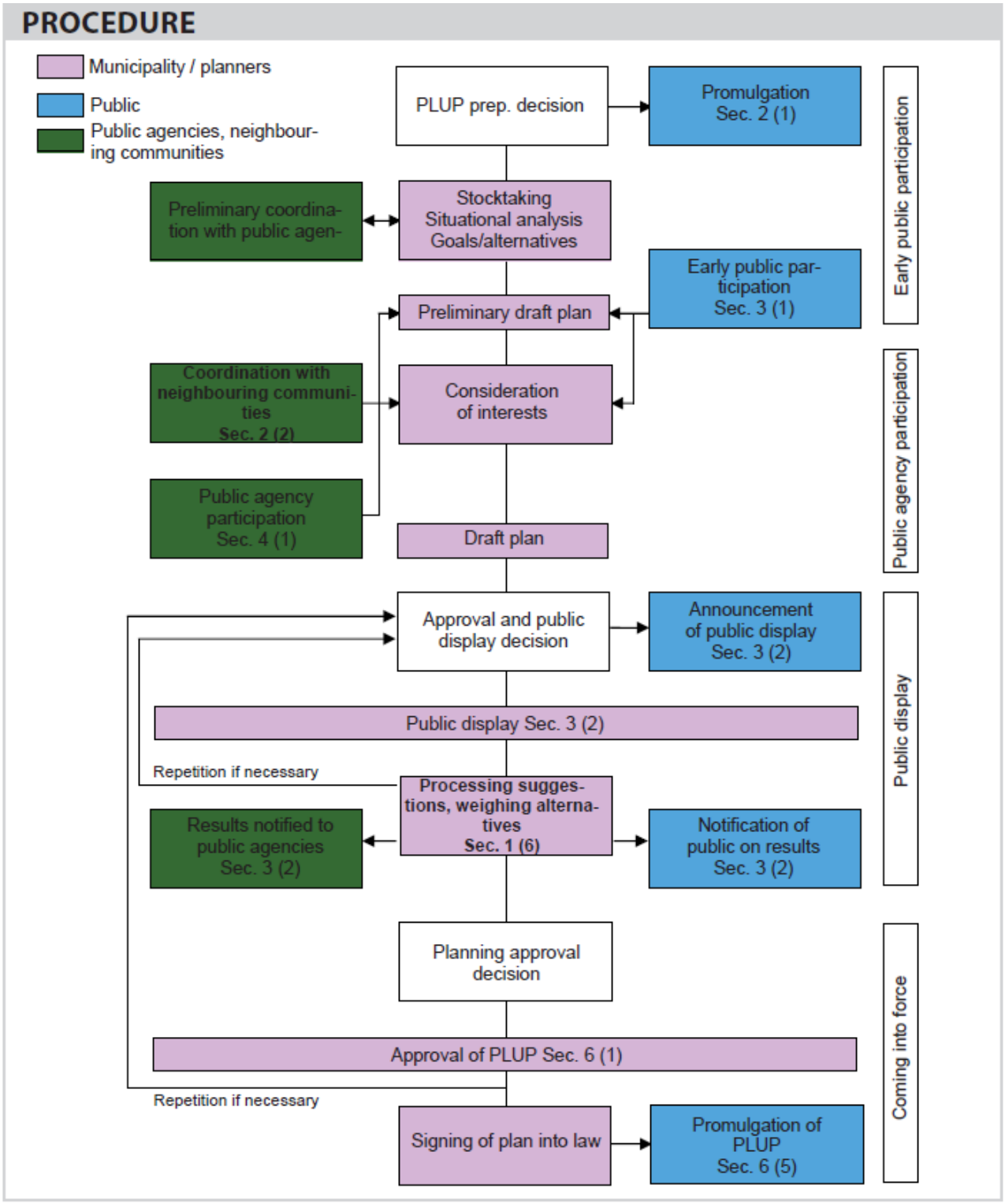


Figure 8: Preparatory land-use plan [11]

Process of Urban Land-Use Planning

Figure 9 shows the regular process of urban land-use planning and will be explained below. The impulse for urban land-use planning processes is given by citizens, investors, project developers, political boards or the administration itself. It has to be considered if the submitted idea can be approved under current policies. If not political boards decide whether to a policy change is required to support the idea.

To deploy a new binding land-use plan and to change, complement or cancel an existing plan the district or the senate has to make a plan preparation decision. This decision will be published in the official bulletin. Citizens will be informed about activities by the Authority of Urban Development and Housing. The plan preparation decision can be accessed in the technical authority within the district. Now the first and **informal** step of **participation** can take part, where interested people will be informed about the draft of the binding land-use plan (possibly also the preparatory land-use plan and the landscape programme) and have the chance to discuss the plans. The process will be documented and the contributions (can) affect the planning process. In exemptions the participation process can be skipped.

Editing the draft will not only consider the contributions of the community but also involve other authorities and public agencies as well as public utility companies, transport companies, chamber of commerce, chamber of crafts etc., which have to take a stand.

After investigating and examining the draft the district assembly or the planning committee have to agree and enact the public review process. This **formal participation** process according to § 3 (2) BauGB will be published again in the official bulletin. For one month citizens have the chance to refer to the draft of the binding land use plan. The statements and its consequences will be reviewed. If they cause fundamental changes the formal participation process has to be repeated. If they cause no or minor changes of the draft persons concerned by the planning action will be involved in a next participation step and have the chance for statements. These will be checked again by the district assembly or the planning committee and finally consulted publicly. Those who made a statement will be informed about the result of the examination, which cannot be defended. Now the Authority of Urban Development and Housing approves the binding land-use plan which finally has to be determined by the Head of the District Office and to be announced in the Hamburg law and edict gazette. Former binding land-use plan will be canceled with the determination of new plans.

The Federal Act on spatial planning (federal state/state/regional planning) and the Building Code (municipal level, in Hamburg HBauO) defines formal public participation exactly. For smarticipate Hamburg's planning scenarios will be tested in the field of informal participation.

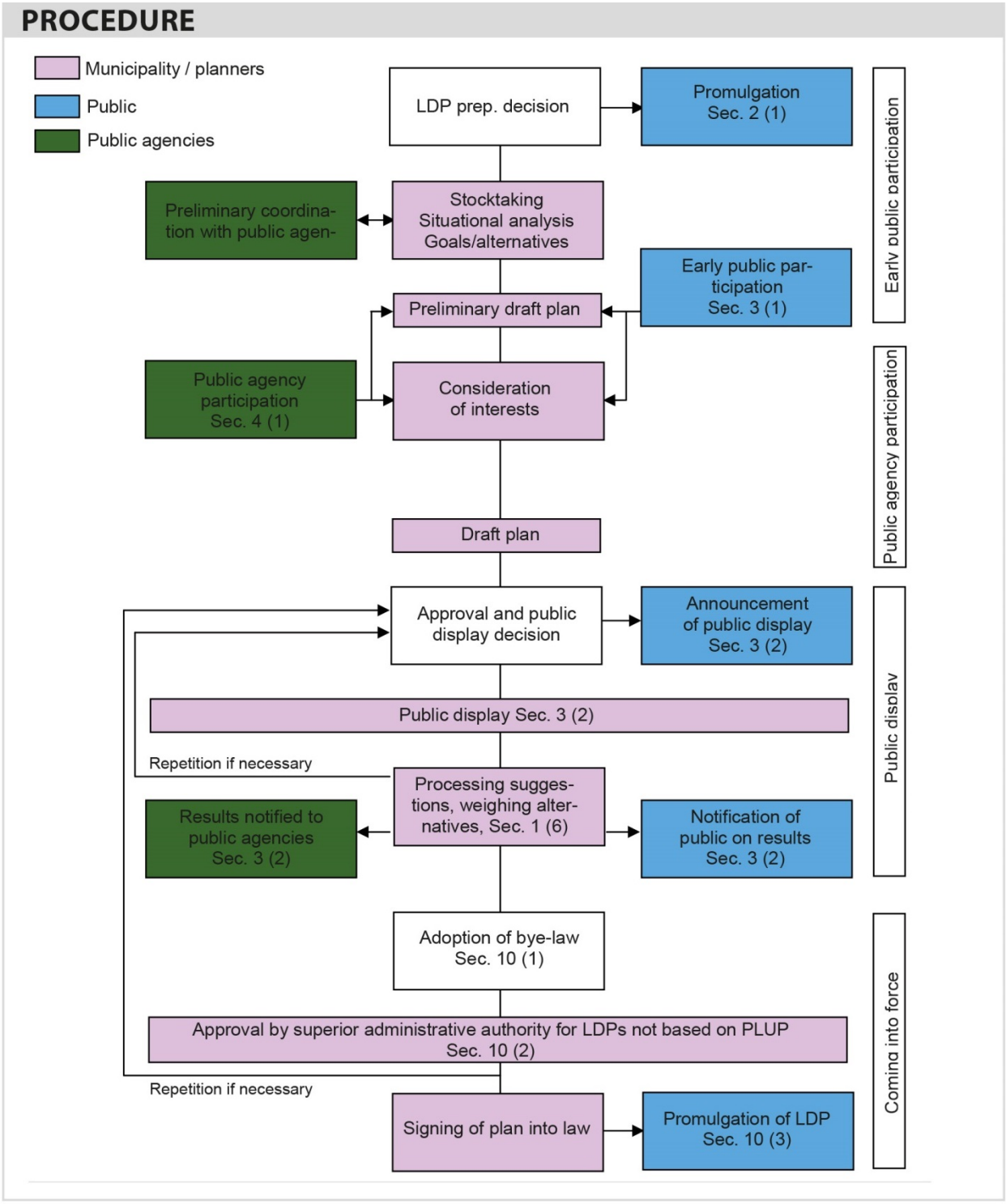


Figure 9: Binding land-use plan [11]

4.2.2 Urban Stories

As with RBKC, a three-day workshop was also organised in Hamburg and a similar agenda was followed. Approximately 10 people attended with representatives of various departments in the Hamburg municipality presenting about their respective departments. Based on these workshops the following two urban stories were identified for Hamburg.

