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Integrated urban data visualising and decision-making framework

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D2.5 INTEGRATED URBAN DATA VISUALISING AND DECISION-MAKING FRAMEWORK

PROJECT

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University of Oxford, Oxford Internet Institute, UK (OXFORD)
Malmö University, Department of Urban Studies, Sweden (MU)
Open Data Institute, Research Department, UK (ODI)
IT University of Copenhagen, Software Development Group, Denmark (ITU)
ZSI Centre for Social Innovation, Department of Knowledge and Technology, Austria (ZSI)

DELIVERABLE

Number: **D2.5**

Title: **Integrated urban data visualising and decision-making framework**

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Work package: WP2: Basic Exploration, Stakeholder Studies and Requirement Analysis

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1 INTRODUCTION

1.1 Scope

The work package (WP) 2 on **Basic Exploration, Stakeholder Studies and Requirement Analysis** creates the scientific fundament of the project and produces essential knowledge for the conceptualisation of UrbanData2Decide. The present report brings together the previous research results and elaborates **an integrated research model as well as a stakeholder requirements catalogue with first use case scenarios**. In this integrated deliverable previous results of WP2 are combined to define a first blueprint for the UrbanData2Decide system as it will be developed later in the project. In more detail, this report refers to previous deliverables in WP2, especially particular research on data sources, visualisation methods (D2.1), existing processes, concepts and approaches (D2.2), stakeholder studies (D2.3), and ethical, legal and social aspects to consider when it comes to data privacy (D2.4).

Chapter 2 summarises the highlights from the basic exploration looking into urban challenges and decision-making, stakeholders, data integration and decision-support tools as well as legal, social and ethical aspects. Chapter 3 presents a first blueprint of the UrbanData2Decide concept. It brings together high level stakeholder requirements and UrbanData2Decide potentials, provides an overview of the two UrbanData2Decide units that are the UrbanDataVisualiser and the UrbanDecisionMaker, and lists a number of explicit concepts that were developed by project partners. At the end of this report a comprehensive list of user stories describe interactions between actors and decision-support applications. Chapter 4 gives an outlook on the upcoming activities in the UrbanData2Decide project. This blueprint supports and encourages a full range of application specification activities in WP3 (concept design), WP4 (demonstration) and WP5 (validation and testing).

1.2 Method

Figure 1 shows the general approach used in UrbanData2Decide. We started our analysis and research on a general meta-level to get a broad overview on the urban decision-making landscape across Europe. In detail we looked into existing urban challenges, stakeholders, data sources, types of visualisations, decision-support processes, tools, and applications as well as social, ethical and legal aspects. Based on in depths research on selected cities first concepts for decision-support methods and tools were drafted. To do so, we moved from the meta-level to the local and case-based level where we worked in teams focusing on the cities Copenhagen, Malmö, Vienna and Oxford. Based on qualitative interviews with stakeholders, literature research, and/or participation at conferences and events in the field of smart cities, each team provided descriptions of selected local challenges, scenarios for decision-support, an overview of required functions and features including

first sketches, mockups and interface designs, descriptions of the stakeholders and required data. In total around 15 concepts for the development of applications that support urban decision-making were collected in the first stage. They are the basis for the work in WP3 – the specification of methods, concepts and frameworks, and the proof-of concept in WP4. Broad dissemination and exploitation activities will bring the UrbanData2Decide results back on a European meta-level.

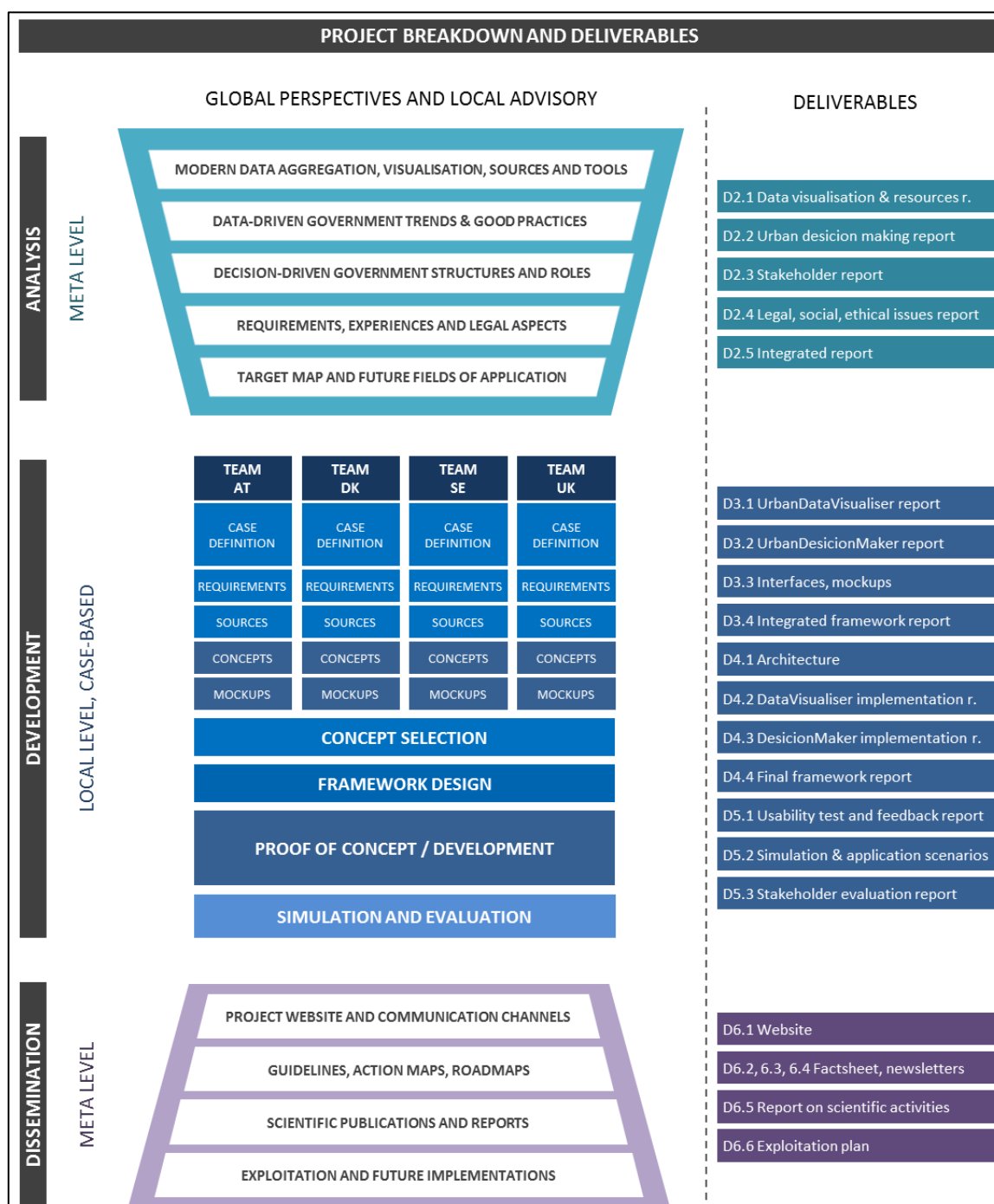


Figure 1: UrbanData2Decide general approach

2 HIGHLIGHTS OF THE BASE RESEARCH

2.1. Urban decision-making

2.1.1 Urban challenges to face

Europe is one of the most urbanised continents in the world. More than two thirds of the European population lives in urban areas. Cities are places where both problems emerge and solutions are found. They are fertile ground for science and technology, for culture and innovation, for individual and collective creativity, and for mitigating the impact of climate change. However, cities are also places where problems such as unemployment, segregation and poverty are concentrated. Great challenges of some today's cities are demographic decline and social polarisation, and the vulnerability of different types of cities. The population development of many European cities and regions is quite dynamic, whereas some face population growth, others are confronted with population decline. With this comes a range of subjects to tackle, e.g. meeting the need for affordable housing, providing the right amount of school places for children, and ensuring capacities of transport networks (European Union, 2011).

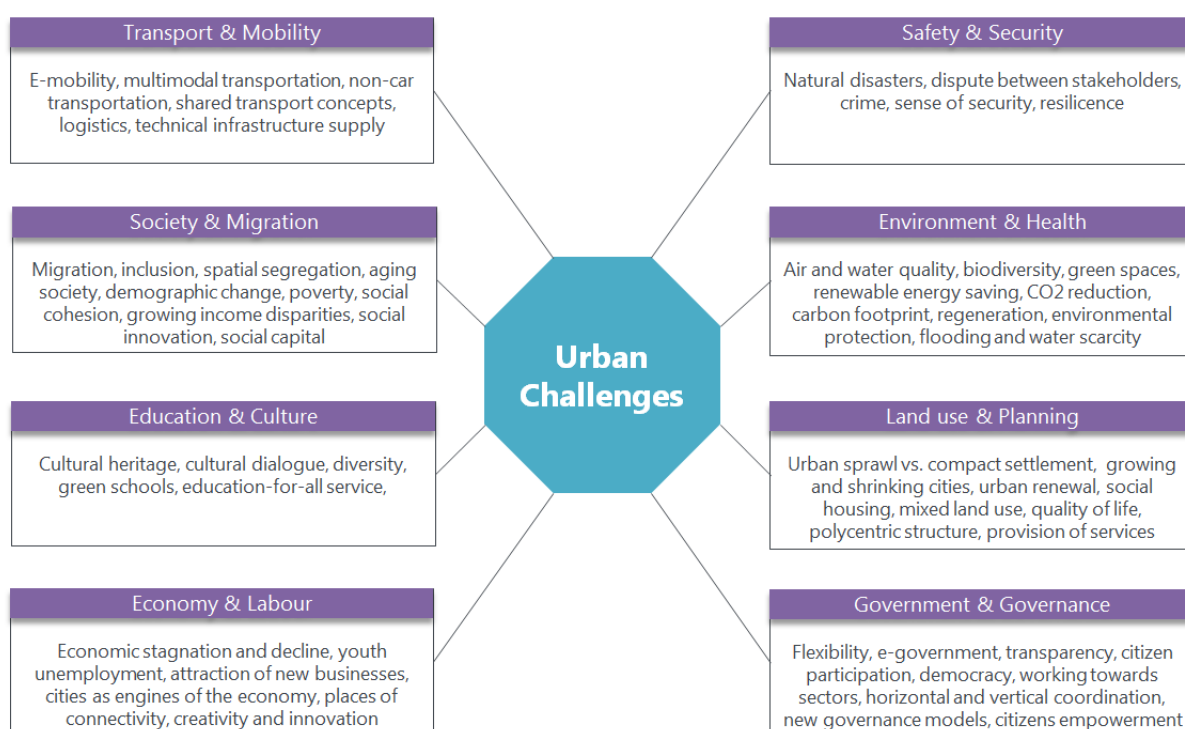


Figure 2: Urban challenges (based on European Union, 2011)

Figure 2 provides an overview on today's issues that urban management is facing. For example culture can be an opportunity for a city to generate considerable educational, social and economic benefits and it can help foster urban regeneration, change the city's image and raise its visibility and profile on an international scale. A healthy city is one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential (WHO, 1998). With opening health data several applications to show and support health of citizens have been developed. Cities play a crucial role as engines of the economy, as places of connectivity, creativity and innovation, and as centres of services for their surrounding areas. Urban challenges are manifold and different for each city.

2.1.2 Urban decision-making today

The following discusses urban decision-making today while attempting to disentangle some of the related complexities. Urban decision-making occurs at the interface of varying **topics** (urban planning, transport planning or urban safety) different spatial scales, administrative structures and local traditions of urban decision-making (e.g. more plan-led or consensus-led decision-making or practices of consultation with public/private entities). Urban decision-making today, both in terms of key actors and decision-making processes has most significantly been influenced by the increasing shift from government to governance. While concepts of **urban governance** as 'softening borders of government and the governed' are not new, they are certainly gaining more and more public attention. Urban governance stresses the role and political power of local organizations, NGOs and lastly the citizens themselves, referring to a more open decision-making process which – at its best – results in a transparent decision-making process. (Hendriks, 2014)

The operational principles of good urban governance as described by UN Habitat (2001) and shown in figure 3. They are civic engagement, equity, transparency, security, subsidiarity, efficiency, and sustainability.

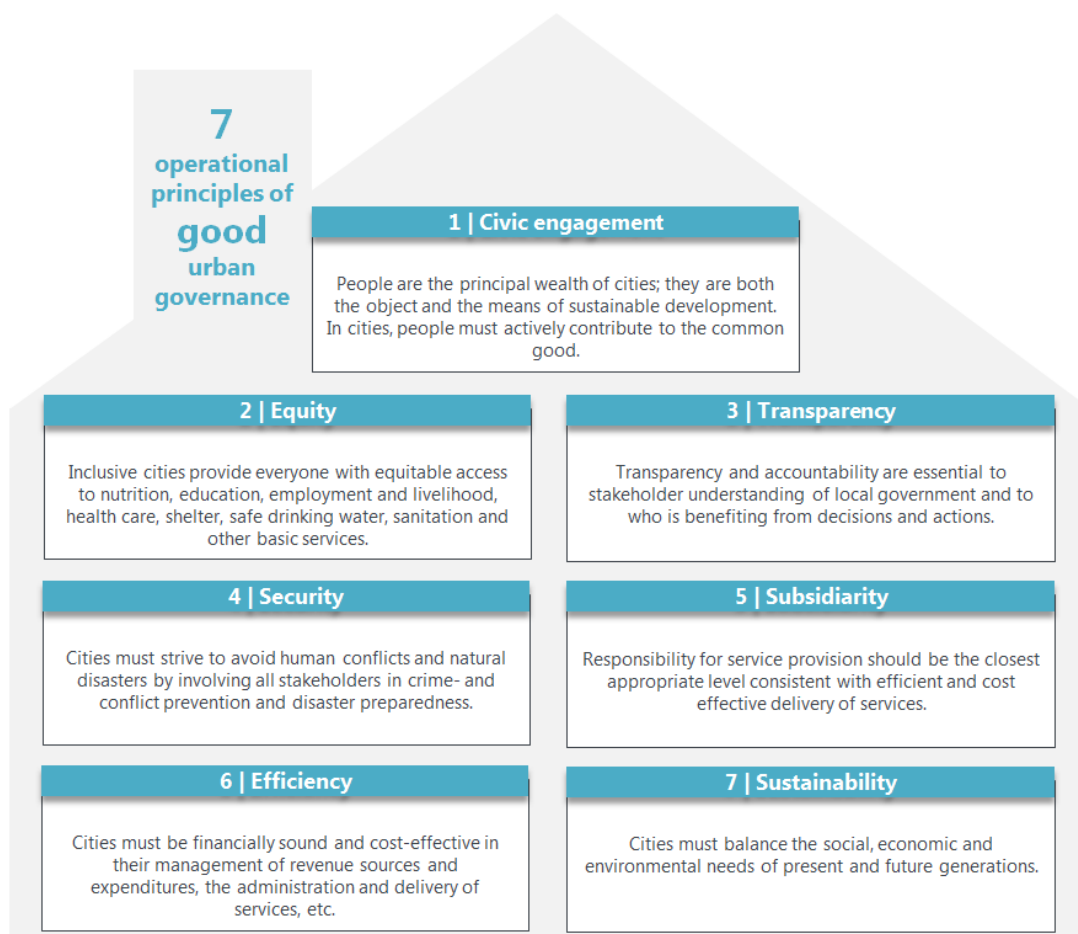


Figure 3: The 7 operational principles of good governance (based on UN Habitat, 2001)

Urban decision-making processes **vary greatly between countries and their respective cities**. Often cities within the same country do not necessarily follow the same decision-making approach. Furthermore, there is no one-size fits all approach in urban decision-making. One has to pay attention to the local context in regards to political and institutional trajectories, which greatly influence predominant decision-making approaches. For instance, a city with a strong history of citizen involvement and participation will showcase a different decision-making approach than a city with a more traditional top down planning approach (URL 1). Moreover depending on the issues and topics a city is confronted with, whether it is transport planning or urban safety, different decision-making processes take place, which require specific tools and involve different stakeholders and decision-makers. In this case operational decision-making processes are concerned and demand different procedures (e.g. fast decision-making in case of crisis management).