4.2.2.1 Urban Story 1: Binding Land Use Planning

Scene 1

The City of Hamburg makes a preliminary draft plan for the Holsten area and uploads it in the municipality's 3D model.

Scene 2

The proposal is circulated via smarticipate using the Mein HamburgService postal code notification system. Residents within Altona-Nord und Altstadt receive an automated message.

Scene 3

Kristin, a resident living nearby, receives the message. She likes the proposal because the area needs more housing. Although there's a train station nearby, she's afraid there will be too much extra car traffic. In addition, she would really like to have a cultural square for the surrounding neighbourhoods.

Scene 4

Kristin forwards the proposal to her friend Christoph, as she wants to know his opinion. He supports her. He is also worried about the CO2 footprint of the new development as there are already too many cars in the surrounding neighbourhood.

Scene 5

Christoph discovers the design feature of smarticipate. With a traffic simulation, he can see the impact the development will have on neighbourhood streets. Based on this, he moves the cultural square to the historic factory chimney and uses the tree planting tool with CO2 meter to make it totally green.

Scene 6

He receives automatic feedback on his proposal. The cultural square fits the goals of the municipality to maintain the cultural heritage of the site. The idea of reducing CO2 with trees is also good, but he receives negative feedback: this has made the site completely inaccessible for cars.

Scene 7

Christoph shows Kristin the feedback from the smarticipator. Kristin sees a chance to add a public parking facility with a range of services like car-sharing, electric car charging points and bicycle parking. They locate this next to the main road, so that cars can easily enter and exit the neigbourhood. The updated plan now receives a positive score.

Scene 8

Christoph publishes their idea with the cultural square, the green urban space and the sustainable parking garage via the postal code notification system. Subscribers can see his proposal alongside the municipality's original proposal. Residents respond very enthusiastically.

Scene 9

There is a lot of enthusiasm for Kristin and Christoph's ideas, and the city invites residents to a workshop. At the workshop, the urban planner of the municipality presents an additional idea: the parking garage is enlarged by 20% to make it possible to increase green on the surrounding streets.

Scene 10

The co-creation version of the proposal is published via the postal code notification system. A lot of reactions come in via social media. The majority are positive.

Scene 11

However a small minority is still against the preliminary draft plan. Jürgen is one of them. Ulrike, a civil servant, invites Jürgen and other concerned residents to use formal channels to communicate their opinions. That information is published via the postal code notification system.

Scene 12

smarticipate identifies issues out of the entire interactive process and plugs them into the planning policy. This is the crucial link between the binding land use Planning steps and the Planning Policy steps.

4.2.2.2 Urban Story 2: New Trees for a CO_2 Neutral Hamburg

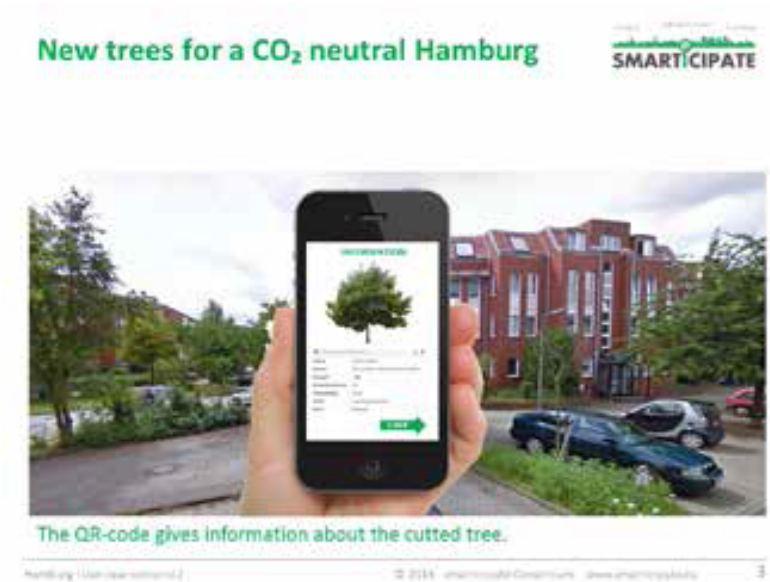
When a public tree is cut in Hamburg, citizens are informed via the tree cadastre followed by a link to smarticipate. They can use the planning feature to simulate the planting of a new tree on the location of the cut tree. smarticipate provides automatic feedback that it is not possible to plant a big tree on this spot and it proposes alternative locations. It also provides information about estimated CO2 reduction and the costs. Citizens can add their choice to the priority list for planting public trees. They can accelerate the process and move up the priority list by mapping privately-owned trees and adding them to the tree cadastre. Because not all citizens have a garden, they can use social media to contact other citizens and ask for their support. The initiator and their supporters are invited by the municipality to join in the tree planting. smarticipate identifies main issues from the entire interactive process and plugs them into the city's ambition for a CO2 neutral Hamburg.

Scene 1

Helen Müller loves to live in Hamburg Bergedorf because of its urban green environment. As she doesn't have a private garden, the public green areas mean everything to her.

Scene 2

One day after work Helen comes home. The tree in front of her house has been cut. She is angry about it. Next to the little stump she finds a sign from the municipality with a QR-code, which she scans with her smartphone. It links her directly to the tree cadastre.



Scene 3

The cadastre gives information about the cut tree: species, year of planting, trunk diameter and crown size. It also explains why the tree was removed: it was ill due to mildew.

Scene 4

Helen wants to have a new tree. She uses the link to smarticipate, which enables her to simulate alternatives. The feature shows different types of trees and the estimated CO2 reduction. Helen chooses a chestnut tree.

Scene 5

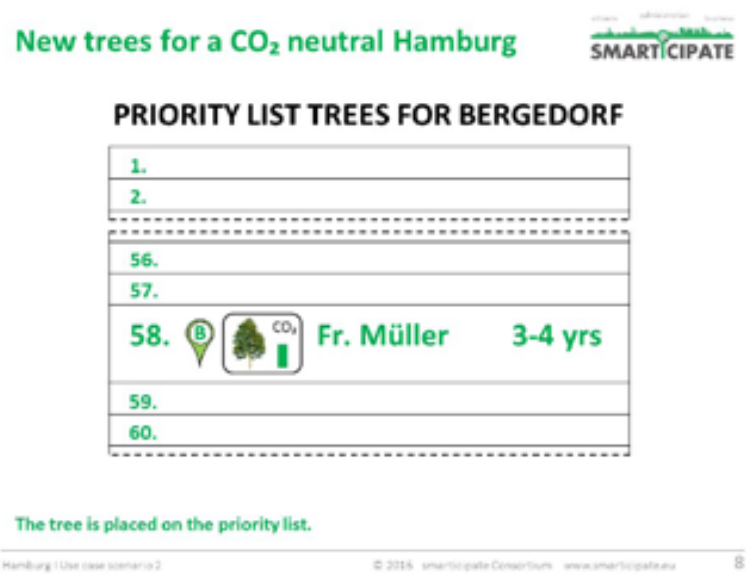
She receives automatic feedback. The chestnut tree is not a good choice because the expected growth of neighboring trees and the high groundwater levels mean the tree will have a short life span. smarticipate gives the option to plant a small tree that can thrive in such an environment.

Scene 6

Helen is not happy with a small tree because of its low contribution to CO2 reduction. Happily, smarticipate proposes two alternative locations based on property and environmental conditions. Location A is at a public park behind the Gretel Bergmann school and location B is next to the Nördlicher Bahngraben. Both locations support the urban green structure of Hamburg.