Real world example: Citizen participation in Vienna as part of decision-making

The Mariahilfer Straße is the biggest shopping street in the City of Vienna and was heavily frequented by cars and other motorized vehicles until it was decided recently to transform most parts of the street, including its parking spaces, into a pedestrian area and a shared space area. After first baseline studies were conducted, the stakeholder involvement process started in 2011 with a number of big stakeholder involvement events including more than 600 participants (citizens) that contributed with more than 1.000 ideas for the reconstruction of the street. In addition to the physical meetings, an online dialogue with more than 900 posts was moderated. In 2012 selected experts were integrated in the stakeholder involvement process in the form of round tables. An extra survey for all residents in the relevant districts was conducted in 2013. In the same year further stakeholder involvement was done to collaboratively design the new Mariahilfer Straße with citizens, experts and urban planners. In late 2013 first pilots were implemented and tested. The feedback had influence on the final detail planning and reconstruction of the street. The first major section of the street was completed by the end of 2014. In 2015 all parts of the street are planned to be fully reconstructed. (City of Vienna, 2014)

Operational decision-making processes in cities are highly complex and depend on the issue, its duration and urgency as well as the institutional context and histories of decision-making processes in cities. Operation decisions can take place **over a long period of time, or can occur quickly** for instance in the case of a fire hazard. Nevertheless, decisions regarding operational procedures to follow in urgent cases like fires are usually based on crisis management procedures set up over a longer time frame by local authorities, including local councils, external stakeholders such as fire brigade or rescue services. Further, operational decisions are often distinguished between decisions that are part of an **automated process and those that need human intervention**. Both processes to varying extents include and rely on data. Decisions always reflect certain strategic and political directions of cities. It is done by decision-makers who come with specific roles, decision-making power and agendas to the table. (Ddamba et al. 2015)

When it comes to **decision-making related to planning**, the Decision Makers Guidebook by the PROSPECTS¹ project emphasizes three prevalent approaches that are vision-led, plan-led and consensus-led approaches, whereas the latter appeared as most common among the cities (URL 2 and May et al. 2001, 14). In detail they are:

¹ Prospects (**P**rocedures for **R**ecommending **O**ptimal **S**ustainable **P**lanning of European **C**ity **T**ransport **S**ystems), an EU-funded project from 2000 – 2003

- **Vision-led:** an individual or committee has a clear vision of the measures needed to improve transport and land use in the city, and focuses all action on implementing them;
- **Plan-led:** objectives are specified, and the measures which best satisfy these objectives are determined, usually by analysis; the resulting plan is then implemented;
- **Consensus-led:** discussions take place between the stakeholders involved in transport and land.

Some efforts to break down the complexities of decision-making processes focus on different steps or phases. Within their guide “Tools to Support Participatory Urban Decision-making” the UN Habitat discusses four **phases of participatory decision-making processes** (UN Habitat Report, 2001). The scheme describes steps within each of the four decision-making phases that are preparatory and stakeholder mobilization, issue prioritization and stakeholder commitment, strategy formulation and implementation, and follow-up and consolidation. This is not to be understood as a linear process, but rather as different tasks which take place simultaneously. Tasks are for example mobilizing stakeholders, identifying key issues or agreeing on action plans. Within all of the tasks the participation process as well as use of data to make informed decisions can vary. Decisions in an urban renewal project with regards to the identification of key issues or the mobilization of stakeholders can entail different types of information and methods, including the analysis of social media data, spatial data, press releases, policy briefs and conducting interviews. The scheme does not explicitly assign a role to the use and types of data used within each task or phase. Additionally, the implementation of the different decision-making phases also needs to take the specific (national/local) context, i.e. local and institutional traditions of urban decision-making, into account. (Ddamba et al. 2015)

Seven main factors that influence the decision-making approach are outlined below (figure 4). These factors are institutional embeddedness, administrative structure, funding, spatial scale, duration of the project, the stakeholders and data.



Figure 4: Factors influencing urban decision-making (compiled from findings of URL 2 and UN Habitat, 2001)

Urban decision-making is an interaction of several stakeholders, e.g. from public administration on national, regional, local level, research, industry, policy makers, the public, media, etc., that generate certain dynamics. Urban development is not a one way street leading towards an ideal end. Changes of the framework like revival or crisis of the economic sector, the change of social ideals or ecologically driven challenges, ask for the adaption of the system, its aims, strategies and concepts. Therefore, urban decision makers rely on regular input of sound data and information. New data and information need to be collected and analysed to be able to detect changes and to estimate the impact these changes could have. (Schrenk et al., 2011)

Table 1: Highlights of the analysis on urban decision-making

★	Dynamics and challenges	Cities are dynamic and face challenges regarding smart transport, population development, education, economy, security, environment, health, quality of life, governance, etc.
★	Balancing interests	Decision-making in cities is complex as it deals with different thematic themes, and stakeholders with different interests and expectations
★	Decision-making processes vary	Decision-making depends on the issue, its duration, automatisisation, urgency, the institutional context and histories
★	The value of data	Urban decision-makers rely on regular input of sound data and information to ensure evidence-based and transparent decisions
★	The value of expert knowledge	Data alone is not enough and in integrated urban management hardly all the required data has been available, therefore the right analysis and interpretation of data by experts is an essential ingredient for making urban decisions

To be highlighted is the strong need of sound data and information for evidence-based decision-making processes from different thematic areas and sources. Data sources are mainly public administrations on local, regional and national level, research sector and industry, and more and more citizens in the form of user-generated content.

2.1.3 Overall framework and requirements

Based on the discussion above and the detailed description in the UrbanData2Decide Deliverable 2.1 (Bright et al., 2015) figure 5 summarises the overall framework of urban decision-making including different phases that can be issue identification, stakeholder engagement, analysis, strategy development, prioritization, implementation and evaluation. It also highlights the normative goals, stakeholders, and decision-support tools that can play a role in urban decision-making. In addition, it shows that urban decision-making is an interdisciplinary task and tackles different sectors of activity or thematic areas, e.g. transport and mobility, societal challenges, environment, and the economy. Increasing technical opportunities open the door for new management tools to support processes of urban governance. A stream of guidelines and tools can be used for reporting, public information or consultation, data analysis, data visualisation, monitoring, or modelling.

 Phases of urban decision making	 Urban governance normative goals	 Sector of activity	 Stakeholders	 Role of decision support tools
Issue identification Stakeholder engagement Analysis of the current situation and trends Development of strategies and plans Prioritisation Implementation Evaluation and monitoring	Civic engagement Equity Transparency Security Subsidiarity Efficiency Sustainability	Transport and mobility Society Culture Education Leisure and sports Environment Economy Security and safety Health Urban planning	Local (and regional) authorities Private sector Civic/ community organisations National public sector institutions	Enquiry/reporting Public engagement Analysis Visualisation Collaboration Trend modeling Simulation Scenario development Tracking and monitoring

Figure 5: Overall framework of urban decision-making (based on UN HABITAT 2001, Kingston et al. 2005, Schrenk et al., 2011)

To sum up we can say urban decision-making has experienced major shifts in the past decades from more top-down to bottom-up approaches, given the increasing trends of urban governance (as opposed to government). However, there are many forms and types of citizen participation and engagement, ranging from low-level participation (e.g. online petition) to high-level participation (e.g. participating in workshops throughout a project) of citizens and experts. Depending on the scope (e.g. spatial scale, financing) and timespan of a project as well as a cities approach towards decision-making, various forms of citizen participation can be found. (Ddamba et al. 2015)

Table 2: Stakeholder requirements on urban decision-making

!	Urban planner	Access to data and information from different sources as well as tools and techniques to balance the social, economic and environmental needs of present and future generations
!	Urban decision-maker	Accountability, sound planning and presentation of options in a clear way for evidence-based decision-making and good governance
!	Citizen	Transparency and civic engagement, i.e. citizen can actively contribute to the common good

!	Urban expert	Involvement in urban processes through state of the art tools and techniques to provide knowledge, expertise and advice for urban managers
!	Data provider	State of the art tools, techniques and processes to provide data for urban managers according to defined standards and guidelines

From the discussion in this chapter we can derive requirements for the development of an urban decision-support concept for different stakeholder groups such as urban planners, decision-makers, citizens, experts and data providers. Accessibility, good governance, civic engagement, expert integration, sound tools and techniques, and data provision are seen as essential ingredients. For more information refer to D2.2 on decision-support processes (Ddamba et al., 2015) as well as to D2.1 on data sources (Bright et al., 2015).

2.2. Stakeholders

Parts of the following chapter are also published in UrbanData2Decide D2.3 – Stakeholders, Roles, Workflows and Requirements by Markus Rasmusson, Nicklas Guldåker, Per-Olof Hallin, Joshua Ddamba, Yvonne Dittrich and Julia Neuschmid.

2.2.1 Stakeholders on a general level

On a general level, a stakeholder is an individual, group or organizations that have an interest in or is affected by an organization's plans and decisions. From an urban decision-making perspective it can be a wide range of possible stakeholders, such as citizens, property owners, corporations, NGOs, political parties, but also different administrations within a local authority as well as international policy makers such as EU. Different stakeholders have different influences and power to affect urban decision-making. The transition from 'government' to 'governance' is one very important shift in urban policy and decision-making procedures which may hamper transparency in decision-making for some stakeholders but not for others. Furthermore, the influence of international organizations such as EU affects the freedom of action for actors on both national and local levels. The shift to a 'governance model' does not change such power relations, but in many cases it has made them more invisible since decision-making becomes more informal, complex and difficult to follow. Consequently, different lobby groups emerge that represent various stakeholder groups without being visible to the public. On the other hand, and which in many cases can be viewed as counter movements, social media has become more powerful and more important for public opinions and social mobilization.

In urban decision-making, and in many cases, stakeholders have opposite positions and advocate different solutions but have difficulties to clarify more in detail what the different positions are based on, and what the consequences can be. In other cases, stakeholders can have difficulties to grasp overall complex urban processes and therefore need to be supported by methods and tools that help them to get a better overview, as well as to distinguish important aspects of the current issue. In both cases, visualisation of urban problems, stakeholders and decision processes is an important path to tread, but equally important is to develop transparent platforms that can clarify different positions, and in relevant cases to enable collaboration across organizational borders. These platforms can be viewed as boundary objects. (Leigh Star and Griesemer, 1989)

2.2.2 Stakeholders' characteristics in decision-making processes

Given that stakeholders in urban decision-making processes can include a wide range of possible actors with different influences and powers the characteristics of the stakeholders will also differ. To make general conclusions on the characteristics of stakeholders involved in urban decision-making is therefore a difficult task. The conducted case studies undertaken in the UrbanData2Decide deliverable 2.3 – *Stakeholders, Roles, Workflows and Requirements Report* are a demonstration of this. One important conclusion of these studies is that stakeholders involved in urban decision-making processes seem to be defined by responsibilities, or more exactly by their sector responsibility and geographical area responsibility. Depending on which sector and geographical area responsibility a stakeholder has, laws, principles and values will differ, affecting the outcome of decisions. This will therefore also affect the characteristics of the stakeholder since they will have different prerequisites and policies to relate to upon making decisions. Local policy makers will, for instance, not have the same basis for decision and prerequisites as international policy makers. Upon discussing stakeholders' characteristics it is therefore always important to be aware of the stakeholders' sector and geographical area responsibilities, as the real world example from the City of Copenhagen below demonstrates. This conclusion also underlines the importance of developing boundary objects such as communication platforms and where different forms of visualisation play an important role. (Rasmusson et al., 2015)

Real world example:

In the City of Copenhagen urban renewal projects for disadvantaged areas are implemented by *The Technical and Environmental Administration* (TEA). TEA is a central administration in Copenhagen Municipality and has the responsibility to decide which disadvantaged area (out of all disadvantaged areas in Copenhagen) that is of greatest need of an urban renewal project, based on physical, socio-cultural and economic factors. TEA's sector responsibility is therefore limited to urban development, but their geographical area responsibility includes the whole municipality. However, if TEA wants to receive a co-funding of the project, the project also has to fulfil certain

criteria's set up by the *Ministry of Housing, Urban and Rural Affairs* (MUHRA). MUHRA is a national ministry with the responsibility for housing, urban development and development in sparsely populated areas in Denmark. As a stakeholder MUHRA therefore shares sector responsibility with TEA (both stakeholders have a responsibility for urban development), but have a different geographical area responsibility (Denmark as a whole compared to Copenhagen municipality). Besides TEA (municipal level) and MUHRA (national level) the decision-making process on where to initiate urban renewal projects in Copenhagen also includes local neighborhood councils. The local neighborhood councils have an interest in the prioritization of their neighborhood, and throughout the decision-making process the local neighborhood politicians will provide information and knowledge about their neighborhoods to officials at TEA.

The above given example also highlights how an urban decision-making process initiated by a stakeholder with specific responsibilities is influenced by other stakeholders with different responsibilities, and how these responsibilities creates different prerequisites and policies that influence and affect the decisions made by the stakeholder. Stakeholders can therefore also be characterized to some extent by these responsibilities, since they will act according to them.

Table 3: Highlights of stakeholders' characteristics

★	Characterized by responsibility	Stakeholders are characterized by responsibility. Depending on their responsibility they will have different prerequisites and policies.
★	Sector responsibility	The sector responsibility is limited to the sector which the stakeholder is active in.
★	Geographical area responsibility	The geographical area responsibility it limited to the geographical area which the stakeholder is active in.

2.2.3 Roles and functions in decision-making processes

Roles and functions generally outline the level of responsibility within an organization and clarify who has the power to make a decision. But decision can be made on different levels within an organization, and although a specific role or function might not have the authority to take the final decision, he or she might have the authority to take minor decisions that ultimately leads to the final decision. Depending on the decisions made in the decision-making process, external roles and functions with more power might also get involved with the authority to make decisions based on their organizations interest. A role or functions level of responsibility within an organization might therefore not always be equal to actual power, since they might be dependent on other organizations decisions.

The roles and functions in urban decision-making processes also need to be versatile and flexible. In the case studies undertaken in the UrbanData2Decide deliverable 2.3 – Stakeholders, Roles, Workflows and Requirements Report, the roles and functions involved in the decision-making process needs to be able to collect, process and analyse information to make decisions, but they also needs to be able to disseminate the information and communicate with other roles and functions to make sure that the right stakeholders are informed during the whole decision-making process. A decision-making process therefore relies on the communication and visualisation of information between different roles and functions in order to make the best decision. (Rasmusson et al., 2015)

Real world example:

In the City of Malmö the City Office Administration has instituted three standby functions for officials working with issues related to safety and security. The standby functions are active around the clock for seven days a week and all have different roles. The most prominent role is held by the *Official In Standby* (OIS), who has the responsibility to continuously monitor occurring events and make assessment on if they might turn into incidents or not. This means that each time an event occurs in the City of Malmö, the OIS has to make a decision on whether to act on the event or not. Depending on the assessment made by the OIS, he or she will have different powers to adopt measures. If the OIS makes the assessment that the event might turn into a minor incident, he or she will have the responsibility to solve it. This does not, however, mean that the OIS will have the responsibility to solve the actual consequences of the incident; instead he or she will mainly be responsible to forward the information to the stakeholder who has the responsibility to deal with the consequences of the incident. This could for instance be a specific administration. But if the OIS makes the assessment that the event might turn into a severe incident, he or she will be responsible to contact the *Decision Maker In Standby* (DMIS) (one of the other standby functions) to provide a basis for decision. The DMIS, who has more authority, would then be responsible to adopt proper measures in order to solve the incident. The OIS might therefore be seen as a mediator of information and even though he or she does not make any decision on how to actually solve an incident, the assessment he or she makes on the severity of the event will influence the outcome of the final decision. A faulty assessment might worsen the situation, while a correct assessment might prevent the incident from escalating further.

As the example from the City of Malmö illustrates, a role or a function's level of responsibility does not always correspond to their actual powers (since they are dependent on other organizations decisions), but they can still have an influence on the outcome of the decision-making process. Furthermore, the example also demonstrates how the complex urban decision-making process requires a specific role or function to be versatile and flexible to make the decision-making process work.

Table 4: Highlights of stakeholders' roles and functions

★	Power to influence	Depending on their level of responsibility, roles and functions will have different powers to influence the decision-making process.
★	Versatility and flexibility	Roles and functions in an urban decision-making process need to be both versatile and flexible in order to handle and communicate complex tasks.
★	Communication and visualisation	Visualisations and communication between different roles and functions is an important part of urban decision-making processes.

2.2.4 Stakeholders' requirements

The case studies undertaken in the UrbanData2Decide deliverable 2.3 – *Stakeholders, Roles, Workflows and Requirements Report* (Rasmusson et al., 2015) all describe different approaches to how decision are made by stakeholders in an urban environment. Some of the cases describe a collaborative decision-making process where the municipal planners work closely with the citizens throughout the whole process, whereas some of the cases describe how municipal officials have close collaboration with other public and private stakeholders. Although the decision-making processes differs from each other in several ways they both serves as examples of what was stated in the beginning of this chapter; the need for collaboration across organizational borders.

As described in the beginning of this chapter, collaboration across organizational borders is not always an easy task. Stakeholders have opposite positions, advocate different solutions and bring in their own norms, values, time frames and interests into the process. These differences make the urban decision-making processes complex and sometimes difficult to grasp for the stakeholders involved. Within this context the two decision-support tools that are to be developed by the UrbanData2Decide team could fulfil an important function. The tools would not only allow the stakeholders get a better understanding of complex situations by visualisation and expert input, it could also allow them to use appropriate data sources and exchange and communicate this information across organizational borders in an easier way.