Scene 7

Helen likes option A because she is a teacher at the Gretel Bergmann school. She chooses this option and smarticipate tells her this tree will cost €8.000,-. She is startled. It makes her curious about the costs for location B and she clicks to get the additional information. This location only costs €4.000,- because the soil is ready for planting.

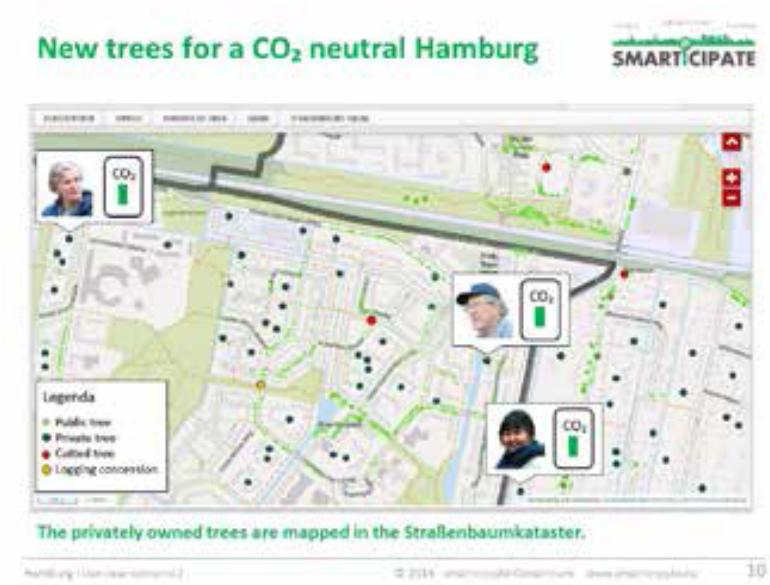


Scene 8

Helen decides to go for location B, because she thinks it's important that Bergedorf's tree budget is used to plant as many trees as possible. She confirms, makes the application and automatically receives feedback. The tree is number 58 on the Bergedorf Tree Priority List. The estimation is that it will take 3-4 years until her tree is planted.

Scene 9

Helen is disappointed because she wants to go faster. This is possible if she participates in the inventarisation of private trees. For every private parcel that is mapped, she will move up one position in the priority list. Because she doesn't have a garden (only a balcony), she uses Facebook to reach out for help within her social network.



Scene 10

Three people respond to Helen's request: a friend, an old colleague and her sister-in-law. They upload their trees in the cadastre, including information about species, year of planting, trunk diameter and crown size.

Scene 11

Within two months Helen moves from position 58 into the TOP 10. That means her tree will be planted during the next round, in autumn. The municipality of Bergedorf invites Helen and her supporters to join on planting day.

Scene 12

smarticipate identifies issues from the entire interactive process and plugs them into the city's ambition for a CO2 neutral Hamburg.

4.2.3 Requirements

As for RBKC, a number of functional and non-functional requirements were identified for Hamburg based on the urban stories as well as user workshops, shown in Table 2. The IDs are automatically assigned by Redmine to each requirement. We have used the same IDs here for simplicity and traceability. More details for these requirements can be found in Annex A.

Table 2: Functional and Non-functional Requirements - Hamburg

ID	FUNCTIONAL REQUIREMENTS
8	As a user the system should allow me to agree or disagree with a proposal
9	User should be able to select whether to publish a development proposal to wider community or not
10	User should be able to select target audience when publishing a development proposal with wider community
11	Council should be able to specify a budget for a specific development proposal
13	System should export the 3D model in a standard format such as CityGML for perusal by the council along with relevant statistics
14	System should send mobile notifications to relevant/interested users when a proposal is published
21	System should allow users to create 3D models of proposed development plans

22	The system should allow users to import 3D models which are available in standard formats
23	Users should be able to explore (or navigate through) the 3D model
24	System should allow users to define permissions for other users on a proposed 3D model
25	System should provide automated feedback to the user about the constructed 3D model
27	System should perform a planning policy check to verify if the development would be permitted under existing policies and regulations
28	System should calculate estimated cost of a proposal
29	System should allow users to leave feedback on a 3D model
30	System should allow users to share the proposals via social media and to receive comments
31	Users should be able to toggle (or enable) commenting for specific proposals
33	The system should provide feedback to users about the suitability of a proposed development
37	Users should be able to specify specific goals to be achieved by a proposal
48	System should be able to track the complete planning process
26	System should allow users to create development proposals using mobile phones and other media
40	The system should link with the Mein Baum - Meine Stadt programme
42	The system should be accessible from multiple platforms
ID	**NON-FUNCTIONAL REQUIREMENTS**
18	The system should be intuitive and user-friendly
19	Developers should provide training documentation to learn about the system

4.3 Rome

The Local Authority of Rome, one of the largest municipal territories of the EU (1'285 km²), has 3.5 million inhabitants and is the largest agricultural municipality of the EU.

The metropolitan area has a population of 4,331,856-density of 807.69 inh./km² (city population 2,889,305-density 2,244.37 inh./km²). The large dimension of the City connected to the low density results in a very fragmented urban tissue which faces great connectivity challenges, both in social and mobility terms.

The value added per capita in Rome is in 5th place with €30,592.2, after Milan, Bolzano, Bologna and Trieste, against a national average of €23,333.4[2]. The services sector represents 87.6% of the total value added of the metropolitan area, against 12% in industry (the Italian average is 73.8% in services sector and 24% in industry)[3]. The 2013 unemployment rate

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equals to 11.4% against 12.2% on average in Italy [4].

The Metropolitan City of Rome is in the process of transferring the local governance to the districts and this project will act as the proof of concept. According to the current general policy of the city, the priorities are focused on urban districts, citizen engagement, Open data and promotion of transparency in the administration of social services and public works. These priorities are also shared by smarticipate.

This project will lay the foundation for the development of future metropolitan municipalities in the framework of the new **Metropolitan City,** through the transfer of competences from the City to the Municipalities**.** The City and the citizens have developed the **Charter of Values** in 2014, following the **Urban Municipalities Conferences** held in the 15 Municipalities of Rome, giving priority to sustainable mobility, ICT-enabled social services and heritage.

The area of the Ex Caserma Ulivelli-Forte Trionfale is located within the District XIV of Rome, with a residential population of 17,224 in 2015 (approx 9% of the District's total population of 190,513). Over the past five years, the population growth (+ 0.1%) was lower than that of the District (+ 2.3%). Population density remains high: more than twice the City's average: 5,157 inhabitants/sq km against 1,451 inhabitants/sq km of the District and 2,200 of the City. The age distribution of the District's population shows a similar structure to the City's average, with 21.2% of the total population over 65 years of age that can be compared with the 21.8% in the City.[5]

District XIV covers over 131.3 sq km; the green areas cover a total of over 918,000 sq m: equipped District green areas (283,200 sq m, accounting for 30% of the total), the great urban parks (570,000 sq m, accounting for 62.1%), green areas for schools (over 65,000 sq m, approximately 7%) and green archaeological areas (100,000 sq m). The two Regional Parks of Pineto and Valle Aurelia are, in fact, located in the District's territory, as well as the archaeological area of Cisterna.[6] The health facitilies falling into the District's territory are the University Hospital Agostino Gemelli, the San Filippo Neri Hospital, the "Cristo Re" Hospital and the pavilions of the former provincial mental hospital Santa Maria della Pietà, most of which are used for health assistance, psychiatric residential facilities and hospital residential facilities. In addition, there are eight Senior citizens' homes welcoming approximately 17% of the District's citizens over 65 (the City's average number of elderly residing in senior citizens' homes is 15%) and 21 kindergartens able to meet 16% of the requests in the District for the care of children under 3 (approximately 21% of requests are met in Rome).

Approximately 4,000 local businesses are present in the District. Moreover, there are also 682 craft workshops, 285 hairdressers and beauticians, 50 newsstands, 166 activities in the category of arcades, video games, car rental with or without driver, garages, distribution and management of automatic machines, and approximately 62 activities in the category of

4 ISTAT

5 Fonte: Open data Roma Capitale-Archivio Anagrafico, 2015

6 Fonte: Open data Roma Capitale - Dipartimento tutela ambientale e del verde - Protezione civile - Unità di direzione Servizio Catasto del verde, 2013

internet points and phone centres.[7]

4.3.1 Rome Planning Processes

Rome is characterized by the high number of citizens' associations present throughout its territory that are actively engaged in terms of socio-cultural-educational activities as well as planning development initiatives within their communities.

It is through smarticipate that the City can stimulate and encourage the participation of single citizens as the project aims to enhance participation by engaging those who may not usually comment on proposals. So by reaching a more representative selection of residents, it should have a positive impact on equality. The Rome planning processes are described using the developed urban stories as examples.

4.3.2 Urban Stories

Through smarticipate the City will put in place two different modalities of citizens' participation in planning processes: the first urban story (Urban Story 1) will show the possibility of citizens to express their views/suggestions/objections on a drafted preliminary plan by the City for the recovery of an historical site; Urban Story 2 shows the "bottom-up" approach for the planning of urban gardens in green public areas of the City.

4.3.2.1 Urban Story 1 – Recovery planning (Ex Caserma Ulivelli-Forte Trionfale) - "co-creation: city, community and investor"

The City of Rome makes a preliminary draft plan for a historical site in the inner city. The proposal is disseminated via Smarticipate using the City of Rome's online portal. Neighbourhood residents receive the message and come into action by answering specific questions about the future programming. They use the design feature of Smarticipate to try out different options. The system provides automatic feedback that they use to improve their proposal. This includes a simulation that shows the consequences of adding social programme on the amount of required commercial programmme. After ideas are published via a notification system and receive the minimum required number of followers, foreign investors/developers are also to view the proposal. Residents can then use Smarticipate to fine-tune and improve their proposal. Finally, they can participate in a Tender at the invitation of the municipality. During this process, a public meeting is held in which the public also has a vote. The winning plan continues through the planning process. In addition, Smarticipate identifies main issues from the entire process and links them to the planning policy steps. This includes the tender process for finding interested and appropriate developers.

7 Fonte: Open data Roma Capitale - Dipartimento Sviluppo Economico e Attività Produttive - Formazione Lavoro - Sistema Informativo del Commercio, 2016

Scene 1

Rome's Caserma Ulivelli is an historic military barracks and part of a ring of fortresses around the city. Silvia, a civil servant, uploads to the Smarticipate platform the municipality's guidelines for the site's conversion. These must be carried out in line with heritage restrictions.

Scene 2

Residents within District 14 receive a notification about the project, guidelines and questions to share their ideas for future programming: Which social and cultural functions would you like to have in the Caserma?

Scene 3

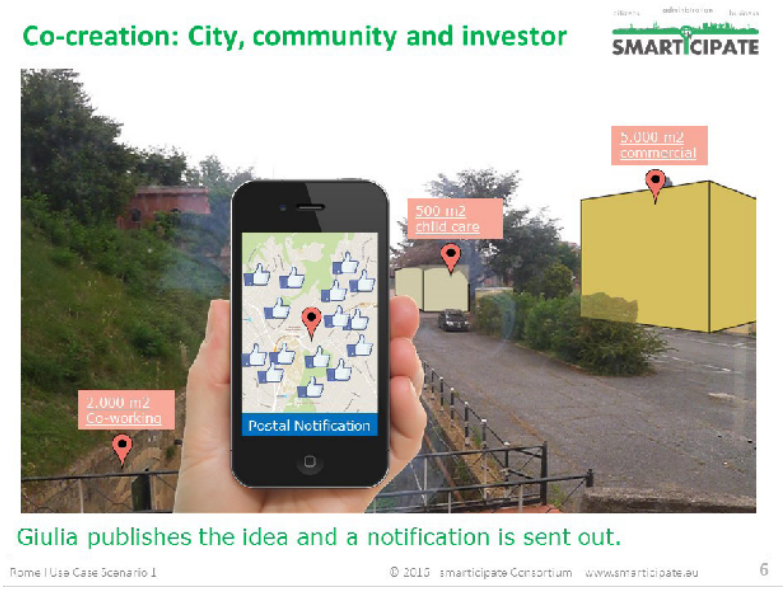
Giulia has a lot of ideas. Together with her friends she dreams up a programme consisting of a large neighbourhood center with child care, a restaurant, sport facilities, affordable housing for youth, co- working space and a primary school. The total programme area is 15.000 m².

Scene 4

Giulia receives automatic feedback on her proposal. She realises that for each square meter of social programme, two square meters of commercial programme are added to compensate the costs. The simulation visualizes the consequences.

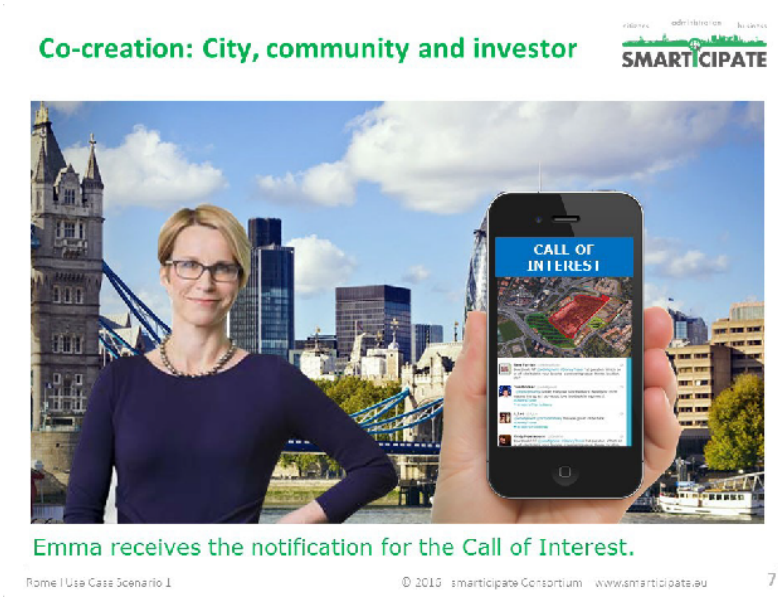
Scene 5

Together with her friends, she tries out different options. They discover that co-working, in combination with a kindergarden, is the most important for them. That means that a totale of 2.500m2 also means much less commercial area. This is acceptable for them.



Scene 6

Giulia's group publishes their idea via the notification system. A buzz is created in the neighbourhood, and they receive a lot of followers who support the group. Now the idea is also visible to a larger public.

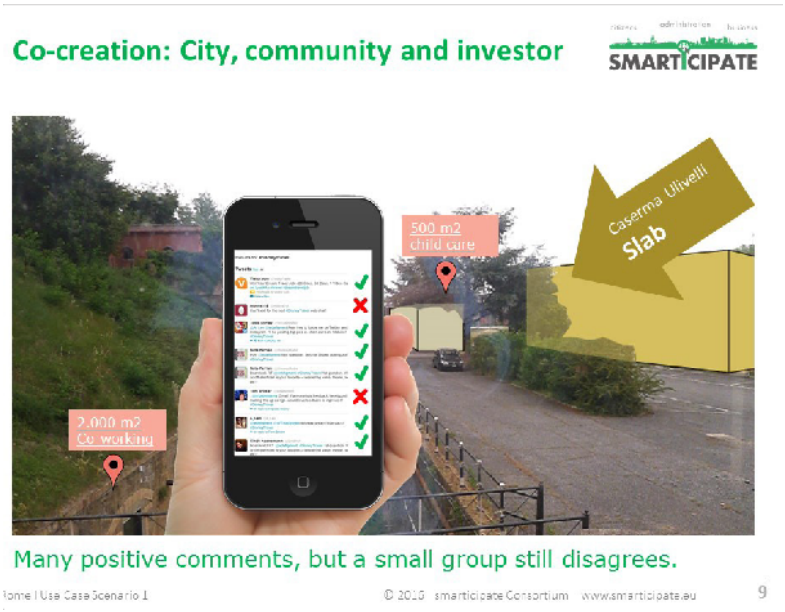


Scene 7

Emma is an English developer & investor. She sees the municipality's Call for Interest for the Caserma and decides to take a look. She is triggered by the unique history of the place and the lively participation process. She decides to give it a try and makes a plan!

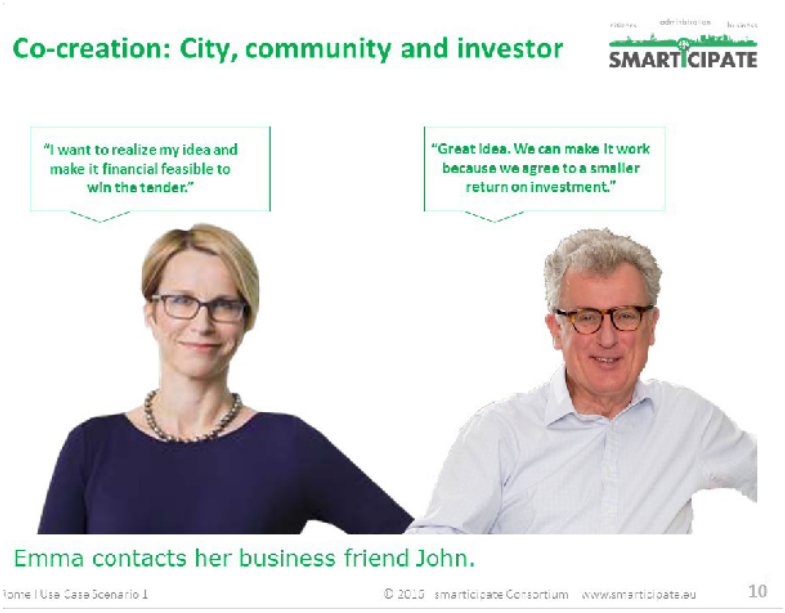
Scene 8

She makes the most beautiful co-working space in Rome, financed by a 75-meter high tower next to the entrance. That's how we do it in London! She receives automatic feedback from Smarticipate: The social-cultural programme is great and fits the municipality's project guidelines. However, the building's height doesn't fit within the heritage guidelines.