2.3. Data sources

In the UrbanData2Decide project research into social media data and open data was done. In both cases, we focused on the use case of urban decision-making, hence distinguishing our report from more general literature on social media, open data and visualisation. (Bright et al., 2015)

2.3.1 Social media data

At a basic level, social media can be defined as media where those using the system are also those who create the content. It is this characteristic which distinguishes them from other types of media (such as the news media), where content consumers and content producers play different roles (though of course news outlets are increasingly incorporating many social features into their offerings). In addition, many social media sites permit users to create and maintain lists of contacts with whom they want to share content with; lists which are often based on social ties formed elsewhere; some have defined these more restrictively as social networking sites, though in the Deliverable 2.1 report we referred to them as social media. Of course, under this definition, many types of media (such as email or even the telephone) are essentially “social”. However much of the current academic and policy interest around social media stems from the recent spread and mass uptake of a small number of relatively new social media websites, of which Twitter and Facebook are the primary examples. Two main factors have generated this trend. First, unlike (for example) email platforms, these social media platforms have adopted a quite open stance to sharing the data created on their service. Partly as a way of spreading usage, and partly as a way of encouraging third parties to develop applications which make use of their systems, Twitter, Facebook (and others) have made some portions of their data available through “Application Programming Interfaces” [APIs]: which has encouraged researchers to use this data as a way of better understanding users of these platforms. Second, these platforms are increasingly reaching very high penetration rates in many countries around the world. This mass penetration creates the possibility that content created on these platforms will offer increasing insight into what is going on in society as a whole (though we raise important challenges to this claim below). (Bright et al., 2015)

Owing to both of these factors, a wide variety of projects have been launched which attempt to use social media data for a wide variety of different purposes. In what follows, we first map out the key projects and ideas which have been created of relevance to urban decision-making. We then look at some of the key challenges and barriers still to be overcome.

Crisis Detection and Management

Probably the biggest relevant research area which social media has stimulated has been in the domain of crisis detection and management (Kavanaugh et al., 2012). By providing live access into the thoughts, feelings and opinions of citizens, social media are uniquely positioned to be able to

highlight unusual events or crises as they emerge, or perhaps even before then. Importantly, this can take place much faster than conventional crisis highlighting mechanisms.

Social and Demographic Data Capture

A second and more developing area of research has been in the use of social media data as a substitute for traditional data capture techniques, such as censuses and surveys, which are costly and time consuming to implement. Social media data offer potentially cheaper and faster solutions, as well as offering the possibility of capturing data which traditional data collection instruments would struggle to identify. (Bright et al., 2015)

Real world example:

In terms of public health, studies have successfully applied Google Search data (Ginsberg et al. 2008) and Twitter data (Signorini et al., 2011) to detect influenza type outbreaks and epidemics (though recent studies have highlighted that Google Search data may be decreasingly useful in this regard – see Lazer et al. 2014). Such mechanisms are useful because they are able to report instantly; whereas flu statistics collected from local hospitals and clinics might suffer a time lag of several weeks. Similarly, other research has applied Twitter data to the case of dengue fever (Gomide et al., 2011). Early detection is especially important in this case because it permits the targeting of insecticide and bug spraying activities, which can suppress epidemics but only if they are launched quickly enough. Similarly, Sina Weibo data has also been analysed for its potential usefulness as a pollution sensor, by looking at the extent to which pollution related words in these social media postings relate to actual pollution outcomes.

Social media data hence offers a wide variety of opportunities for policy makers and decision makers in urban environments. However, the use of this data is also not without its challenges. In this section, we highlight three key ones: its demographic representativeness, its accessibility and its long term sustainability. A key concern for both researchers and decision makers using social media is the extent to which users of social media can accurately be said to represent the population as a whole. Social media penetration levels are high, yet are also unevenly distributed throughout the population, particularly tilted towards younger age groups (OXIS 2013). Furthermore, not everyone who uses social media creates equal amounts of content: rather, the majority of content is created by the minority of users. Many social media platforms make data available for free (though under a specific licence or service level agreement), but do not guarantee its availability over the long term. (Bright et al., 2015)

2.3.2 Open (government) data

We will now move on to examine our second major data source that is open data. Open (Government) Data [O(G)D] platforms such as by the Government of the United Kingdom (n.d), the Austrian Government (Bundeskansleramt Österreich, n.d) or an European data portal, providing access to open, freely reusable datasets from local, regional and national public bodies across Europe (Open Knowledge Foundation, n.d) make datasets available to the public. The majority of open data comes from central government departments, a number of other public sector bodies and local authorities, but also from research (Kauppinen, 2012), industry and the non-governmental sector (NGOs). We also have to mention that the open data movement is diverse and made up of a range of constituencies with different agendas and aims, which are not driven by one party but several national, regional and local initiatives (Kitchin 2013). Data exists for all different kinds of themes, e.g. environment, health, sports and leisure, education, transportation, etc., and often with a spatial reference to be used not only in tabular form but also in form of cartographic representations. This discussion on open data shows that there are several characteristics of open data, but not one common definition.

The Open Data Institute (ODI) writes on their website: *Open data is data that anyone can access, use and share* (URL 3). This is not the only definition of open data. The GovLab has compiled an overview on their blog (URL 4). In summary, the definitions center on similar themes, but have different flavours when it comes to specific elements such as licensing or costs. For example, the ODI states that a license is a necessary requirement for open data.

Open data and citizen involvement

The open data-trend has been picked up by a number of cities and – together with networks, software and innovation-friendly legal standards – can be considered as part of the fundament of innovative city governance (European Innovation Partnership, 2015). As regards the definition of open data, however, it is crucial to note that in spite of its widespread use, there is no common understanding as to the type of data (raw data versus processed or aggregated data), topical foci (e.g. traffic, mobility, health data, etc.) or the target group of this data (citizens generally, businesses, web-developers, NGOs, etc.). Due to this broad definition, numerous urban initiatives labelled “open data” can be found, which differ in all of these aspects but share the characteristics of an information source that is meant to serve the broader public. In the governmental context, this indicates that parts of government data shall be made freely accessible to citizens (Kuhn, 2014) – an aspect that is often discussed under the label “open government” and “government as a platform” (O’Reilly, 2011). Yet, the concepts of open data and open government are not interchangeable, but in general, the first is the precondition for the latter: Citizens shall be given the possibility to contribute to government initiatives and to interact with the public sector, which requires sufficient information, e.g. through open data (e.g. Chan, 2013). For pointing out this interrelation, we are using the term

“open government data” for open data published by public agencies or governments. The participation and collaboration of citizens is a possible new paradigm of governance that can be enabled by open government data. The general way of thought is that open (government) data could enable forms of collaborative and participative governance since, in order for citizens to participate in public projects or to voice their opinions, they first need to learn about the addressed issue and also need to have a platform where they can share their contributions. From this perspective open data can serve both to lower the barriers for participation and collaboration and to make citizen involvement more attractive (Jetzek et al., 2013).

Recent initiatives have dramatically increased the range of previously “closed” data being made “open” by the government, including data sets on travel, weather and healthcare. Without any doubt, access to data allows people to work together more effectively, collaborating with each other, with policy-makers and with service providers to improve governance, public life and public services to make more informed decisions in cities. However, the open data initiative also raises some concerns and criticism. Challenges to face when dealing with open data include the following:

Data needs to be actionable

There is a clear and compelling case that information produced at public expense should be made open and freely available to benefit the public. However, simply declaring data sets to be open in itself does not make it of any practical use to the public. When released in its raw form, data is not open to the public in any meaningful sense. It is only open to a small elite of technical specialists who know how to interpret and use it, as well as to those that can afford to employ them. Therefore, data needs to be made easy-to-use (or actionable) and public awareness and training needs to take place to enable communities to apply data to solve local problems (Kitchin 2013).

Costs

Collecting, 'cleaning', managing and disseminating data are typically labour- and/or cost-intensive processes. Open data might well be a free resource for end-users, but its production and curation is certainly not without significant cost (especially with respect to appropriate technologies and skilled staffing). (Kitchin 2013)

Feedback effects on data quality

The very act of publishing the data can influence the quality of future data. Crime maps illustrate the sort of problems that can arise: The creation of crime maps have been a clear public benefit, showing on the one hand the police, emergency organisations, private security organisations, urban planners, public administration, and other stakeholders in the field of safety and security where resources should be concentrated. On the other hand the public can identify risky areas to avoid and demand

more police action if necessary. Nevertheless, this can also lead to the stigmatisation or downgrading of certain neighbourhoods. (Hand 2012)

2.3.3 Great potentials when treated with care

An argument for open data is not only that public money was used to fund the work and so it should be universally available, but there are many potential gains and values from Open Data Initiatives. Open data can be used by anyone to create great new products, business opportunities and community services. Open data enables accountability: it is difficult to conceal something if the facts are there for all to see. Open data empowers communities: crime rates, educational achievement, social services and so on are laid bare. Open data drives economic growth: more small companies are using open data to build innovative applications. They are creating new forms of transparency and accountability, fostering new form of social participation and evidence-informed modes of governance, and promoting innovation and wealth generation. Open data may even lead to more accurate conclusions and better decisions, as a wider variety of interested parties have the opportunity to examine the facts. No technology is without concomitant risks, but provided we tread carefully, with an awareness of the problems, the open data initiative holds immense promise. (Huijboom and Van der Broek, 2011; Kitchin, 2013)

Table 5: Highlights of the analysis on data sources (based on Bright et al., 2015)

★	Social Media data potentials	Twitter, Facebook & Co made some portions of their data available through Application Programming Interfaces (APIs) which has encouraged researchers to use this data as a way of better understanding users of these platforms.
★	Social Media data challenges	Demographic representativeness, its accessibility and its long term sustainability creates important questions about the consequences of using social media data for urban decision-making.
★	Open data movement	The open data movement is diverse and made up of a range of constituencies with different agendas, definitions and aims, which are not driven by one party but several national, regional and local initiatives.
★	Open data potentials	The open data-trend has been picked up by a number of cities and – together with networks, software and innovation-friendly legal standards – can be considered as part of the fundament of innovative city governance. Citizens shall be given the possibility to contribute to government initiatives and to interact with the public sector, which requires sufficient information, e.g. through open data.

★	Open data challenges	Data in its raw format can often be used only by experts, therefore data needs to be made easy-to-use (or actionable). Open data might well be a free resource for end-users, but its production and curation is certainly not without significant cost. Feedback effects on data quality also need to be taken into consideration.
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Finally, we explored data visualisation methods for urban decision-making, looking in particular and content and map based visualisations. No visualisation is perfect: rather, each one adapts better to different situations (and we also highlighted the great potential of interactive visualisations for displaying more data). The UrbanData2Decode Deliverable 2.1 (Bright et al., 2015) provides a menu of visualisation options from which the resulting UrbanData2Decide application could choose. For each of them the strengths and weaknesses are discussed. Examples for word clouds, stream graphs and sunburst graphs are shown below.

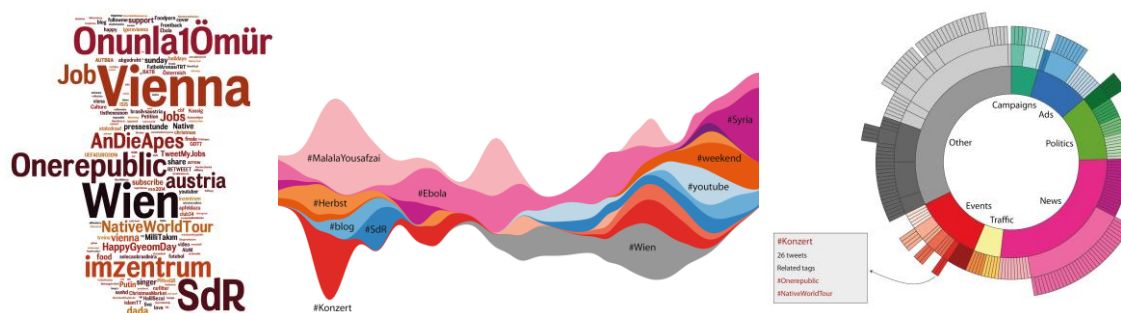


Figure 6: Visualisation examples (from left to right): word cloud, stream graph, sunburst graph (Source: Bright et al., 2015)

Both, open data and social media data are rich sources for urban decision-making with great potential. The aim is not to replace traditional data collection methods such as surveys, but additionally to consult new rich sources. The UrbanData2Decide decision-support demonstrators will show the use of various sources, namely (open government) statistical data and social media data in combination with expert advisory to support holistic urban decision-making processes and will test it on real world use cases.

Table 6: Requirements on social media and open data sources (based on Bright et al., 2015)

!	Plan in advance	Social Media data availability is often quite limited: for example, Twitter makes tweets available as they are being created, but offer very limited options for long term historical search. This means those using the data need to plan in advance to capture it as it is created.
!	Sustainability	As the business models of social media platforms evolve, it may be that the content they produce evolves as well, changes which may come to invalidate applications which were developed to rely on them.
!	Benchmarking	The need for social media data to be benchmarked continually: that is, validated against existing trusted sources of data and other ways of measuring the phenomenon in question.
!	Treat open data with care	The very act of publishing the data can influence the quality of future data; positively but also negatively so that it creates poor quality data (e.g. when you publish open crime data for a neighbourhood, people might not report crimes anymore that often because it might negatively affect the value of their houses).
!	Harmonisation and standards	In order to use data from different sources harmonisation processes, standards and guidelines are required.

From the discussion in this chapter we can derive requirements for the development of an urban decision-support concept for different stakeholder groups such as urban planners, decision-makers, citizens, experts and data providers. Early definition of data requirements, flexibility to achieve sustainability, benchmarking, careful treatment of open data, and the need for harmonisation and standards are seen as essential ingredients. For more information refer to UrbanData2Decide Deliverable 2.1 on data sources and visualisation methods (Bright et al., 2015).

2.4. Legal, social and ethical aspects

Parts of the following chapter are also published in UrbanData2Decide D2.4 – Social, Ethical and Legal Aspects of Big Data and Urban Decisions Making by Susanne Dobner and Christian Voigt.

2.4.1 Privacy

With the rise of information technologies, the amount of information and data gathered daily alongside unprecedented forms of online communication and participation has been increasingly challenging our notions of privacy. Given the focus on the use and collection of data in the UrbanData2Decide project, issues related to this topic are important to address.

The term privacy itself is hard to define. Many of the concepts on privacy discussed by authors are broad and indistinct, encompassing too many things to be useful in the context of current privacy concerns. Comparisons are also made with similar terms such as intimacy, making the discussion even more complex, since information might not be considered intimate but may be regarded private. A clear definition of privacy is therefore hard to come across, instead some privacy theorists suggest putting the context to the fore (Solove, 2002). This means that the circumstances under which privacy may be threatened or encroached should be illuminated instead of finding an all-encompassing definition. Taking the context into account also allows discussions on privacy to discuss differences in information sharing. Information on health might, for instance, be appropriate to share in a hospital but not in a bank. By this definition, the context sets the appropriate benchmark of privacy.

2.4.2 Social guidelines

The difficult question of how privacy can or should be treated in the context of rapid growth of information technologies is not an easy endeavor. Many approaches treat information as a binary concept where information is either private or not, or describe different levels of privacy. But in order to understand current privacy expectations and privacy practices it is important to treat the concept of privacy as described in the previous chapter; with the context in the fore. By this definition privacy is treated in a socially relevant way, allowing the context to determine whether privacy is being violated or not (Krupa and Vercouter, 2010). Further, the purpose of collecting and analyzing data is essential; data can be collected in various contexts and for different purposes.

This approach to social guidelines stresses the importance to consider the contexts of (1) data collection and (2) data usage in research and decision-making. Additionally, the type of data and its source, for instance whether it is retrieved from social media sites (tweets), open data portals provided by governments, or non-public data from local authorities (e.g. police), also needs to be reflected upon.

2.4.3 Ethical guidelines

The rapid growth of information technologies and the amount of data generated each day also raises new questions and challenges regarding privacy and ethical standards. These questions do not only concern questions and concerns about personal privacy, but also new questions about personal identity. Thus ethics of the rapid growth of information and data generated do not only entail questions relating to the collection, storing and processing of data in a company or organization, but also more general (and widely shared) concerns about persona identity and reputation.

2.4.3.1 Ethical guidelines for individuals and organizations

Agreements how data is used should be made explicit and easily understood and accessible. Additionally, it is not only a question of providing information on how data is being collected, used, or processed, but also how the information is provided in terms of technological design and readability (David and Patterson, 2012). Of course it is not only a question of design whether users actually pay attention and read the privacy information (e.g. notice about using cookies on websites) or not, but how information is designed should not be underestimated. Ethical decision points can ease and facilitate ethical inquiries and dialogues in organization.

2.4.3.2 Ethical guidelines in software engineering

Given that software engineers design and program tools, including the mechanisms of writing a code to collect data and personal information of its users, ethics play an important role within the profession of software engineering. Within software engineering three codes of ethics are most prevalent: ACM Code of Ethics, AITP Code of Ethics, and Software Engineer's Code of Ethics. Each code of ethics is briefly described in the table below.

Table 7: Code of ethics in software engineering

ACM Code of Ethics	The ACM Code dates back to 1992, with last revisions made in 2004. Generally, the ACM Code is divided into four sections: General Ethical Considerations, Specific IT Professional Responsibilities, Leadership Responsibilities, and principles for complying with the code.
AITP Code of Ethics	The Association of Information Technology Professionals (AITP) Code of Ethics is addressed to IT professionals generally. AITP is the leading worldwide society of information technology business professionals and the community of knowledge for the current and next generation of leaders. The code of ethics is formulated for four stakeholders: management, fellow IT professionals, society, and employers.