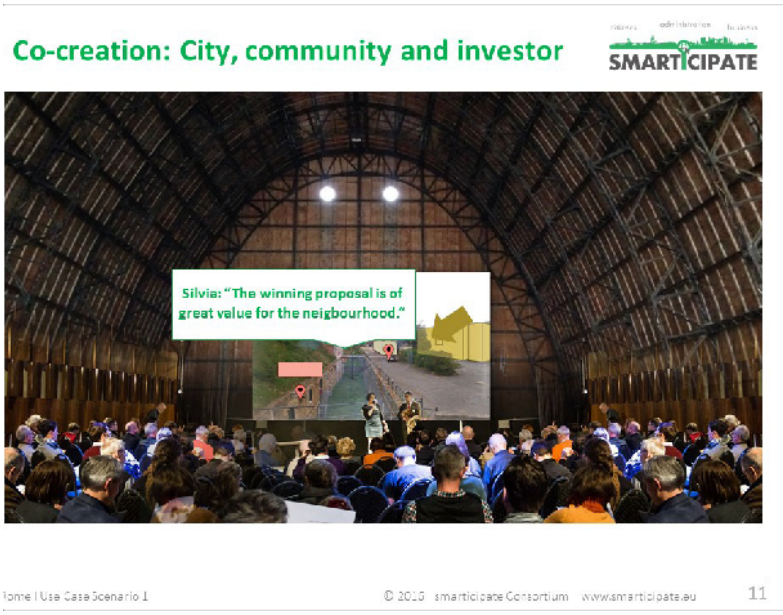
Scene 9

After reconsidering, she decides to change her plan. But she doubts whether she should publish it: the competitors can also see her ideas. However, she's brave and also curious about the opinion of the neighbourhood. She's rewarded with mainly positive feedback. Only the most direct neighbours are opposed: cut some holes in the building!



Scene 10

Emma realizes that this small group of neighbours can influence and therefore decided to revise her business case. The co-working place will now be financed by ethical capital, with the result that fewer commercial square meters have to be built.



Scene 11

She applies her proposal for the municipality's Call for Tender. Although Emma's plan hangs between 19 others, she has hit the target right on and receives the public vote! And because she also fullfills the spatial and financial guidelines, she wins.

Scene 12

Smarticipate identifies issues from the entire interactive process and plugs them into the planning policy process.

Planning Process

The City, through a City Assembly Resolution, has adopted a recovery plan for the former Ulivelli Army barracks.

Participatory process: the City deposits the plan at the City Secretariat for 30 consecutive days and publishes it on the Regional Gazette. During this period, citizens/associations may forward their observations/suggestions to the Administration. This is the stage where the smarticipate App would come into action: it would disseminate the plan through the online portal of the City on which residents of the area are registered, giving them the opportunity to send written comments and observations to the Urban Planning Department.

Draft of a new recovery plan: Once the Urban Planning Department has gathered all the observations from citizens via the smarticipate app, it proceeds then to the draft of a new recovery plan taking into account their observations.

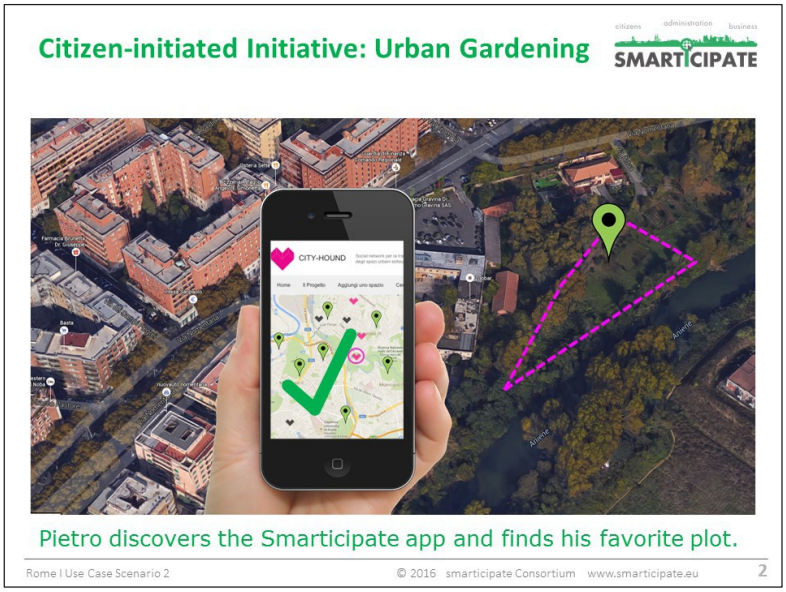
Decision/Development of new policymaking process: Once the new recovery plan has been drafted, the Urban Planning Department publishes it whilst, in parallel, it undergoes a consultation with citizens on the solidity of the key decisions taken because of their participation (new policymaking process). Once again the smarticipate app would come into action, giving citizens the opportunity to comment on the new policy making process. After citizens' consultation, the Urban Planning Department submits the new policy making process to the Planning Commission of the City Council. The Commission examines the process and drafts a report, following which the City Council modifies the policy accordingly. Finally, the new recovery plan and the policy making process are approved.

4.3.2.2 Urban Story 2 – Regulations for green areas – "citizen-initiated initiative: urban gardening"

A residents association in Rome wants to have more space for urban gardens. They use Smarticipate to find a potential site. They make a plan by completing an easy-to-use application and using the design feature of Smarticipate. With the support of the automatic feedback feature, the applicant fine-tunes the plan such that it fullfills all the criteria. After they submit the plan, it is published. From that moment, other associations can -within the deadline- show their interest in the same plot. If another association also qualifies, a lottery system is used to make an objective decision. The selected association can then start realizing their urban garden, while the other association is offered an alternative location. Citizens are able to monitor the use of the plots via the Smarticipate app and inform the municipality if they discover illegal use. In these cases, the municipality comes into action and enforces the violation. Such a control mechanism can result in the municipality having the confidence to add more land to the database.

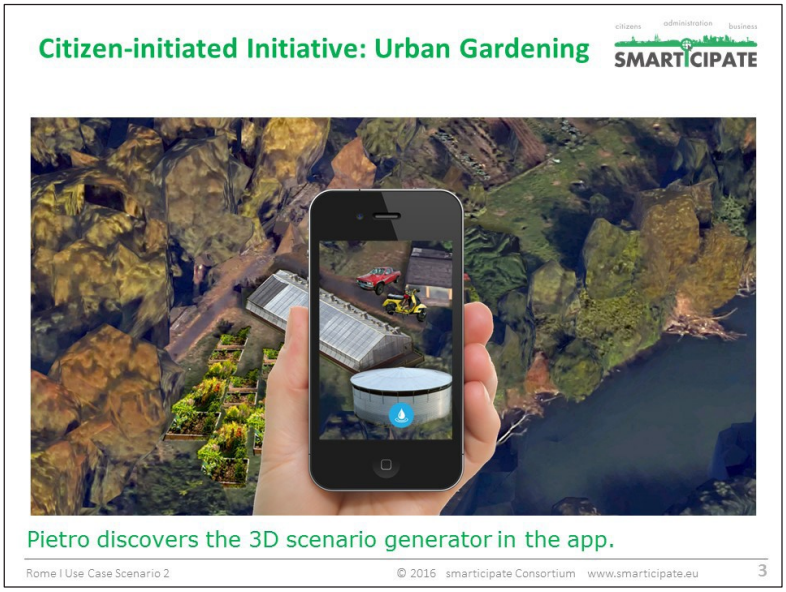
Scene 1

The association 'I Vicini Verdi' maintains an urban garden in the III Municipality of Rome. The members share the harvest to prepare their own food and to sell to the local community. The association has expanded in the past few years and needs more space to accommodate its activities.



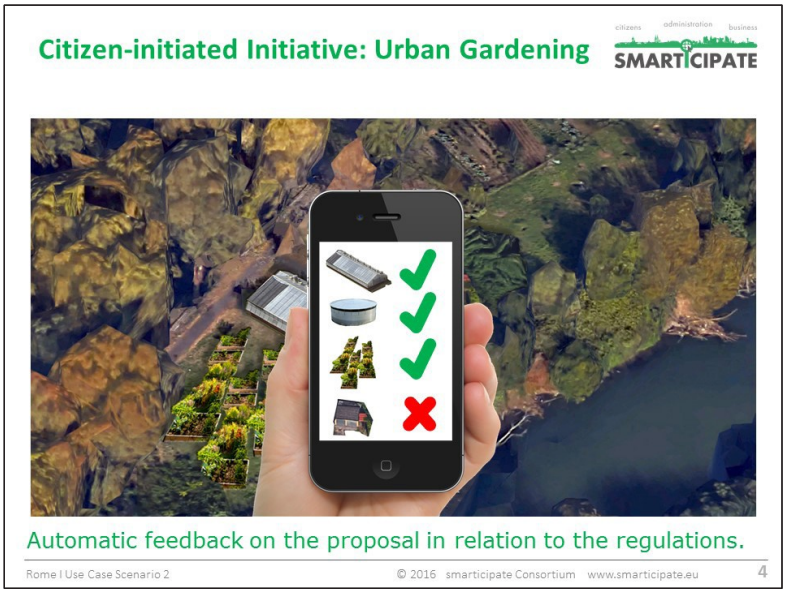
Scene 2

Laura informs her father Pietro, the chairman of the association, about Smarticipate. She shows him an overview of the avaiable plots, which are marked as potential sites for urban gardening. He receives all information necessary to make a good plan: size, soil, sunlight, electricity, accessibility and availablity of water.



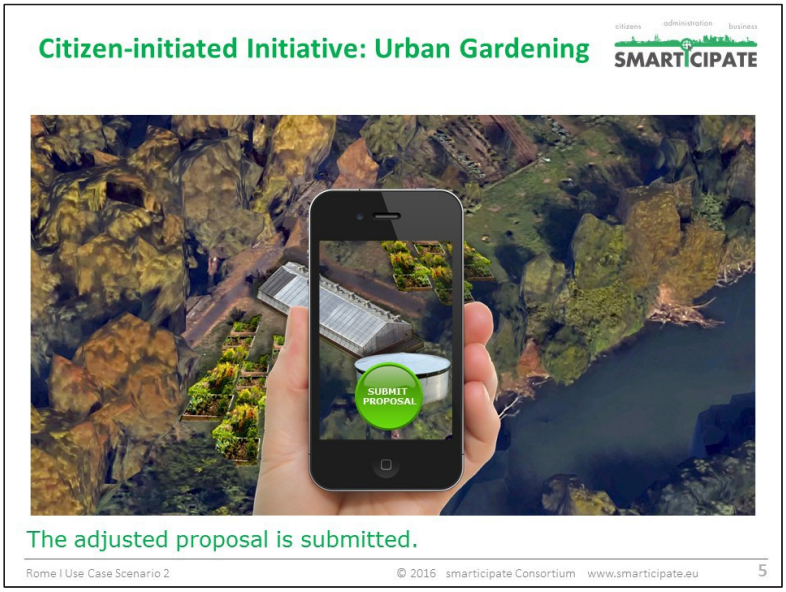
Scene 3

Pietro works with other members of his association to make a plan that includes a water tower, as the plot has no access to drinking water and the water from the nearby river is too polluted. For that he completes the information in the easy-to-use format Smarticipate, allowing him to have a finished sketch in only 15 minutes.



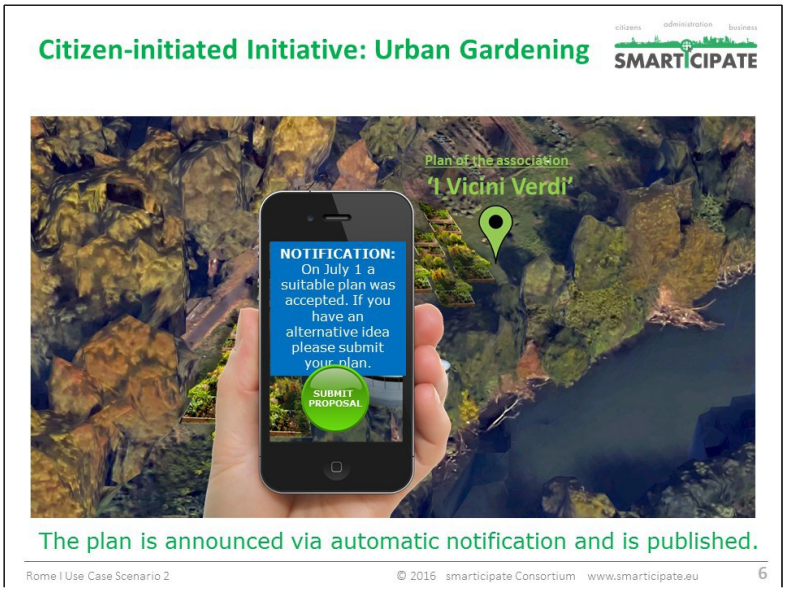
Scene 4

He receives automatic feedback on his proposal. The greenhouse and the water tank add extra value to the site in terms of environmental quality. Also the proposed planting beds fit the permitted uses of the site. However he receives negative feedback on the proposed garage, which is intended to repair the cars and scooters of association members. He is not allowed to build this here.



Scene 5

Pietro is disappointed with the negative feedback regarding the garage because it was important for his business plan. He removes the garage. The business plan is under pressure, but by adding extra planting beds he barely manages.

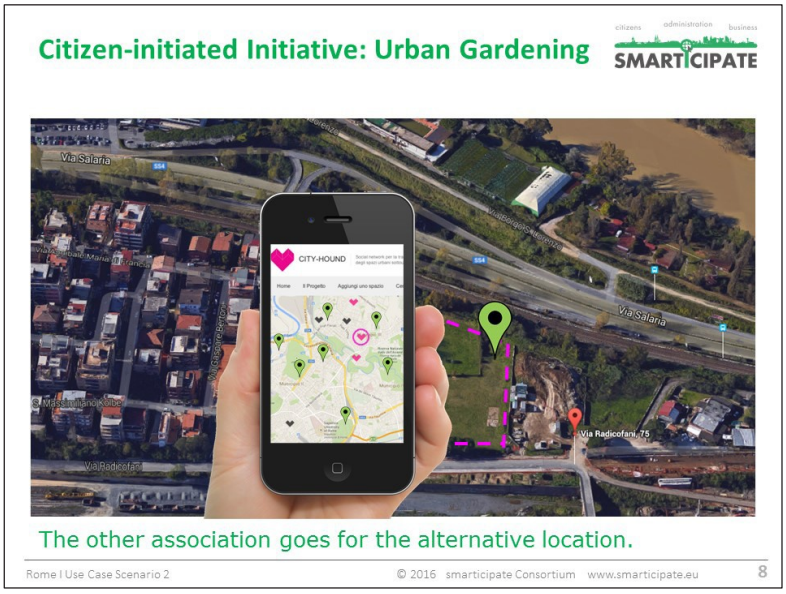


Scene 6

Smarticipate automatically checks the plan. The result: it fullfills the criteria for use as urban garden. A notification is therefore sent out: "On July 1 a plan was accepted for this site. If you also are interested in it, you have until August 15 to present an alternative plan."

Scene 7

1) Another association is also interested in the plot. They develop an alternative plan that is accepted. Because they also used Smarticipate, the result is that this plan fullfills the criteria. A lottery system is used to select the final plan.

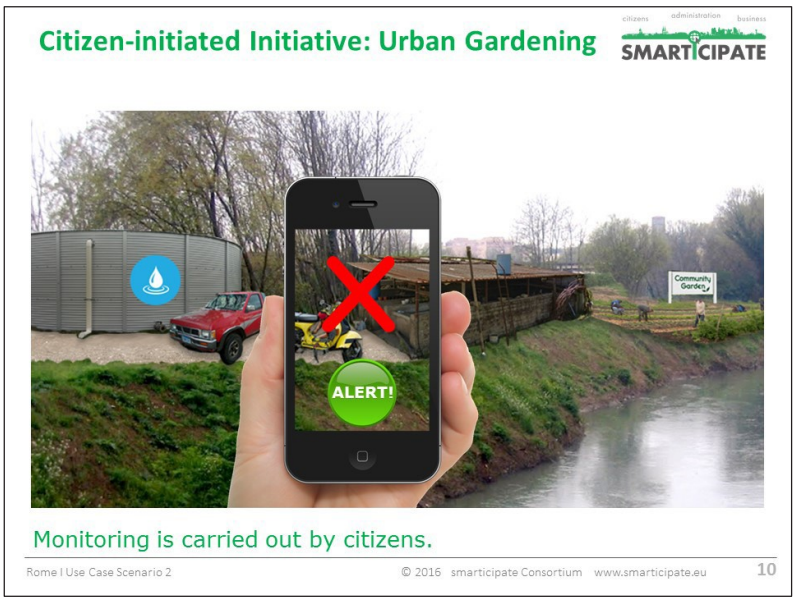


Scene 8

The second association is offered an alternative location, which fits their requirements. If they want to qualify for this location they have to follow the whole procedure.