Software Engineer's Code of Ethics	The Software Engineering Code of Ethics and Professional Practice (SECC) dates back to 1998, and consists of eight principles that express ethically responsible relationships related to software development.
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2.4.4 Legal guidelines

Legal guidelines determining control and access over (personal) data can be found in almost all countries. Despite variation in implementation, some underlying principles on how to process personal data refer to the specification of the purpose, limiting the use of personal data and the right for individuals to be notified and allowed to correct inaccuracies. Below some of the most influential international frameworks and EU directives on data protection, e-privacy and data retention are described briefly. A more thorough description of the frameworks can be found in the UrbanData2Decide deliverable 2.4 – *Social, Ethical and Legal Aspects of Big Data*.

2.4.4.1 International guidelines

Fair Information Practice Principles

The Fair Information Practice Principles developed in 1973 by *US Health, Education, Welfare Advisory Committee on Automated Data Systems* was one of the first privacy framework and "became the dominant U.S. approach to information privacy protection for the next three decades." (Westin 2003, 436). The five guiding principles can be found in the table below.

Table 8: The five guiding principles

Notice	Notifying about data collection
Choice/Consent	Usually not explicit (e.g. access of third parties allowed)
Access/Participation	View, verify or correct your data
Security	Encrypt data, limit access to data within the organization
Enforcement	(a) Self-regulation by collections (b) suing perpetrators and (c) government enforcement

OECD Privacy Guidelines

The OECD Privacy Guidelines on the Protection of Privacy and Transborder Flows of Personal Data are the most widely used privacy framework internationally. The first privacy guidelines by the OECD were developed in 1980, but were revised in 2013 to adapt to the increased amount of personal data that is collected, used and stored (digitally and on-digitally) today, and variety of actors (e.g. number of social media users). The OECD Privacy Guidelines are closely related to data protection legislations

by EU member states (see for instance EU Directive 95/46/EC Data Protection Directive) and consists of eight guiding principles.

Table 9: The eight guiding principles

Collection Limitation	Collection should be limited and consented
Data Quality Principle	Personal Data should be relevant to the purposes, accurate, complete and kept up-to-date
Purpose Specification Principle	Purposes should be specified not later than at the time of data collection
Use Limitation Principle	Personal data should not be disclosed, made available or otherwise used for purposes other than those specified except: a) with consent or b) by the authority of law.
Security Safeguards Principle	Personal data should be protected
Openness Principle	A general policy of openness about developments, practices and policies with respect to personal data
Individual Participation Principle	An individual should know whether there are data relating to him/her, know which data there are, understand why access might be denied, and be able to correct or delete these data
Accountability Principle	Data controller should be accountable for effectively implementing these principles

2.4.4.2 EU directives

Directive 95/46/EC (Data Protection Directive)

The Data Protection Directive was adopted in 1995 and refers to the protection of individuals with regard to the processing of personal data and on the free movement of such data. In accordance with this Directive, Member States shall protect the fundamental rights and freedoms of natural persons and in particular their right to privacy with respect to the processing of personal data. European member states had to transpose the Directive into internal law by the end of 1998, however the Directive is not legally binding. Hence each state has enacted its own data protection legislation. However the Directive is planned to be fully adopted by member states in 2015, which would clear off all national legislation and national differences in implementation.

Real world example:

The Data Protection Directive was implemented in the Austrian Federal Act concerning the Protection of Personal Data 'Datenschutzgesetz' (DSG) in 2000. All Austrian federal states (nine states) have adopted data protection laws to implement the Directive. In Austria, recent discussion concerning the 'ELGA Healthrecord' has raised concerns by many citizens regarding personal data

protection. Alterations to the current federal act due to member state wide binding implementation of directive would in the case of Austria for instance be the following:

- Companies in member states with more than 250 employees are obliged to have a *data protection officer* (also obligatory for public authorities despite its size)
- In case new IT systems are installed protocols for *Data protection impact assessment*, e.g. what would happen if the IT system is leaked? need to be followed

The European Union has been pushing for (more) national certifications and seals of quality (Gütesiegel) in member states to raise the level of data protection, e.g. IT product will be more transparent and can be assessed faster when seal of quality. A European Privacy Seal (EuroPriSe) started by Unabhängigen Landeszentrum für Datenschutz in Schleswig-Holstein (funded under eTEN-Program) has been in place since 2007. Receiving the European Privacy Seal² requires a two-step procedure to certify IT products and IT based services.

Directive 2002/58/EC (The E-Privacy Directive)

Directive 2002/58/EC on Privacy and Electronic Communications concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications) and free movement of data, communication equipment and services. The E-Privacy Directive complements the 'Data Protection Directive' as it specifically applies to legal persons (e.g. providers of websites, not only individuals). The E-Privacy Directive has been implemented in member states since 2009 directive. The Directive often referred to as 'Cookie Law' deals with the confidentiality of information, treatment of traffic data, spam and cookies.

Real world example

The Danish implementation of the E-privacy directive is done through Executive Order no 1148 of 9 December 2011 - commonly known as "cookie-bekendtgørelsen", and describes the guidelines and regulation for the use of cookies. The Danish implementation is described in the "Guidelines on Executive Order on Information and Consent Required in Case of Storing and Accessing Information in End-User Terminal Equipment ("Cookie Order")".

Directive 2006/24/EC (The Data Retention Directive)

Directive 2006/24/EC on data retention was implemented in 2006 after two occurrences which made the EU eager to harmonize crime investigation prosecution among the EU member countries: the attacks in Madrid in 2004 and London in 2005. Initially all members states were required to retain all data necessary to trace and identify the source, the destination, the date, time and duration and the type of communication, as well as the communication device and the location of mobile

² <https://www.european-privacy-seal.eu/EPS-en/Home>

communication equipment for between 6 and 24 months. However, the directive was highly controversial from the very beginning and was rejected as unconstitutional by several member states. In 2008 it was challenged at the EU Court of Justice for the first time by the Digital Rights Ireland, and was later declared illegal on 8 April 2014 by the same court. Some EU member states did, however, keep legal regulation on a national level.

Real world example:

The EC Directive 2006/24/EC on Data Retention encountered heavy criticism in Sweden when it was implemented by the EU in 2006. Originally Sweden was supposed to implement the directive on the 15 of March in 2009 and an investigation on how to implement it in accordance to the Swedish Code of Statues was initiated at the request of the government in 2007. The investigation concluded that the collection and retention of data should be done by the service provider and stored for 1 year, and after that destroyed. But the proposal faced heavy criticism on the violation of personal integrity and the political parties which constituted the government could not agree on how to design the legislation, which made it impossible to pass it.

In March 2009 the government agreed on how to implement the directive and sought to impose the minimum requirements established by the EU, keeping data for only six months and not for 1 year as the initial investigation proposed. But due to the controversy and difficulties surrounding the directive the Swedish government decided to delay the legislation proposal in order to investigate it further. In March 2012 the legislation was finally passed and at the beginning of May the same year service providers had to collect and store data for six months.

When the Court of Justice of the European Union declared the Data Retention Directive invalid in April 2014, the Swedish Post and Telecom Authority (PTS) announced that they would not take any legal actions against service providers who decided to stop the collection and storing of data due to the unclear situation. The Swedish government therefore appointed an investigation with the purpose to clarify if the current law on data retention violated the personal integrity or any other fundamental rights.

In June 2014 the investigation concluded that the existing law on data retention did not violate any fundamental rights and is therefore valid, meaning that the law should still be applied. Shortly after PTS announced that they once again would take legal actions against service providers who refused to collect and store data for six months.

Currently the existing legislation on data retention applies. Some service providers in Sweden, such as Bahnhof, decided not to follow the law and were therefore fined by the PTS.

2.4.5 Summary

In the previous chapters some of the social, ethical and legal guidelines that need to be taken into consideration when collecting, processing and analysing data have been highlighted. The social guidelines emphasize the importance to consider the contexts of validation of data collection and data usage in urban decision-making, research and other sectors. The consideration of ethical values is clearly translated into user centered and technological design, where the three main ethical guidelines in software engineering (ACM Code of Ethics, AITP Code of Ethics, and Software Engineer's Code of Ethics) provide sets of standards of ethical conduct in the professional domain. The discussion of legal guidelines covers different international and European directives as well as some examples of how they are implemented nationally. All of the above highlighted guidelines will serve as a reference text for privacy questions faced throughout the UrbanData2Decide project. For a more thorough summarization, see UrbanData2Decide deliverable 2.4 – *Social, Ethical and Legal Aspects of Big Data and Urban Decision-making*.

3 URBANDATA2DECIDE BLUEPRINT

3.1 High level stakeholder requirements and UrbanData2Decide potential

The following table presents the different stakeholder groups, their requirements and the UrbanData2Decide potential. Urban stakeholders including decision makers are manifold and we can find them in the public, private, non-government, and research sector as well as in different domains due to the interdisciplinary of cities and urban topics. From the perspective of UrbanData2Decide we grouped stakeholders into a manageable amount of main stakeholder groups that are urban planners, urban decision-makers, urban experts, citizens, policy-makers, data providers and researchers. The first group is **urban planners** that includes all kind of stakeholders dealing with the operational development of strategies, plans, concepts, portfolios, programmes, projects, initiatives, etc. that effect cities. They are for example urban renewal specialist, spatial and regional planner, GIS-expert, service providers, social and technical infrastructure providers, education provider, health care provider, emergency organisations, etc. They can have different roles such as data collector, data analyst, project contributor, and brainstorm new ideas and solutions, and might also implement them after a decision has been made. **Urban decision makers** can be the head of a department, a project manager, the mayor, CEOs, etc. and are mainly involved in evaluating and selection of alternatives and solutions. In UrbanData2Decide **urban experts** are professionals that are not directly involved in the planning and implementation of solutions but function as a third party advisor. They are involved in the brainstorming of solutions and in their prioritisation through commenting, ranking and rating activities. **Data providers** are organisation or individuals that create

data that is required by urban planners, decision-makers and experts. Data can be either quantitative, i.e. facts, statistics, sensor data based on external measure, or qualitative in the form of a person's individual opinion. All these stakeholders can come from the municipality but also from the private, the research or the non-governmental sector. **Citizens** including civic interest groups and the general public are on the one hand the ones that are affected by urban strategies, plans, concepts, etc., and on the other hand they can also be the ones that can influence urban development through active contribution in citizen participation processes. A stakeholder group that is involved in urban decision-making on a strategic level is **policy-makers** at European, national, regional or local level, Parliament, ministries pushing open data, coordination bodies for e-government and ICT, governance structures for cross-level collaboration in e-government and ICT, etc. **Researchers** and **emergency personnel** have also been identified as stakeholders involved in urban decision-making processes.

Table 10: **Stakeholder requirements summary and UrbanData2Decide potential**

Stakeholder	Requirements	UrbanData2Decide-Potential
Planner , data collector, data analyst, project contributor in different thematic fields such as urban renewal, health, social and technical infrastructure, education etc. form public and private sector	Interdisciplinary approach, holistic and integrated data analysis, access to a wide range of spatial data and information (quantitative and qualitative), balance the social, economic and environmental needs of present and future generations, benchmark and validate data against existing trusted sources of data	Aggregate data from different sources, i.e mainly social media and open government data catalogues, aim to provide a picture as holistic as possible
Emergency personnel in stand-by such as police officer, fire brigade, red cross	Get fast accurate data and information about an incident and respond to crises and alerts quickly	See relevant information on occurring incidents coming from Social Media and use this data for crisis management
Urban decision-maker , Head of department, project manager, mayor, CEOs	Presentation of the current situation, of problems and options for solutions in an easy to understand and clear way, visualisations, a sound basis for decision-making, good governance, i.e. transparency and accountability	Focus on the creation of sound and impactful charts, graphics, diagrams maps and other forms of visualisation to present data and information in a clear and easy to use way
Urban expert , energy expert, security expert, transportation expert, social scientist,	Involvement in urban processes through state of the art tools and techniques to provide knowledge, expertise and advice for urban	Integrate data-driven with expert-driven approaches; include the human capital in the decision-making process as

consultant, etc.	managers	much as possible by giving urban experts the possibility to comment, rate and rank urban issues and solutions
Open data provider , government, private companies, research organisations	See the data to be used by others; get feedback on the data; state of the art tools, techniques and processes to provide data for urban managers; careful publishing of data taking into account ethical, social and legal aspects	Make open government data to be used, develop a set of concepts for urban applications making use of open data, apply the data in real world cases and proof of concepts
Citizen and civic interest groups, the public	Transparency and civic engagement, i.e. citizen can actively contribute to urban decision-making processes and the common good	Include the human capital in the decision-making process as much as possible by giving citizens and the public the possibility to actively report problems or participate with own solution proposals
Policy-maker at European, national, regional or local level, parliament, ministries, coordination bodies for e-government and ICT	Understanding barriers to open data and social media data publication and use; understand, develop and enforce widely used standards (formats, structure, licenses etc.), and privacy policies, push open data and e-government	Provide good practice for open data and social media data use in urban decision-making, identify challenges and opportunities
Researcher	Carry out research, publish papers	Aggregate data from different sources, aim to provide a picture as holistic as possible

Based on the defined stakeholders and their requirements the UrbanData2Decide blueprint has been defined that can support urban decision-makers through data-driven and expert-driven approaches.

3.2 UrbanDataVisualiser and UrbanDecisionMaker

The UrbanData2Decide decision-support application consists of the **UrbanDataVisualiser** and the **UrbanDecisionMaker** (figure 7). The UrbanDataVisualiser aggregates and visualises data from different sources that are (1) Social Media data from Facebook, Twitter & Co, (2) open data from primarily governments, and (3) data from citizens through active participation on specific issues and topics. The UrbanDecisionMaker brings urban experts and professionals – the human knowledge,

experience and expertise – into the decision-making process. Urban experts comment, rate and rank data and information coming from the UrbanDataVisualiser. At the same time experts identify and define new issues and additional data requirements for the UrbanDataVisualiser.

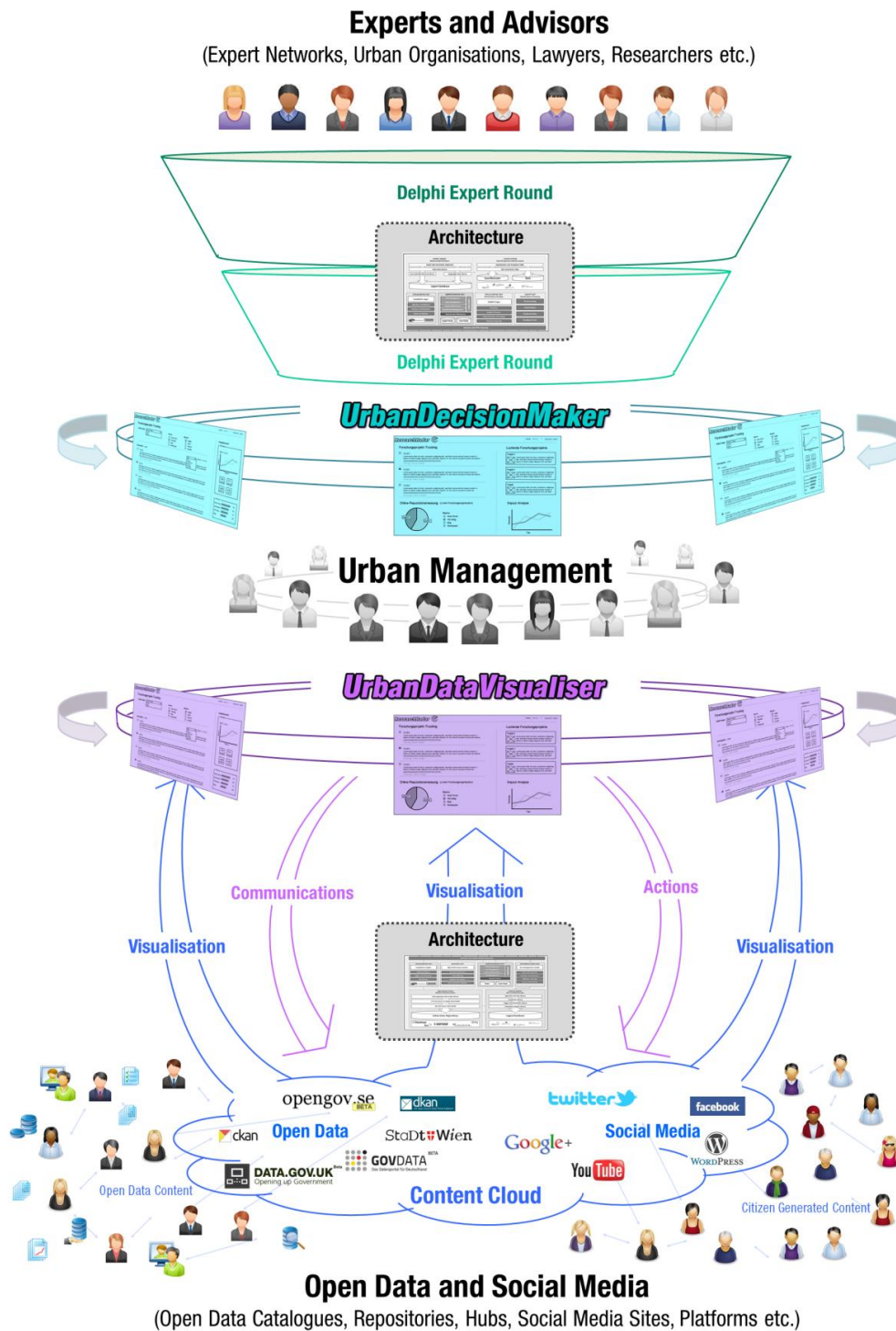


Figure 7: UrbanData2Decide overall concept

In UrbanData2Decide data-driven approaches and expert-driven approaches complement each other and can support urban stakeholders in complex decision-making processes. As already outlined in the UrbanData2Decide deliverable 2.2 (Ddamba et al., 2015) and in chapter 2.1.2 of this report, there is no one-size fits all approach in urban decision-making. One has to pay attention to the local context in regards to political and institutional trajectories, which greatly influence predominant decision-making approaches. Therefore, the decision-making process outlined in figure 8 is not a concept that should be understood as set in stone but shows frequent use cases in decision-making processes. The figure shows general data-driven use cases marked in purple and expert-driven use cases marked in blue colour that interconnect with each other. This means data regularly feeds the expert-driven use cases, whereas expert's input and feedback influence the collection and gathering of new data and information. Data-driven use cases are for example data gathering, analysis and visualisation, whereas expert-driven use cases are for example problem identification, preparation for third party experts, define and invitation of experts, discussion and brainstorming of solutions, evaluation of alternatives, solution selection, implementation and monitoring. We also have to note that not all of these use cases will always apply in decision-making processes, and not all of these use cases will always apply in this specific order. Also there can be backwards and forwards between use cases, e.g. between data gathering and data analysis, or between brainstorming of solutions and evaluation of solutions. These generic use cases serve as input for the detailed elaboration of use cases in WP3 – concept design.