Scene 9

The association 'I Vicini Verdi' starts right away with the realization of their plan. They prepare the land for the planting beds, order a water tank and start building the greenhouse. The site is so big that they also make a shed for storage. Soon the storage is used to store an old car and mechanical equipment.

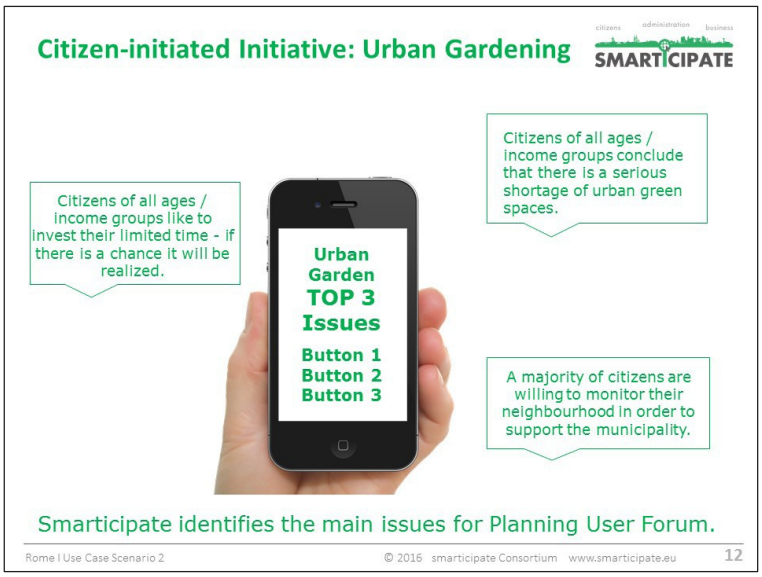


Scene 10

A neighbour sees the garage and doubts if it was approved by the municipality. She uses Smarticipate to check. Her assumption is correct, and she sends an alert to the municipality.

Scene 11

The municipality comes into action and sends a civil servant to check the site. He informs the association that the garage has to be torn down within 4 weeks or else the site will be cleared and returns to the database for available land.



Scene 12

Smarticipate identifies issues from the entire interactive process and plugs them into the city's existing regulations for green areas.

Planning Process

The City of Rome has recently approved the Regulations for the Management of Green Areas for Urban Gardens" to mainly respond to two requirements: on the one hand, the increased request from citizens to access to plots of land for the development of urban gardens and, on the other hand, the need to reduce maintenance costs of the city's large number of public green spaces. The Districts of Rome have competence over green areas under 5,000sqm falling into their jurisdiction.

In order for the smarticipate app to come into place, the first step to be taken is to allow access to the database of available land (data provided by the City).

Pre-application: A citizen prepares a scheme for the development of an urban garden in a specific area and may consult the help desk of the District the green area falls into for any advice. The smarticipate app allows other citizens to give comments on the scheme prepared by the applicant.

Application: The applicant submits the application for an urban garden to the District involved. The application is then registered and the District assigns a case officer for this application. The application is publicized by the District and other citizens may give comments and suggestions on the application to the District, all this done via smarticipate. Once the feedback from other citizens is received and evaluated, the case officer assesses the application.

Decision: A Technical Officer of the District will consider the application, after which the District may approve the application or refuse it. In case of a refusal of the application, the applicant may appeal the decision.

Implementation: During the implementation stage citizens will have the opportunity (via smarticipate) to report their concerns to the District in case of works being carried out not in compliance with the plans approved. The District is responsible for monitoring the implementation of the urban garden, with the possibility to envisage enforcement actions if works are not compliant with the plans.

4.3.3 Requirements

Based on the identified urban stories as well as user workshops a number of functional and non-functional requirements were identified for Rome, shown in Table 3. The IDs are automatically assigned by Redmine to each requirement. We have used the same IDs here for simplicity and traceability. More details for these requirements can be found in Annex A.

Table 3: Functional and Non-functional Requirements - Rome

ID	FUNCTIONAL REQUIREMENTS
7	System should be able to calculate and show financial cost of building e.g. higher vs wider
8	As a user the system should allow me to agree or disagree with a proposal
9	User should be able to select whether to publish a development proposal to wider community or not
10	User should be able to select target audience when publishing a development proposal with wider community

11	Council should be able to specify a budget for a specific development proposal
12	Users should be able to specify estimated cost for a proposal as an attribute
13	System should export the 3D model in a standard format such as CityGML for perusal by the council along with relevant statistics
14	System should send mobile notifications to relevant/interested users when a proposal is published
21	System should allow users to create 3D models of proposed development plans
22	The system should allow users to import 3D models which are available in standard formats
23	Users should be able to explore (or navigate through) the 3D model
24	System should allow users to define permissions for other users on a proposed 3D model
25	System should provide automated feedback to the user about the constructed 3D model
26	System should allow users to create development proposals using mobile phones and other media
27	System should perform a planning policy check to verify if the development would be permitted under existing policies and regulations
28	System should calculate estimated cost of a proposal
29	System should allow users to leave feedback on a 3D model
30	System should allow users to share the proposals via social media and to receive comments
31	Users should be able to toggle (or enable) commenting for specific proposals
33	The system should provide feedback to users about the suitability of a proposed development
36	System should allow users to designate a specific site as an Asset of Community Value (ACV)
37	Users should be able to specify specific goals to be achieved by a proposal
45	System should be integrated with Google's 3D view
47	Users should be able to publish specific parts of the proposal
48	System should be able to track the complete planning process
51	The system should allow users to query the municipality to database to determine if a particular plan has municipality approval
ID	**NON-FUNCTIONAL REQUIREMENTS**
18	The system should be intuitive and user-friendly
19	Developers should provide training documentation to learn about the system
34	The system should be integrated with crowdfunding initiatives such as SpaceHive
35	The smarticipate app should be available via publicly accessible app stores
46	System should be available in local languages
49	The system should link to notification system of Rome's online portal

5 Completeness Analysis

Requirements specification is a complicated process due to the inherent ambiguity of natural language. It is further complicated by the fact that often coders and end users possess different vocabularies. To bridge this gap in the most effective way possible, a structured and formal requirements specification process must be followed. Accordingly, in smarticipate we used a combination of the CoReS methodology and a modified Fagan inspection methodology [10]. A Fagan inspection is a structured process of trying to find defects in development documents such as programming code, requirements specifications etc. It involves a peer review process in which a number of people with specified roles participate. The roles used in a Fagan inspection include:

1) **Author:** the person who wrote the low-level document
2) **Reader:** paraphrases the document
3) **Reviewers:** reviews the document from a testing standpoint
4) **Moderator:** responsible for the inspection session, functions as a coach

Once all the requirements gathering workshops had been conducted and a first draft of all requirements was identified after consultation with the city representatives, we also conducted a final consolidation workshop in Darmstadt in July, 2016. A number of people at this workshop were present, each with a specified role. The author was the person who specified the initial requirements based on the outputs of the various workshops. The reader was a person who was asked to paraphrase the requirements in their own words and to circulate that to all of the other participants in preparation of the consolidation workshop. In addition to these two participants there were also four other people who acted as reviewers as well as one moderator who conducted the review session. During the session each requirement was reviewed by the entire panel. The paraphrased requirements were used to ensure that everybody understood exactly what the author intended each requirement to mean. In case there were any mismatches, the requirement was rephrased to make the language clearer and more explicit. The output of this workshop was a set of changes to the requirements clarifying some things as well as a set of questions requesting additional clarifications from the users in some cases. The questions were subsequently put to the users and the requirements were further modified in accordance with the clarifications. In this way a succinct and unambiguous set of requirements was developed.

6 Critical Reflection

An analysis of the requirements for each city yields two things; that most of the functional requirements are common for all cities and that they fit into a finite set of categories. These categories represent common activities that the smarticipate platform is expected to be able to support. The activities are:

1) Modelling
2) Visualising
3) Collaborating
4) Analysing

The activities are described below:

A1 - Modelling

The purpose of the smarticipate platform is to increase citizen involvement in city planning processes through the use of ICT. The way we have chosen to achieve this in smarticipate is by creating and sharing 3D visualisations of proposed development plans. The first step in this process is to create 3D models of the city that can be manipulated to reflect the proposed plans. This involves loading 3D data from LIDAR scans into the system and displaying them in a 3D environment to the user. The user can then explore the 3D models, view them from different angles and make changes to them. Once these models are ready, they can be used to visualise future developments.

A2 - Visualising

The system should allow a user to manipulate the prepared 3D models to be useful. Users should be able to add certain objects such as buildings, bridges, trees, roads etc to the models and see their effects to be useful. For example, if a user adds a school to a neighbourhood, the system should report on its impact on various parameters such as number of jobs created, increase/decrease in CO2 emissions, increase/decrease in traffic etc. The results should be shown visually to allow users to intuitively understand them.

A3 - Collaborating

Collaboration involves sharing a development proposal with various stakeholders to gather their feedback. This necessitates on the one hand a remotely-accessible interface such as a web interface, and on the other hand a notification mechanism that can alert the various stakeholders about the availability of a proposal for comment. In addition, the remote interface must support various collaborative features such as commenting, collaborative editing of proposals and access control mechanisms. These capabilities are necessary for the smarticipate platform in order to support engagement and participation. Finally, once feedback from the various stakeholders has been received, the platform must support analysing that feedback.

A4 – Analysing

These activities involve performing various quantitative and qualitative analyses on the developed proposals. The various types of analyses that can be performed include number of positive and negative responses, number of changes performed to the proposals by various users, statistical differences between alternate proposals etc. These analyses help planners to gain overall insight into the proposals being developed and make evidence-based decisions.

6.1 Common Requirements

Table 4 shows an overview of the commonality amongst the requirements as well as the activity to which they pertain.

Table 4: Commonality between requirements

ID	SUBJECT	OWNER	ACTIVITY
7	System should be able to calculate and show financial cost of building e.g. higher vs wider	RBKC, Rome	A4
8	System should allow users to vote on proposals	Hamburg, RBKC, Rome	A3

9	User should be able to select whether to publish a development proposal to wider community or not	Hamburg, RBKC, Rome	A3
10	User should be able to select target audience when publishing a development proposal with wider community	Hamburg, RBKC, Rome	A3
11	Council should be able to specify a budget for a specific development proposal	Hamburg, RBKC, Rome	A1
12	Users should be able to specify estimated cost for a proposal as an attribute	RBKC, Rome	A1
13	System should export the 3D model in a standard format such as CityGML for perusal by the council along with relevant statistics	Hamburg, RBKC, Rome	A1, A3
14	System should send mobile notifications to relevant/interested users when a proposal is published	Hamburg, RBKC, Rome	A3
21	System should allow users to create 3D models of proposed development plans	Hamburg, RBKC, Rome	A1
22	The system should allow users to import 3D models in standard formats	Hamburg, RBKC, Rome	A1, A3
23	Users should be able to explore the 3D model	Hamburg, RBKC, Rome	A1, A2
24	System should allow users to define permissions for other users on a proposed 3D model	Hamburg, RBKC, Rome	A3
25	System should provide automated feedback to the user about the constructed 3D model	Hamburg, RBKC, Rome	A2
26	System should allow users to create development proposals using mobile phones and other media	Hamburg, RBKC, Rome	A1
27	System should perform a planning policy check to verify if the development would be permitted under existing policies and regulations	Hamburg, RBKC, Rome	A4
28	System should calculate estimated cost of a proposal	Hamburg, RBKC, Rome	A4
29	System should allow users to leave feedback on a 3D model	Hamburg, RBKC, Rome	A3
30	System should allow users to share the proposals via social media and to receive comments	Hamburg, RBKC, Rome	A3
31	Users should be able to toggle commenting for specific proposals	Hamburg, RBKC, Rome	A3
33	The system should provide feedback to users about the suitability of a proposed development	Fraunhofer IGD, Hamburg, RBKC, Rome	A4
34	The system should be integrated with crowdfunding initiatives such as SpaceHive	RBKC, Rome	A3
36	System should allow users to designate a specific site as an Asset of Community Value (ACV)	RBKC, Rome	A1, A3
37	Users should be able to specify specific goals to be achieved by a proposal	Hamburg, RBKC, Rome	A1
48	System should be able to track the complete planning process	Hamburg, RBKC, Rome	A4

Figure 10 shows the distribution of requirements for each activity type. As can be seen 43% of the requirements are related to collaborative activities. This shows that there is significant interest in using ICT to engage citizens in the planning processes of the cities. Due to the

intuitiveness and ease-of-use of 3D models, they are strongly preferred by the cities for this purpose as they can greatly assist the process of reaching out to citizens and getting them involved. Of these requirements numbers 27, 36 and 37 were identified as high priority indicating that the cities are interesting in automating the assessment of the proposals as much as possible.

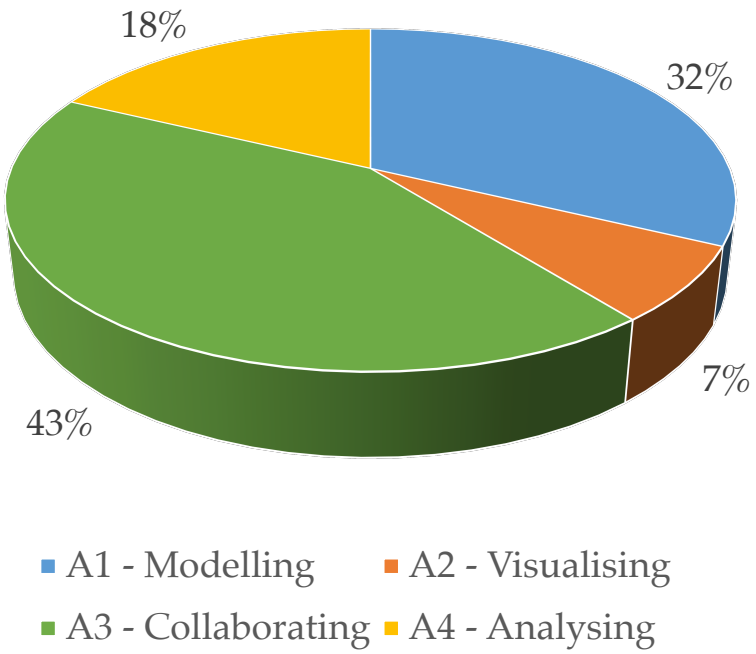


Figure 10: Distribution of common functional requirements for each activity type

7 What's Next?

One of the main aspects of requirements management is to manage evolving and changing requirements. As the project continues users may identify additional requirements or refine existing ones. Using Redmine we can easily keep track of how the requirements have evolved over time. Any changes in requirements are preserved as historical evidence and any new requirements will be accepted or rejected based on consultation with all relevant stakeholders including developers. Moreover, some additional requirements will be extracted from the feedback from Smartathons being held in the pilot cities. The Smartathons are community engagement events where citizens and other community organisations will be invited, and after some training and introduction will be asked to solve some problems using the smarticipate platform. The results and feedback from the Smartathons will be used to develop new requirements for smarticipate which will be recorded in Redmine. For this purpose two new fields have been added in Redmine that capture the source of the new requirements (which Smartathon? Did It come from users or developers etc) as well as how much demand there was for that requirement.

The requirements discussed in this document will act as input to WP3 and WP8. In WP3 they will be used to develop the architecture of the smarticipate platform and framework and in WP8 they will be used to derive the criteria for evaluating the platform.

8 Summary and Conclusions

This document presents the requirements definition methodology adopted in the Horizon 2020 smarticipate project. We have adopted the CoReS methodology combined with a modified Fagan inspection process to define requirements that are succinct, unambiguous and complete. The CoReS methodology involves a number of steps such as laying the groundwork and context through questionnaires, conducting workshops with users, identifying relevant usage scenarios and finally deriving requirements. The usage scenarios have been termed urban stories in this project.

The smarticipate project involves three pilot cities; London, Rome and Hamburg. As part of the CoReS methodology we conducted a requirements workshop at each of the pilot cities where city representatives presented their needs and requirements to us from which we derived urban stories and requirements. Finally, once we had an initial draft of requirements, we conducted a consolidation workshop where we employed a modified Fagan inspection process to refine and review the requirements. As a last step in this process the city representatives, as the expert users of the smarticipate platform, reviewed and signed off on the requirements. As a further output of the requirements workshops, we also identified the planning processes of the cities that are also documented here.

An analysis of the requirements shows that most functional requirements are common amongst all the cities and that they fit into a finite set of activity categories. We have identified these categories as modelling, visualising, collaborating and analysing. Approximately 43% of the requirements pertain to collaborating while 32% and 21% pertain to modelling and visualising respectively. This shows that there is significant interest by the cities in using 3D modelling as a tool for enabling increased citizen participation and collaboration. The requirements described in this document will act as input to WP3 and WP8 where they will be used to develop the smarticipate platform as well as the evaluation criteria.

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Annexes

A Detailed Requirements

For a list of the detailed requirements including acceptance criteria, assumptions and rationales, see attached document "082-annex_a_-_d2_1_-_smarticipate_requirements-uwe-001-rfc.pdf”.

B Redmine Tutorial

Please see attached document “105-redmine_tutorial-uwe-001-final” for a tutorial about using Redmine.