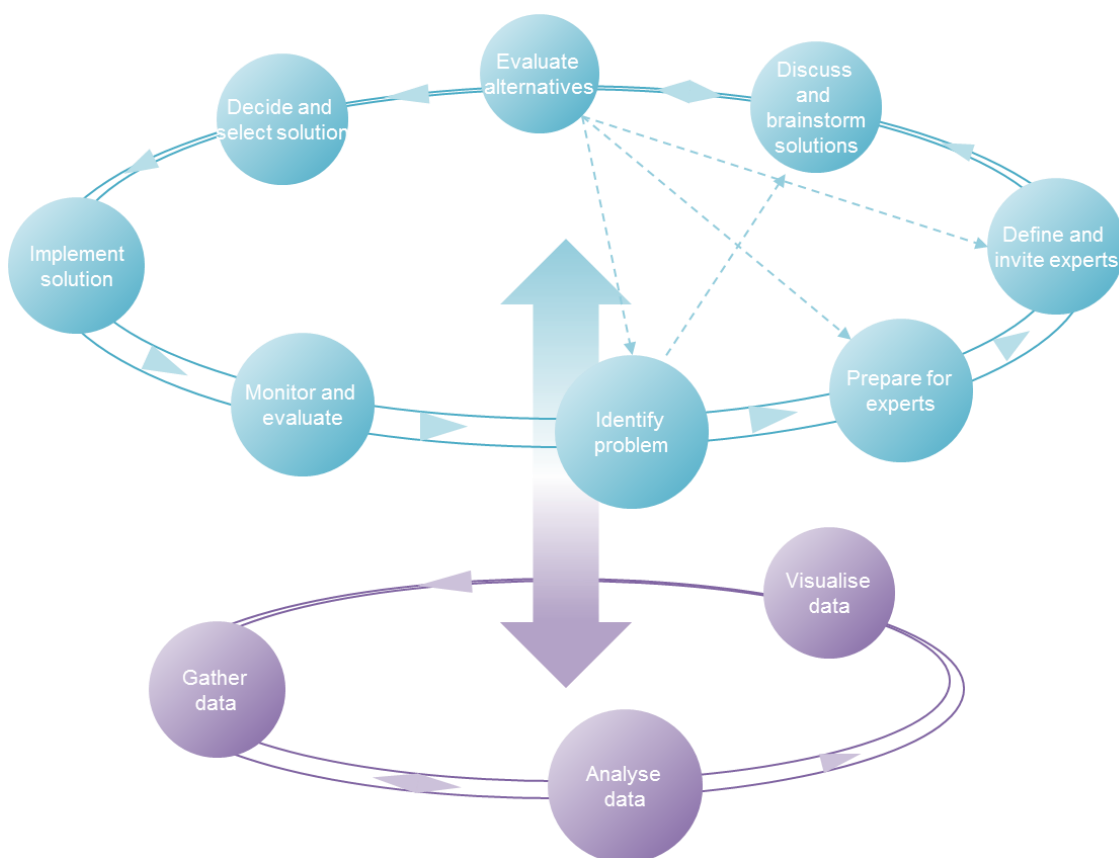


Figure 8: Generic use cases in urban decision-making

3.3 Concept collection

This section provides a first collection of different concepts for decision-support applications focusing on the cities Oxford, Copenhagen, Malmö and Vienna. The concepts are based on requirements and needs identified through qualitative interviews with stakeholders, literature research, and participation at conferences and events in the field of smart cities. The Expert Integrator (AT07), Collective Collaboration Tool (AT08) and the Expert Pool (AT09) tackle expert integration of urban decision-making (UrbanDecisionMaker), whereas all the other concepts focus on data aggregation and visualisation (UrbanDataVisualiser). They mainly consist of (a) Social Media monitoring and visualisation components, (b) Open Data visualisation components, and (c) citizen participation components. The following briefly describes for each concept first the background or problem, second the proposed solution, i.e. supportive applications or components (functionalities) and third a scenario. The scenario shows different steps, involved stakeholders and expected outcomes. Here we present the first version of concepts that will be further elaborated, analysed and compared in WP3.

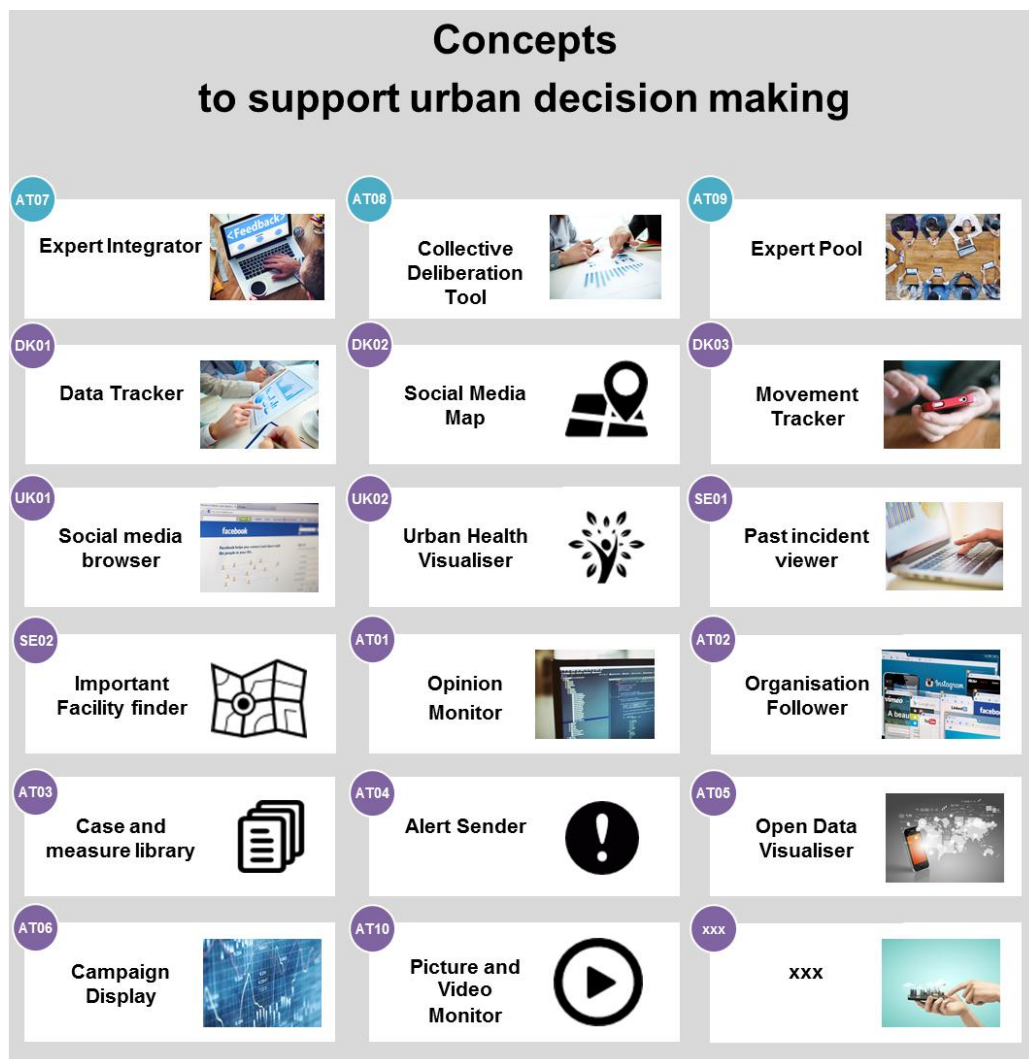


Figure 9: UrbanData2Decide concepts version 1

3.2.1 DK01 Data Tracker

In 2014 research on urban renewal projects began with the participatory observation of planners on an urban renewal project in Sydhavnen (Copenhagen). In pilot study of the project preparation process, planners conducted a pre-study of the community by meeting with local residents, actors and stakeholders from the community. This required teams of planners with expertise in various disciplines. However, the interdisciplinary approach to urban renewal projects involves periodic contraction of planners and officials who work on the project, by conducting fieldwork in community, collecting data and analysing it. Already, the municipality has a lot of statistic, economic and demographics data in various formats in its possession. These existing data forms the baseline for further investigation when a planner begins to search for data relating to an issue. Project activities are partly driven by the existing data, the policy for disadvantaged areas and but also by issues that come up during citizen engagement activities. For instance, planners returning from the field after meetings with the community stakeholders might begin to search for complementary data from internal sources from the municipality as well as information from the social media. Consequentially this process is a reciprocal one and planners have to regularly search for new data from different sources each time. Planners do not know what data is available or relevant to the clues or problems they discover and prolonged searches have to be done to find data to support their findings. The team members collaborate throughout the process searching and analysing data, and regularly place data at a central hub linking the different disciplines and informing the converging opinions and decisions made by municipal officials and community members on various subjects.




DATA TRACKER		
Tracking existing data to be used for identifying issues		
DK 01		
STEP 1 Identify Problem & Data Needs	STEP 2 Monitor	STEP 3 Request for Relevant data
IDENTIFY ISSUE , COLLECT DATA,DEFINE INSIGHTS & DATA NEEDS Meet with various community actors and Organisation.	DEFINE KEYWORDS, CAPTURE NEW METHA DATA Define Topic/Define Project /relevant thematic area / location of data SEARCH & FILTER Search and filter existing Metha data and selecting only relevant data descriptions for identified issues, identify who has the data	REQUEST FOR DATA ,VERIFY AND CATALOGE DATA Submit rauest for data, Analyse IDENTIFY MORE DATA NEEDS AND NARROW SEARCH Prioritisation and selection of relevant data DEFINE ACTION TAKEN ON DATA ANALYSIS Describe the Change Made to the data
Stakeholder Interest Groups, Planners	Stakeholder Municipality, researcher, people in charge of a specific project	Stakeholder Planner maker, Data providers, municipality, researcher, Project Managers.
		
OUTCOME Sea of information (articles,Documents, Excell, Jason, Shape files and analysis)	OUTCOME Filtered Metadadata about existing data and its location.	OUTCOME Information about analysis and issues as input for further analysis and planning.

Figure 10: Scenario Data Tracker

The Data tracking module will allow urban planners to verify existing data and to trace where such data may be found. The users can type different keywords related to possible data or problem characteristic whether social, economic or statistical, in a search field and a search engine will simultaneously trace the existing data from different sources within the municipality. The program will generate search results from different sources and of different data types, and stores metadata about existing data available for use. The module will allow planners to query data from system users, and generate a result map showing the existing data and possible contact persons. The search terms are based on data and characteristics or criteria defined by users. Planners establish a starting point for their fieldwork investigation and data collection much more quickly when there is some traceability of existing data.

3.2.2 DK02 Social Media Map

On-going urban renewal projects and project preparation process often extend ownership of the project to citizens through participation. From meetings and workshops with urban planners and municipal officials it was clear that in some cases the community undergoing an urban renewal project was not as responsive as predicted when compared with the outreach initiatives. This sparked an interest to explore social media and find what impressions can be gained from its content. In workshops with planners, it was concluded that social media could play a role in bridging the gap between social dimensions hampering citizen's participation. Pictures were identified as the most attractive and engaging methods for people to communicate their thoughts about an area. One of the new urban renewal projects focusing on engaging the youth is the Områdefornyelsen Rentmestervej (Copenhagen), where planners recognised the potential for using social media as an engagement tool and as a data collection method with school children in the community. Instagram is the most regularly posted social blog that young people prefer to use. The goal was to engage young people, as future actors, and give them an opportunity to express their views about things and places they like and do not like about their community or area. A clean, user friendly interface with features for filtering and extracting pictures and hash tags from Instagram, would display its content over a map with multi-coloured boarder/flags around each picture indicating whether it is negative or positive. The challenges that have to be mitigated here is the software design for the integration of social media images with maps to explore citizen impression over area. The Instagram map module will allow community members to participate an on-going urban renewal project in an area by providing their opinion through text and pictures. Members of a community will take photos of things, places and events that they like or do not about their community, then attach a hash tag and post them to Instagram through the mobile app. In other instances community members may post messages about their area on twitter or Facebook. This module collects social media based images and text using APIs and presents them over a street map of the area. The map data representations

present patterns to emerge over the maps and thereby allow planners to identify issues and opportunities emerging from the area.




SOCIAL MEDIA MAP		
Captures pic from instagram with hash tagged and/or geo-tagged an area and visualizes them on a map.		
STEP 1 Express Opinion	STEP 2 Monitor	STEP 3 Issue Identification
POST PICTURE, COMMENT On various social media , for this case uploaded pictures on instagram with a hash tag.	DEFINE KEYWORDS & POST Define Area /Topic/Hash tag text/ Geo coordinates or selected borders. SEARCH & FILTER Collect and filter hash tags and Sentiments relevant to the area.	VIEW INSTIGRAM UPLOAD Analyse map visualisation IDENTIFY ISSUE Recognise and describe Patterns and hotspots on the map visualisation.
Stakeholder Citizen , interest Groups, Planners	Stakeholder Municipality, researcher, people in charge of a specific project	Stakeholder Planner maker, municipality, researcher, Project Managers
		
OUTCOME Sea of Picture and hash tags	OUTCOME Filtered Pictures and hash tag selected its location.	OUTCOME Information about analysis and issues as input for further analysis and planning.

Figure 11: Scenario Social Media Map

3.2.3 DK03 Movement Tracker

The collection of data about how citizens use their neighbourhood and infrastructure is a challenge, often based on different context of a community underdevelopment. The motivation of community members to participate volunteering data one factor that needs to be enhanced or made easier. What is more is that factors specific to the context of the community, such as age groups, sociocultural settings, facilities and history of the area, are some of the key influencers of participation for providing movement data about a community. In addition most volunteering citizens prefer to be as comfortable with the process as possible and with little complexity in the methods of collecting data. This motivated planners to think of collecting data from volunteering citizens as they go about their day today activities. During the project preparation phase planners used physical maps on which citizens pasted stickers to indicate their movements in and about the area. After a number of citizen participation, patterns seemed to emerge, indicating common routs and frequently visited places and facilities. This meant that from the specified map key of questions, a number of specific paths used within the area emerged from an individual, however not all data can be fully mapped on a physical map. Not all movements can be represented by a given set of keys as movement is not pre-determined but takes place whenever required. GPS data generated at any

given point seems to be the most common form of collecting persistent movements of citizens through an area. The goal is to provide volunteering citizens with a mobile app that collects and stores geo-coordinate data about the movements, and builds an overlay of movement tracks over a street map to indicate the movements in the area. The application is could be downloaded and installed on the volunteer's mobile phone. The Citizens enables the GPS functionality on their phone and enables the application to begin tracking. A clear and simple interface with a map view of the area will be visualised to allow participants to monitor the functionality of the app. Here, citizens are provided with a tool that requires little intervention from urban planners and generates data as they go about their daily life. The goal was to engage groups of people as possible, and to generate data in the real-life setting of daily human activities. A clean, user friendly mobile app with a features for capturing GPS data with an interface for extracting data and sending it to a main server application used by planners to be visualised as movements patters over a map with different features, infrastructure and statistical data. The main challenges that have to be overcome is the implementation of a software design of a suitable GPS mobile tracking app that works with an map visualisation application/tool that integrates the movement patterns with existing data.

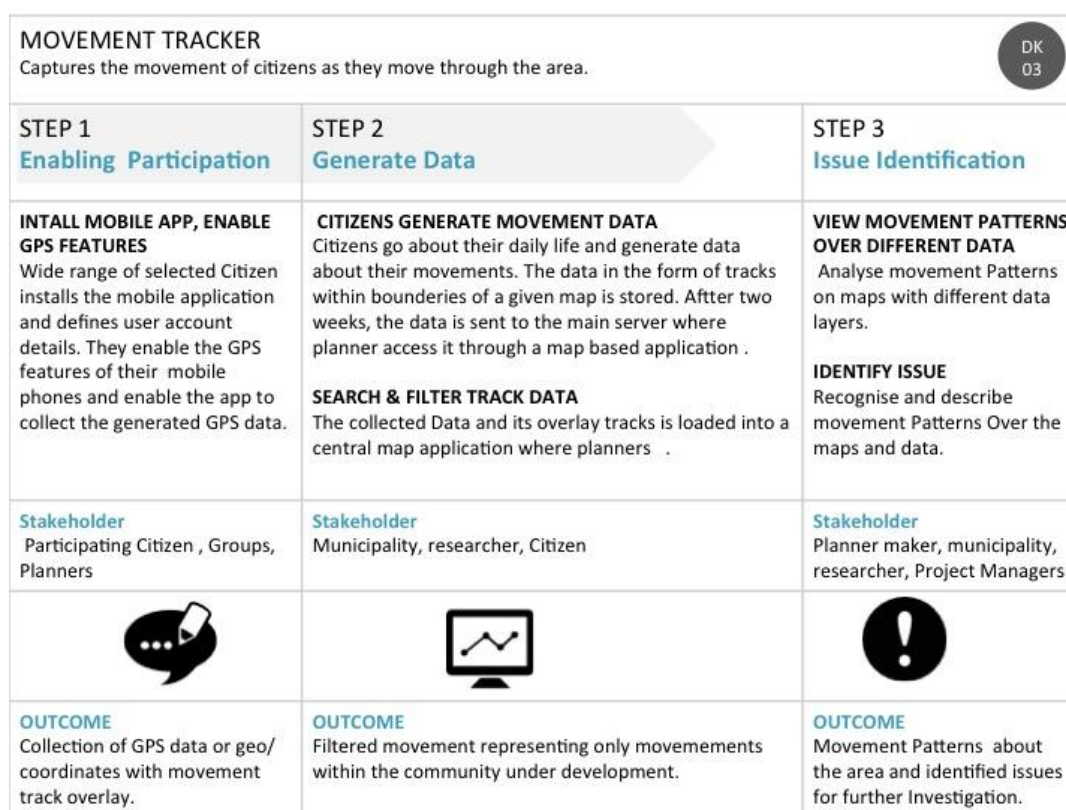


Figure 12: Scenario Movement Tracker

This concept is about the capturing data about how people move through the neighbourhood as they go about their daily activities. The movement tracker is allows citizens participating in the project preparation to generate data by installing a movement tracking app for their mobile phone and enabling GPS tracking on the phones to participate in generating data. Data generated in the forms

movement pattern over an of line map of the area, and is stored on the map. The participant using this app, go about their daily activities for about two weeks un interrupted, after which they meet with planners to provide the generated data from the app.

3.2.4 UK01 Social Media Browser

In meetings with council representatives on the subject of applying social media data to their work, it became clear that while they were enthusiastic about the possibility there was a lack of awareness of what social media could offer to Oxford, or exactly what was going on in social media which could have relevance to the city. This was the stimulation for the social media browser idea: a user friendly interface which would allow local government decision makers, or other interested parties, to quickly gain an impression of the content of social media platforms as they relate to Oxford. The main challenge in this concept is data collection and cleaning in order to narrow down the sample to the most relevant items. This concept is about a monitoring system which is based on the data collected from the social media by following certain tags and within the defined boundaries. Various outputs will be created in real time and visualised. The focus of the concept is on the content volume and the dynamics as well as the geographical aspects of the data. The output provides real time monitoring opportunities.





SOCIAL MEDIA BROWSER			
Monitoring and analyzing geo-located content produced in social media			
STEP 1 Content generation	STEP 2 Data Preparation	STEP 3 Visualisation	STEP 4 Analyzing (option)
Post, Share, Reshare, Like, flag, Tag, Favourite on various channels (social media, media, blogs)	Data Wrangling Transforming the raw data into structured tables Data Filtering To pick the most relevant pieces and filter out spurious data	Word Cloud Visualizing the trending concepts Volume Visualizing the volume of the concepts over time Map Mapping the density of the concept over geography	Sentiment analysis Multiple concepts and correlations Extract seasonality
Stakeholder Social media users	Stakeholder Researchers	Stakeholder Municipality, researcher, people in charge of a specific project	Stakeholder Municipality, researcher, people in charge of a specific project
			
Outcome Corpus of data	Outcome Structured Data	Outcome Maps and visual objects	Outcome Metrics and graphs

Figure 13: Scenario Social Media Browser

3.2.5 UK02 Urban Health Environment Visualiser – Visualising health related open data

Oxford Council representatives have cited a need for better evidence in the field of public health to help improve decision-making. For example, the decision to grant a new licence for a venue to sell alcohol or food is partly based on public health considerations, such as existing availability in the area. Equally, pollution concerns play a role in determining new transport routes. It would help council officials greatly in their work if they could access real time information about the existing status of the “urban health environment” to help them make these tough decisions. This concept is about a tool which allows real time monitoring of factors affecting public health in the urban environment. This includes both short term factors, such as pollution levels, and long term factors, such as the availability of alcohol and food. The Urban Health Environment Visualiser is based around a map and mainly open government data. A search box and drop down box (or other similar mechanism) would allow the user to select the type of issue area they are interested in (e.g. pollution), and the region they want to see (e.g. a sub area of Oxford). The map would then be overlaid with the relevant information. Further summary statistics would be presented in a text box outlining current trends and the sources of the data.




URBAN HEALTH ENVIRONMENT VISUALISER Monitoring opinions on media and Social Media to identify issues UK 02		
STEP 1 Content generation	STEP 2 Aggregate	STEP 3 Visualise
PUBLISH, POST, COMMENT on various channels (Social Media, media, blogs). HARVEST DATA from open data sources, social media	DEFINE TOPICS e.g. pollution SEARCH & FILTER Provide access to the information	VIEW SELECTED TOPICS Map based visualisation
Stakeholder Citizen, interest groups, media, the public, open data publishers	Stakeholder Municipality, researcher, people in charge of a specific topic areas	Stakeholder Opinion maker, thoughtleader, municipality, researcher, people in charge of a specific project
		
OUTCOME Body of information	OUTCOME Filtered information by issue area	OUTCOME Information about health context for a region

Figure 14: Scenario Urban Health Environment Visualiser

3.2.6 SE01 Past incident viewer

When an incident or crisis occurs in the City of Malmö the municipality is bound to handle it according to the law. Upon handling an incident or crisis the municipality and other stakeholders will generate data in internal applications, documents and various media channels on the course of events, how they were handled, decisions made and consequences. Today this data is generally just used to keep track and handle currently active incidents or crises. Representatives of Malmö Municipality have, however, cited an interest in being able to use this data for proactive decision-making as well. By exploiting the vast amount of data collected on past incidents and integrate it into a tool which would allow the user to query it based on attributes or spatial location, the operational decision makers would be able to make better decisions in specific situations.

The application is about a tool which allows decisions makers to search for past incidents or crises based on attributes or spatial location. Each occurred incident or crises generates data on the course of events, how it was handled, decisions made and consequences. Historical incidents data would therefore be beneficial to use as a basis for decisions in operational decision-making.

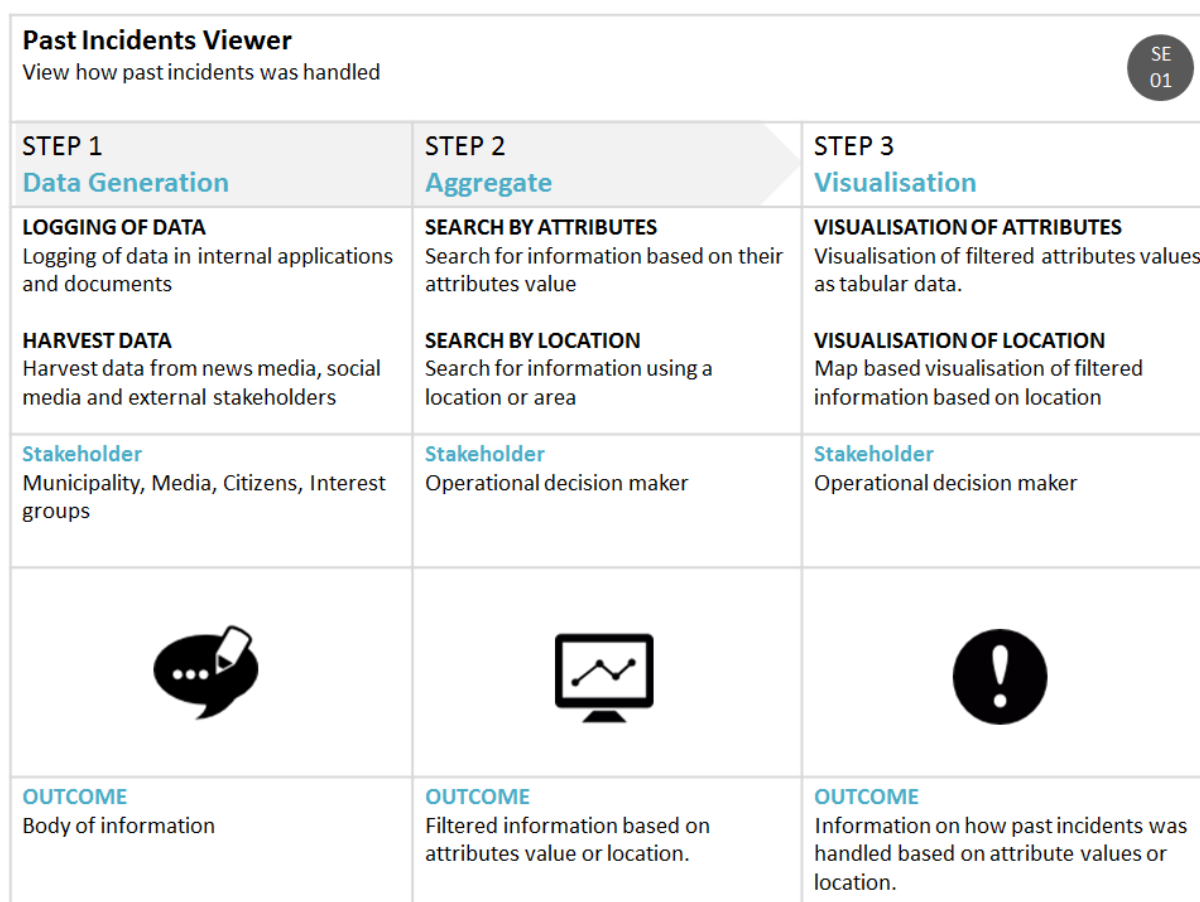


Figure 15: Scenario Past Incident Viewer

3.2.7 SE02 Important facility finder

When an incident or crisis occurs decision makers quickly need to make an assessment on how to handle it. As a part of the assessment an evaluation needs to be done on what public and private facilities might get affected and how it will affect the city as a whole. Today this assessment is generally based on a person's bound knowledge of the area. This means that if a decision maker has knowledge about important facilities in an area that might get affected by an incident or crisis, he or she will contact the person responsible for the facility and discuss how to handle possible consequences. This task is not only time consuming, but the decision maker might also miss out on important facility that might get affected by the incident or crises if he or she does not have knowledge about it. Representatives from Malmö Municipality have therefore cited a need for a tool which would allow them to base their assessment on actual information based on spatial location.

The concept is about a tool which allows decisions makers to find important facilities within a specific geographical area (buffer). When an incident or crises occurs in a city decision makers quickly needs to know which facilities that might get affected. The Important Facilities finder allows decision maker to find important facilities based on spatial location and network analysis.

Important Facilities Finder			
Extract information on facilities that might get affected by an incident or crises.			
STEP 1 Location	STEP 2 Analysis	STEP 3 Visualisation	STEP 4 Extract
MARK OUT LOCATION Mark out the location of the incident or crisis either manually in the map or by searching for an address	SET PARAMETERS Set parameters for buffer analysis based on selected location. EXECUTE ANALYSIS Execute analysis based on selected location and parameters	MAP Visualisation of important facilities which falls within the buffer zone in a map.	EXTRACT INFORMATION Extract information on important facilities based on the analysis into tabular data.
Stakeholder Municipality, Emergency Services, Police Authority	Stakeholder Municipality, Emergency Services, Police Authority	Stakeholder Municipality, Emergency Services, Police Authority	Stakeholder Municipality, Emergency Services, Police Authority
Outcome Spatial data on the incident or crisis	Outcome Spatial data on facilities that might get affected by the incident or crises.	Outcome Visualisation of facilities that might get affected by the incident or crises.	Outcome Information on facilities that might get affected by the incident or crises

Figure 16: Scenario Important Facilities Finder

3.2.8 AT01 Opinion Monitor/Trend Monitor – Identifying current urban topics and trends

The city of Vienna is investing to improve mobility and multimodal forms of transportation in the city. In autumn 2014 the Vienna Main Train Station opened and became fully operational. It is a new central hub linking all four major railway lines converging on Vienna from the North, East, West and South. The modern station offers significantly improved, principally international connectivity. In addition, the “Year of Walking” aims to promote walking in the City of Vienna. To raise safety, comfort, attractiveness and quality for pedestrians the year 2015 will bring a number of events, activities and campaigns, a Vienna Pedestrian City Map and related mobile applications, a Street Festival, the Walk21 Conference and the development of “pedestrian highways”. The trend monitor will allow live searches with individual (user defined) search terms in selected (social) media sources. The users can type different keywords in a search field and an automated process will simultaneously lead to the search results from different media sources. This allows real-time queries based on user-defined search terms, and the identification of how often certain topics are discussed.




TREND MONITOR		
Monitoring trendy topics on media and Social Media to identify issues		
AT 01		
STEP 1 Express Opinion	STEP 2 Monitor	STEP 3 Issue Identification
PUBLISH, POST, COMMENT on various channels (Social Media, media, blogs)	DEFINE KEYWORDS Topic /thematic area / location based SEARCH & FILTER Collect and filter relevant content	VIEW SELECTED ARTICLES & POSTS Read, analyse IDENTIFY ISSUES Prioritisation and selection
Stakeholder Citizen, interest groups, media, the public, experts, professionals, opinion maker, thoughtleader	Stakeholder Municipality, researcher, people in charge of a specific project or initiative	Stakeholder Municipality, researcher, people in charge of a specific project or initiative
		
OUTCOME Sea of information (articles, posts and comments)	OUTCOME Filtered posts and comments, topic and location specific, visualisations such as word clouds	OUTCOME List of relevant posts and articles about trending topics as input for planning and decision making processes

Figure 17: Scenario Trend Monitor

3.2.9 AT02 Organisation Follower – monitoring emergency organisations on Social Media (Emergency Multi Stream)

Starting in the late 1960s there have been numerous plans and suggestions of routings for a new subway line, namely the U5 by Vienna's public transportation provider Wiener Linien. Throughout several decades all these different projects have been shelved, until the construction of a new U5 metro line in Vienna has been announced in early 2014. The newest construction plan will affect several districts of Vienna through the necessary drilling operations over the coming 10 years. The Organisation Follower serves as a monitoring tool that works based on several pre-defined key-words that are related to selected organisations. A continuous monitoring of organisations will be granted through several online channels. This monitor allows interested stakeholders to identify relevant topics, figures and statistics from different organisations and can also provide notifications when a sudden increase in a specific topic occurs within the organization in combination with the alert component. Relevant organisations' activities can be monitored (e. g. from Facebook, Twitter, Official websites) from affected organisations (e.g. Wiener Linien – local public transport provider, construction companies, action groups, etc.) to identify and analyse news, current topics, updates, and initiatives by these organisations.




ORGANISATION FOLLOWER		
Multistreaming and monitoring activities of organisations through social media channels		
AT 02		
STEP 1 Define	STEP 2 Gather	STEP 3 Outcome Comprehension
DEFINE ORGANISATIONS Organization/Department DEFINE CHANNELS Social Media/Blogs/Websites DEFINE OTHER FILTER CONDITIONS e.g. time frame	SEARCH CONTENT Collect relevant content based on previously defined filters	VIEW SELECTED ARTICLES & POSTS Read & Analyse IDENTIFY ORGANISATIONAL NEWS & ACTIVITIES Select interesting aspects, news, new projects, updates, etc.
Stakeholder Municipality, researcher, people in charge of a specific project or initiative	Stakeholder Municipality, researcher, people in charge of a specific project or initiative	Stakeholder Municipality, researcher, people in charge of a specific project or initiative, decision maker
		
OUTCOME Relevant filters to gather useful information from organisations of interest	OUTCOME Different streams of filtered posts, comments, topics for each organization	OUTCOME Lists of aggregated and filtered news from organizations as input for the decision making process

Figure 18: Scenario Organisation Follower

3.2.10 AT03 Case and Measure Library

Within every city the quest for more energy efficiency has become a serious affair, this applies to every sector within urban areas ranging from transportation to educational institutes. Within the educational sector schools are leaving large ecological footprints which is why many cities start to aim at creating 'green schools'. Green schools are toxic free, energy efficient, sustainable, reduce and recycle waste, and teach environmental education. Also connected to green schools are clean and safe routes to schools. Ultimately, the goals of a green school are to measure and reduce its ecological footprint, while making the school environment healthier for students and staff, and getting the community thinking about solutions to the environmental problems.³ The aim of cities should be to improve the environmental health and ecological sustainability of schools, to catalyse and support "green" actions by kids, teachers, parents, and policymakers. In that way the ecological footprint of the whole city will also be reduced and awareness concerning energy consumption will be raised. The Case & Measure Library will include a collection of cases and policy measures for the operating staff in city governments and schools and support decision-making processes within these organisations. They can add their cases to the library to share and analyze measures for green schools with other cities.





CASE & MEASURE LIBRARY			
A library to support the sharing and analyzing of different cases and measures between cities			
STEP 1 Library Development	STEP 2 Case Data Collection	STEP 3 Measure Identification	STEP 4 Balance & Match
TOPIC IDENTIFICATION Urban related topics DEFINE DATABASE Structure	SURVEY CONDUCTION With affected stakeholders in the specific field and topic STATISTICS GATHERING Specific topic related figures	EXPERT MEASUREMENTS Survey conduction with experts in the fields BEST PRACTICES Collection of good examples and practices	VIEW GATHERED DATA Select & analyze MATCH Preferred measure with existing case
Stakeholder Municipality, researcher	Stakeholder Municipality, citizen, researcher	Stakeholder Topic experts, researcher, municipality	Stakeholder Municipality, decision makers, other public and private organisations
			
Outcome Case & measure library structure	Outcome Topic related cases	Outcome Case & topic related measures	Outcome Information about effective measures for specific cases

Figure 19: Scenario Case & Measure Library

³ Green Schools Initiative [online] Available at: <http://www.greenschools.net/> [Accessed April 2015]

3.2.11 AT04 Alert Sender

In May 2015 Vienna is going to host the 60th edition of the Eurovision Song Contest, a big European four-day music event going on in a Viennese event hall with the capacity to welcome 16.000 people⁴. Several public viewing locations will offer thousands of interested to follow the show and tourists from all over Europe are expected in the city. Planning and organisation of such a big event requires ideal conditions in transport, safety and logistics. The city is planning and working on capacities adjustments of the public transportation system, security and safety measures, the construction of the Eurovision-Village, marketing strategies, city branding and tourism campaigns. The Alert Sender can serve as a real-time notification application that can immediately inform or warn the user in case of specific happenings per E-mail or text message. The Alert Sender will become active when a particular threshold (e.g. keyword is mentioned x times, organisation or topic that has a certain number of hits or more) has been reached. Decision makers can be supported with instant and in some cases even location-based information from social media posts to identify happenings as early as possible and to be able to set the right reaction and steering measures on time.



ALERT SENDER	
A real-time monitoring tool that sends immediate alerts when a specified keyword appears or when a sudden happenings occur	
<div>AT 04</div>	
STEP 1 Define	STEP 2 Issue Identification & Alert
DEFINE KEYWORDS Country/ City / Event/ Topic DEFINE CHANNELS Social Media/ Official Websites/ Media DEFINE CRITICAL LEVELS Ratio between hits and alerts	VIEW SELECTED ARTICLES & POSTS Read & Analyse IDENTIFY ALERTING ISSUES Prioritisation and selection based on critical levels
Stakeholder Municipality, event organisers, security organisations	Stakeholder Municipality, event organisers, security organisations, decision makers
	
OUTCOME Filtered posts and comments, topic and location specific	OUTCOME Targeted Alerts on specific topics and opinions as input for decision makers

Figure 20: Scenario Alert Sender

⁴ Eurovision Song Contest 2015 in Vienna [online] Available at: <https://www.wien.gv.at/english/culture-istory/music/song-contest.html> [Accessed April 2015]

3.2.12 AT05 Open Mobility Data Visualiser

The city of Vienna is investing to improve mobility and multimodal forms of transportation in the city. The “Year of Walking” aims to promote walking in the City of Vienna. To raise safety, comfort, attractiveness and quality for pedestrians the year 2015 will bring the development of “pedestrian highways” – the Mariahilferstraße being the first example^{5,6}. Vienna's major shopping street Mariahilferstraße has already been undergoing the whole scale revitalization. In the past year the street has turned from car-busy street into pedestrians friendly. Advantages are broader sidewalks, new concepts for outdoor terraces and street cafes, more space for pedestrians, new seating areas, new lightning, Wifi installation, noise reduction, traffic calming, inclusive street design, etc. Other streets sections in different districts of Vienna will follow. The Open Mobility Data Visualizer can provide high-end intuitive visuals based on open data and user generated content. It will allow public access to dashboards that show key figures and visualisations of open data repositories especially in the fields of mobility and pedestrians.





OPEN MOBILITY DATA VISUALISER Application that provides intuitive, user friendly visuals of open data in the field of transport and mobility AT 05			
STEP 1 Open Data Collection	STEP 2 Tag New Data	STEP 3 Visualise	STEP 4 Analyse and Decide
IDENTIFY DATA REQUIREMENTS What data do I need for my investigation? IDENTIFY OPEN DATA SOURCES What data is available? COLLECT REQUIRED DATASETS In different formats and with attributes	ADD OWN DATA Tag georeferenced points of interest on the map ADD ATTRIBUTES Add further attributes and descriptions to the tag	PROCESS DATA Bring the data in a suitable structure ADD DATA Add the different open data layers to the map VISUALISE Create maps, charts, diagrams	ANALYSE Analyse the visualised data, identify spatial relationships, overlays, distribution, etc. DECIDE Use the collected and visualised data as input for decision making
Stakeholder Municipality, researcher	Stakeholder Citizens, officials	Stakeholder GIS expert, researchers, municipality, officials	Stakeholder Municipality, researchers, experts, decision makers
			
Outcome Structured Open Data Catalogue and list of web services	Outcome Additional georeferenced user generated content	Outcome User-Friendly visualisation in the form of maps, graphs, charts	Outcome Urban decisions based on data and experts

Figure 21: Scenario Open Data Visualiser

⁵ Mobilitätsagentur Wien, 2013. Das Radjahr 2013. Evaluierungsbericht zur Radkampagne der Stadt Wien, 36 p.

⁶ ORF News, 2015. 2015 soll Fußgängerjahr werden. *ORF News*, 03.01.2015. [online] Available at: <http://wien.orf.at/news/stories/2687396/> [Accessed March 2015]

3.2.13 AT06 Campaign Display

Similar to the “Year of Bikes” in 2013 in Vienna the “Year of Walking” aims to promote physical activity among the citizens of Vienna using a number of events, activities and campaigns. The vision and incentive of the city of Vienna is described as “You have to be able to walk through a city to experience it”. Measures carried-out by the city of Vienna are among others improvement of street crossings for pedestrians. Raise awareness and PR work on pedestrian traffic to enhance the image of walking, to contribute to a better coexistence of all road users and create a uniform signage for major pedestrian paths⁷. The Campaign Display Concept can enable organizations to monitor specific online awareness rising campaigns. This will provide helpful insights on statistics and enables organizations to react quickly or adapt an existing campaign based on citizen’s and expert’s feedback.


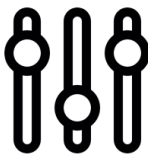

CAMPAIGN DISPLAY A tool that provides helpful insights on statistics to monitor campaigns and other public relation activities. <div>AT 06</div>		
STEP 1 Campaign Characteristics	STEP 2 Define Parameters	STEP 3 Outcome Analyzing
DEFINE PHRASE Claim or organisation-related term	DEFINE CHANNELS Social Media/Media/Blogs DEFINE PARAMETERS Views/Comments/Etc.	VIEW SELECTED ARTICLES & POSTS Read & Analyze IDENTIFY CHALLENGES & OPPORTUNITIES Prioritisation and selection
Stakeholder Affected organization, municipality, interest group	Stakeholder Affected organization, municipality, interest group, researcher	Stakeholder Affected organization, municipality, interest group, researcher, citizen
		
Outcome Campaign related phrase or claim that supports monitoring	Outcome Specific monitoring strategy	Outcome Feedback on campaign from the general public

Figure 22: Scenario Campaign Display

⁷ The year of the foot [online] Available at: <https://www.wien.gv.at/english/transportation-urbanplanning/year-of-the-foot.html> [Accessed April 2015]

3.2.14 AT07 Expert Integrator – integrate expert’s knowledge and advice

Vienna is currently one of the fastest growing cities in Europe⁸. Due to the influx of new inhabitants there is an increasing need for affordable housing. The vacancy of buildings has moved to the political agenda for city officials as well as local initiatives⁹. Some speculative numbers how many buildings are currently vacant range from 30.000 to 100.000 vacant lots but there is no up-to-date data available¹⁰. The last survey was conducted in 1996. Some local initiatives have been collecting geographical data on the location of vacant businesses and apartments, including ‘Leerstandsmelder’¹, an online platform crowdsourcing information about current vacancies or ‘vacant businesses’¹ (‘Leere Lokale’) by the Austrian chamber of economy, offering online information on vacant business premises. The city has been struggling for a long time now with how to manage and position itself concerning the vacancy of buildings. Especially in regards to real estate speculation, legal guidelines (‘vacancy tax’/‘Leerstandsabgabe’), innovative use concepts for vacant business lots on ground floors, and solutions towards turning vacant apartments into occupied ones.

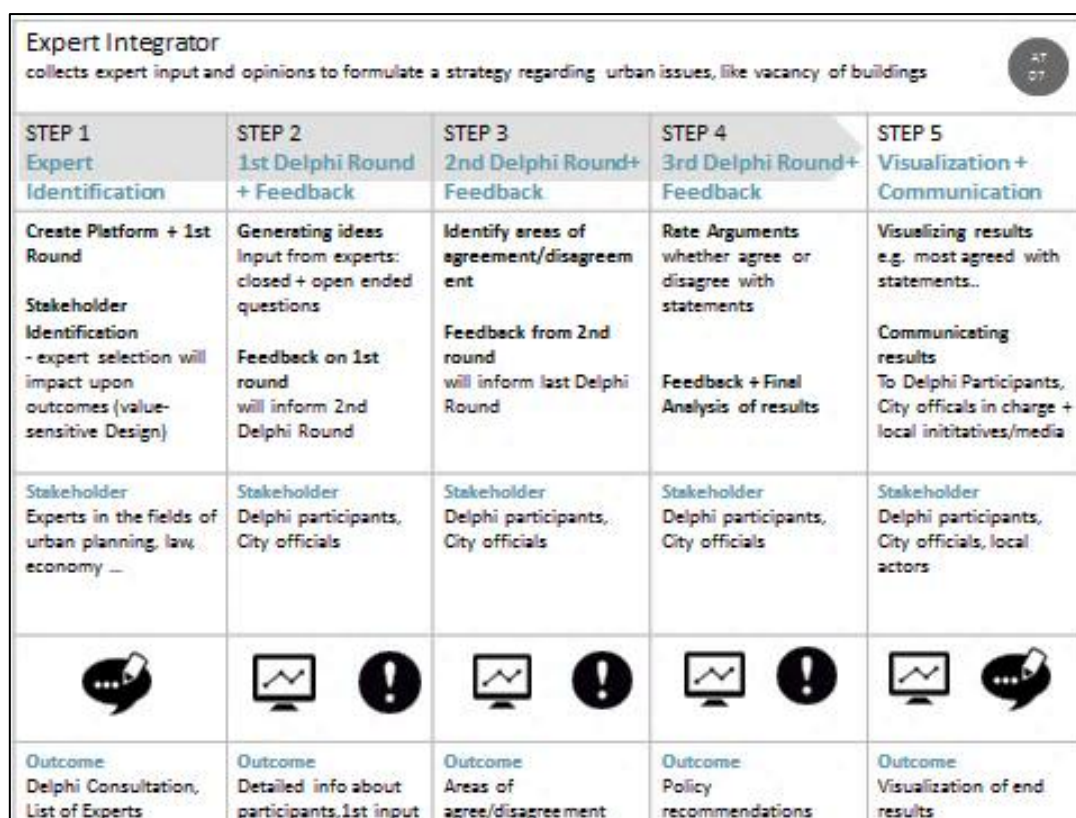


Figure 23: Scenario Expert Integrator

⁸ <https://www.wien.gv.at/english/transportation-urbanplanning/vienna-growing.html>

⁹ <http://derstandard.at/2000008436966/Wiener-Leerstand-wird-in-neuer-Studie-erhoben>

¹⁰ <http://derstandard.at/2000008017686/Haeupl-will-Leerstand-bei-Wiener-Wohnungen-wissen>

The expert integrator aims at collecting *expert knowledge* gathered through Delphi rounds from a diverse range of local and international stakeholders, e.g. city officials, architects, legal advisors. The compilation and presentation of expert knowledge should enable decision-makers to make well informed decisions and take actions concerning vacancy in Vienna. The expert integrator collects opinions and inputs from carefully selected experts on an urban issue. The method of Delphi rounds (multiple online consultations) is applied to collect and contrast information and opinions from experts who are immersed in the topic at hand (e.g. for vacancy of buildings a legal expert in real estate law). Issues of high agree-, or disagreement among experts as well as their suggestions for policy measures are made explicit after the third Delphi Round. In contrast to common surveys, Delphi surveys ask ‘what could or should be?’ instead of ‘what is?’ Typical elements of both Delphi types are *anonymity* to prevent groupthink and undue influence of vocal individuals and the possibility to *reassess previous views* based on insights provided by others. This tool allows experts to rate and rank comments or solutions.

3.2.15 AT08 Collective Deliberation (Argumentation Tree)

Vienna ranks as the second largest city in German speaking countries after Berlin, Germany. Especially due to foreign migration in the past two decades the city has grown to 1,8million inhabitants today. The city will continue to rapidly grow to 2 million inhabitants by 2030¹¹. Migration is one of the big societal challenges worldwide, causing widespread and controversial (political) debates. The fact is that a growing population with diverse cultural backgrounds raises challenging questions, for instance where is more local support in the form of information centres for immigrants needed? And what type of service do people need most urgently (e.g. legal advice, social support or medical information)? Other pressing issues concern an increasingly ageing population with migration background which calls attention to future needs of culture sensitive care options and facilities in Vienna. Challenges are how to better involve people who are concerned with local policy measures and include their expertise in decision-making.

The collective deliberation tool can serve as an online platform facilitating a structured debate on the basis of an argumentation tree. Whereas many collaborative online platforms such as wikis are a good choice for collecting and sharing knowledge, they have proven to be less successful to foster decision-making processes or collaborative deliberation, i.e. “the systematic enumeration, analysis, and selection of solution alternatives” (Klein & Iandoli 2008, 1). Online discussion forums often end up with a collection of too many and redundant arguments and provide no overview of the main statements. The Collective Deliberation Tool can enable large crowds to discuss big societal issues like migration and collectively decide how to best tackle issues that serves as meaningful input for decision-making processes. The online discussion is structured on the basis of an argumentation tree.

¹¹ <https://www.wien.gv.at/statistik/pdf/wien-waechst.pdf>

The tree continuously grows as users contribute issues, ideas or arguments in favour or against an idea. A rating of the arguments shows which ones are most or least accepted by participants.




COLLECTIVE DELIBERATION TOOL		
enables large scale bottom-up deliberation on topics		
AT 08		
STEP 1 Generate initial ideas	STEP 2 Contribute, Revise and Rate	STEP 3 Filter and Take Action
Creation + Dissemination of Platform on various channels, clarify time frame and aim of the platform Generating initial questions, statements, hypothesis Moderate + Structure Argumentation Process moderators delete repetitive arguments + spam	Contribute and Revise Ideas + Arguments possibility to add new statements and change own arguments Rate Arguments on a scale from (1) 'strongly agree' to (5) 'strongly disagree'	Filter Arguments all rated 'strongly agree' are filtered out Structure Arguments + Communicate to Crowd 'top arguments' are presented on platform as end results Communicating Arguments to Decision-Makers as input for decision-making process
Stakeholder Municipality, Application administrator	Stakeholder Crowd community (citizens, interest groups, initiatives), experts	Stakeholder Application administrator, decision-makers
		
Outcome Structured argumentation tree with initial topics	Outcome Elaborated argumentation tree with new and/or more in-depth ideas	Outcome Visualization of top ranked arguments

Figure 24: Scenario Collective Deliberation (Argumentation Tree)

3.2.16 AT09 Expert Pool – search for urban experts and advisors

Most of the times data alone as input for decision making processes is not enough. Decision making processes require the involvement of human experts who can analyse and interpret data visualisations in a right way based on their expertise and experience. Experts in UrbanData2Decide are professionals from different domains such as urban renewal experts, transportation planners, emergency experts, municipal planners, researchers, etc. Furthermore, we can also see citizens as on-site experts for happenings and needs in their neighbourhood. The expert pool is a database where people in charge of expert integration can search for suitable experts for specific topics and urban challenges such as in safety and security, urban renewal, mobility, etc. The experts can be categorised by theme, organisation, and country.





EXPERT POOL			
database where people in charge of expert integration can search for suitable experts for specific topics and urban challenges			
STEP 1 Setup	STEP 2 Add	STEP 3 Search	STEP 4 Contact
Setup database Structure: name, organisation, country, domain, contact information	Add Experts To the database	Identify problem in AT07 or AT08 where you want to involve experts Search for experts According to organisation, country, domain Select experts	Get in touch With selected experts through E-Mail or phone Invite them To join the discussion, rate, rank and provide comments
Stakeholder Municipality, database administrator	Stakeholder Municipality, database administrator	Stakeholder Municipality, database administrator	Stakeholder Municipality, database administrator, Experts
			
Outcome Expert database structure	Outcome Filled database with experts and contacts	Outcome List of selected experts	Outcome Experts contribution

Figure 25: Scenario Expert Pool

3.2.17 AT10 Picture and Video Monitor - Viewing city-related images and videos

What is the “image” of my city? How do people see it? What images and videos are related to my city? Not focusing only on text output but also aggregating graphical information about the city can further enrich the creation of a broad data and information base that serves as input for urban decision making. Organisations can use the Picture and Video Monitor to track images in real-time in social media (Instagram and You Tube). The user can have a feature to define a specific phrase like a city name or neighbourhood-related terms in combination with a series of parameters such as timeframe for when the content was published. Up from that point related content (images and videos) will be collected automatically and presented in an intuitive manner. Organisations like local municipalities or regional stakeholders will have the chance to go through the selection of the visual representation of their city or neighbourhood. Also metadata such as the number of hits can be visualised. To narrow the result the images and videos can be selected and ranked for example by the number of likes, by publishing date, etc.




PICTURE AND VIDEO MONITOR Monitoring pictures and videos on Social Media to identify issues		
<div>AT 10</div>		
STEP 1 Express Opinion	STEP 2 Monitor	STEP 3 Issue Identification
PUBLISH PICTURES AND VIDEOS on Instagram and YouTube	DEFINE KEYWORDS Topic /thematic area / location based SEARCH & FILTER Collect and filter relevant content	VIEW SELECTED PICTURES AND VIDEOS Watch, analyse IDENTIFY ISSUES Prioritisation and selection
Stakeholder Citizen, interest groups, media, the public	Stakeholder Municipality, researcher, people in charge of a specific project	Stakeholder Opinion maker, thoughtleader, municipality, researcher, people in charge of a specific project
		
OUTCOME Sea of information (videos and pictures)	OUTCOME Filtered pictures and videos, topic and location specific, visualisations	OUTCOME Information about what pictures and videos show about a city or neighbourhood

Figure 26: Scenario Picture and Video Monitor

4 OUTLOOK

The work package (WP) 2 on Basic Exploration, Stakeholder Studies and Requirement Analysis created the scientific fundament of the project and produced essential knowledge for the conceptualisation of UrbanData2Decide. Task 2.5 brought together the previous research results and elaborated an integrated research model as well as a stakeholder requirements catalogue with first use case scenarios. In this integrated deliverable previous results of WP2 were combined to define a first blueprint for the UrbanData2Decide system as it will be developed later in the project.

In a next step each team provides version 2 descriptions of the concepts including scenarios for decision-support, detailed elaboration of required functions and features, descriptions of the stakeholders, a catalogue of required data, available datasets, feeds, OGD catalogues and APIs, and updated user stories. The written description of the concepts is supported by easy to understand visualisations in the form of sketches, wireframes or mockups that show what the interface design can look like. In addition, the different concepts will be analysed, compared to derive detailed use cases for the UrbanDataVisualiser and the UrbanDecisionMaker. This is going to happen in WP3 – the method modeling, visualisation design, and framework elaboration.

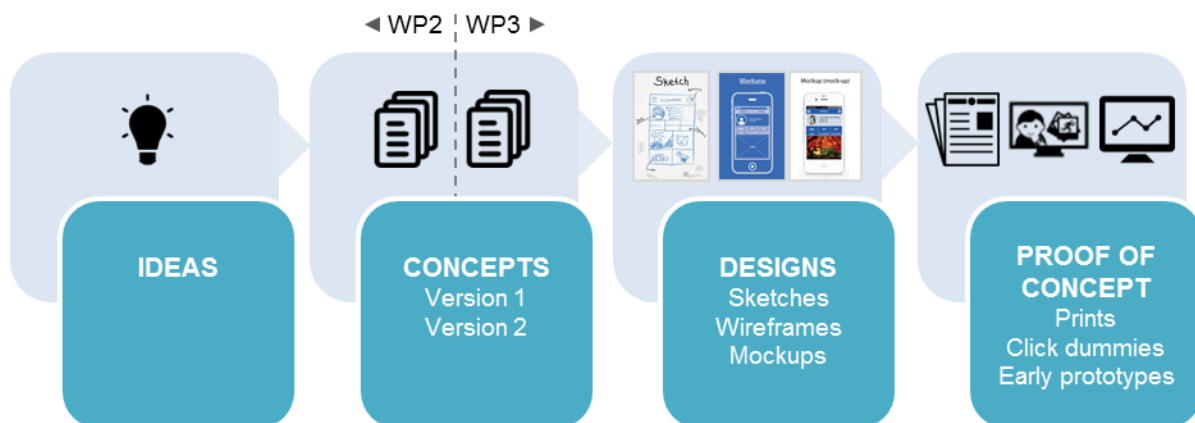


Figure 27: Workflow from idea creation to proof of concepts

Components of the concepts will be demonstrated in WP4 – the Proof-of-Concept and Demonstrator Implementation – either on paper using sketches, wireframes, mockups, or by demonstrating click dummies or early prototypes that show the functionalities using real data. Testing with end users, i.e. mainly city representatives, will happen in WP5 – Demonstration and Validation.

REFERENCES

- Bright, J., Neuschmid, J., Atz, U., 2015. Social and Open Data Visualisation Methods and Data Source Report. Deliverable 2.1 of the UrbanData2Decide project. 75p.
- Bundeskanzleramt Österreich, n.d. Offene Daten Österreichs. *Open Government Data Catalogue Austria* [online] Available at: <https://www.data.gv.at/> [Accessed February 2015].
- City of Vienna, 2014. *Die neue Mariahilferstraße: der Ablauf* [online] Available at: <http://www.dialog-mariahilferstrasse.at/projekt/der-ablauf/> [Accessed February 2015].
- Ddamba, J. et al., 2015. Urban Decision-making and Expert Integration Report. Deliverable 2.2 of the UrbanData2Decide project. 63p.
- David, K., & Patterson, D. , 2012. *Ethics of Big Data: Balancing risk and innovation*. Sebastopol: O'Reilly Media, Inc.
- Dobner, S., Voigt, C., 2015. Social, ethical and legal aspects of big data and urban decision. Deliverable 2.4 of the UrbanData2Decide project. 49p.
- European Union, 2011. Cities of Tomorrow: Challenges, visions, ways forward.
- Ferro, E. and Osella, M., 2013. Eight Business Model Archetypes for PSI Re-Use. Open Data on the Web Workshop 23rd-24th April 2013, Google Campus, Shoreditch, London.
- Ginsberg, J., Mohebbi, M. H., Patel, R. S., Brammer, L., Smolinski, M. S. and Brilliant, L., 2008. Detecting influenza epidemics using search engine query data. *Nature*, 457, 19 February 2009, doi:10.1038/nature07634.
- Gomide, J., Veloso, A., Meira, W., Almeida, V., Benevenuto, F., Ferraz, F. and Teixeira, M., 2011. Dengue surveillance based on a computational model of spatio-temporal locality of Twitter. In *Proceedings of the 3rd International Web Science Conference (WebSci '11)*. ACM, New York, NY, USA, Article 3, 8 pages.
- Government of the United Kingdom, n.d. *Open Data Catalogue* [online] Available at: <http://data.gov.uk/> [Accessed February 2015].
- Hendriks, F., 2014. Understanding Good Urban Governance: Essentials, Shifts, and Values. *Urban Affairs Review* (50/4), pp. 553 – 576.
- Huijboom, N., Van der Broek, T., 2011. Open data: an international comparison of strategies. *European Journal of ePractice*. No. 12 March/April 2011.

Kauppinen, T., 2012. *Linked Science* [online] Available at: <http://linkedscience.org/data/> [Accessed February 2015].

Kingston, R.; D. Babicki, J. Ravetz, 2005. Urban Regeneration in the Intelligent City. *Proceedings of the 9th International Conference on Computers in Urban Planning and Urban Management*.

Kitchin, R., 2013. Big Data and Human Geography: Opportunities, Challenges and Risks, *Dialogues in Human Geography*, 3, p 262.

Klein, M., Iandoli, L., 2008. Supporting Collaborative Deliberation Using a Large-Scale Argumentation System.

Krupa, Y., Vercouter, L., 2010. Contextual Integrity and Privacy Enforcing Norms of Virtual Communities. *Security and Privacy*, 2006 IEEE Symposium, p. 15 - 198.

Lazer, D., Kennedy, R., King, G. and Vespignani, A., 2014. The Parable of Google Flu: Traps in Big Data Analysis. *Science*, 343 (6176), pp. 1203-1205.

Leigh Star S. and Griesemer J. R., 1989, *Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkely's Museum of Vertebrate Zoology, 1907-39*, *Social Studies of Science*, volume 19, issue 3, august 1989, pp. 387-420

May, T., Jarvi-Nykanen, T., Minken, H., Ramjerdi, F., Matthews, B., Monzón, A., 2001. Cities Decision-Making Requirements. Deliverable No. 1, Prospects Project, 5th EU Framework. Available at: <http://www.ivv.tuwien.ac.at/forschung/projekte/international-projects/prospects-2000.html>, [Accessed April 2015].

Open Knowledge Foundation, n.d. *Europe's Public Data Portal* [online] Available at: <http://publicdata.eu/> [Accessed February 2015].

OXIS, 2013. OxIS 2013 Report: Cultures of the Internet. [online] Available from: <http://oxis.oii.ox.ac.uk/reports/> [Accessed March 2015].

Schrenk, M., Neuschmid, J., and Patti, D., 2011. Towards Resilient Cities: Harmonisation of Spatial Planning Information as one step along the way. In: B. Murgante et al. (Eds.) *ICCSA 2011*, pp. 162-171, Berlin Heidelberg.

Solove, D., 2002. Conceptualizing Privacy. *California Law Review*, 90(4), p. 1087-1155.

Rasmusson, M. et al., 2015. Stakeholders, Roles, Workflows and Requirements Report. Deliverable 2.3 of the UrbanData2Decide project.

Signorini, A., Segre, A. M. and Polgreen, P. M., 2011. *The use of Twitter to track levels of disease activity and public concern in the US during the influenza A H1N1 pandemic*. PloS one 6.5 (2011): e19467.

UN Habitat, 2001. Tools to Support Participatory Urban Decision-making. *Urban Governance Toolkit Series*, Nairobi.

Westin, A., 2003. Social and Political Dimensions of Privacy. *Journal of Social Issues*, 59(2), p. 431-453.

WHO – World Health Organisation, 1998. *The WHO Health Promotion Glossary*. [online] Available at: <http://www.who.int/healthpromotion/about/HPG/en/> [Accessed February 2015].

Online:

URL 1: <http://www.its.leeds.ac.uk/projects/konsult/public/level1/sec04/>

URL 2: <http://www.ivv.tuwien.ac.at/forschung/projekte/international-projects/prospects-2000.html>

URL 3: <http://theodi.org/guides/what-open-data>

URL 4: <http://thegovlab.org/open-data-whats-in-a-name/>

ANNEX: CATALOGUE OF USER STORIES

This is a comprehensive list of user stories based on the concepts as well as WP2 deliverables. In a further step they will be refined and prioritised using categories such as “must”, “should”, “nice to have”.

ID	Theme	Source	As a/an	I want to...	so that...
DK01-1	Data Tracker	D2.3 ITU	Municipal planner	combine qualitative and quantitative data from different data sources	I can get a full and holistic picture
DK01-2	Data Tracker	DK01	Municipal planner	access a database showing all available data and sources	I can have an overview on what data exists
DK01-3	Data Tracker	DK01	Municipal planner	define keywords and criteria, i.e. filter conditions	I can perform advanced search
DK01-4	Data Tracker	DK01	Municipal planner	refine my search (i.e. apply additional filter conditions, or edit existing ones)	I can prioritize, narrow and filter for more relevant descriptions to the investigated issue and data
DK01-5	Data Tracker	DK01	Municipal planner	save filter conditions	I do not need to select the particular items again when opening the module later on
DK01-6	Data Tracker	DK01	Municipal planner	submit a request for the data via e-mail or even telephonically from the internal or external source	I can receive data from different internal and external sources
DK02-1	Social Media Map	DK02	Municipal planner	define keywords and criteria, i.e. filter conditions	I can search, filter, explore data coming from Social Media
DK02-2	Social Media Map	DK02	Municipal planner	refine my search (i.e. apply additional filter conditions, or edit existing ones)	I can prioritize, narrow and filter for more relevant descriptions to the investigated issue and data
DK02-3	Social Media Map	DK02	Municipal planner	save filter conditions	I do not need to select the particular items again when opening the module later on
DK02-4	Social Media Map	DK02	Municipal planner	have a map	I can see georeferenced data (Instagram photos, tags) on a map
DK02-5	Social Media Map	DK02	Municipal planner	have tables, graphs and charts	I can see statistics
DK02-6	Social Media Map	D2.3 ITU	Municipal planner	combine qualitative and quantitative data from different data sources	I can get a full and holistic picture
DK03-1	Movement	DK03	Volunteer Citizen	create a profile	I can use the Movement Tracker App and

	Tracker				generate movement data
DK03-2	Movement Tracker	DK03	Volunteer Citizen	turn on GPS	I can generate location based data
DK03-3	Movement Tracker	DK03	Municipal planner	filter data	I can limit it to specific coordinate boundaries of the community, so as not to store data generated from longer distances out bound from the community over metros, bike or car.
DK03-4	Movement Tracker	DK03	Municipal planner	view movement data	I can see a series of line tracks over a map
DK03-5	Movement Tracker	DK03	Municipal planner	analyse movement data	I can identify movement patterns within the city and analyse it together with additional data from other sources in order to identify issues and optimise transport and mobility planning infrastructure
UK01-1	Social Media Browser	UK01	Policy Maker	have a search box to specify keywords that I would like to see displayed	I can see how certain issues are discussed or presented on social media
UK01-2	Social Media Browser	UK01	Policy Maker	see a word cloud	see the top words present in social media content for the current date range or search term
UK01-3	Social Media Browser	UK01	Policy Maker	refine my search by clicking on one of the words in the word cloud	I can look at only social media content containing one specific word
UK01-4	Social Media Browser	UK01	Policy Maker	see graphs	I get displayed the over time evolution of the currently displayed or selected social media content
UK01-5	Social Media Browser	UK01	Policy Maker	see a map	I get displayed the geographical location of the social media content
UK01-6	Social Media Browser	UK01	Policy Maker	have semantic analysis functions	I have the ability to automatically analyse the sentiment of social media content
UK01-7	Social Media Browser	UK01	Policy Maker	have comparison functions	I can compare different keywords / geographical regions
UK01-8	Social Media Browser	UK01	Policy Maker	have a map with overlay functions	I can combine Social Media Data with open data about different regions in the city
UK02-1	Urban Health Environment Visualiser	UK02	Policy Maker	select the type of issue area (topic) I am interested in and the region	I can overlay layers on a map and see content for my area and topic of interest
UK02-2	Urban Health	UK02	Policy Maker	see summary statistics (tables, graphs,	I can use the data to identify current trends

	Environment Visualiser			charts)	
SE01-1	Past incident Viewer	D2.3	Official in Standby	add data to the map	I can enrich the map/geodatabase with data from occurring incidents
SE01-2	Past incident Viewer	D2.3	Official in Standby	log information about an event or incident, activities and decisions made	I can enrich the map/geodatabase with data from occurring incidents
SE01-3	Past incident Viewer	SE01	City Office Administration	query data coming from different sources based on attributes and spatial location	I can see spatial relationships between certain incidents and their location
SE01-4	Past incident Viewer	D2.3	City Office Administration	do Hot Spot Analysis	I can identify clusters of crime
SE01-5	Past incident Viewer	D2.3	City Office Administration	set the span of time that I want to study to visualise data over time	I can visualise and studying changes over time in a map, graph or a timeline
SE01-6	Past incident Viewer	D2.3	City Office Administration	have a fully interactive timeline	I can add or change events and decisions made related to the incident or crisis on the timeline
SE01-7	Past incident Viewer	SE01	City Office Administration	search for past incidents based on own search terms and keywords	I can see in incidents that are interesting for me in a list
SE01-8	Past incident Viewer	SE01	City Office Administration	to search for past incidents based on the location, i.e. by drawing a geometrical shape anywhere on the map	any incident which falls within the geometrical shape will become visible as a point in the map.
SE01-9	Past incident Viewer	SE01	City Office Administration	have a filter function	I can search for either closed data from the municipality or open data (incl. Social Media Data)
SE01-10	Past incident Viewer	D2.3	City Office Administration	categorize the search results based on certain attributes	I can focus on specify attributes of the data
SE01-11	Past incident Viewer	D2.3	City Office Administration	have the possibility to create a private session where one stakeholder could invite other stakeholders	I can share information in real time
SE02-1	Important Facility Finder	D2.3 SE02	Official in Standby	see a table of content and turn on and off different thematic layers	I can show different thematic layers and support affected stakeholders with spatial information during the events of an incident or a crisis
SE02-2	Important Facility Finder	D2.3 SE02	Official in Standby	search for a location	I can mark out specific points or areas of interest when an incident occurs
SE02-3	Important Facility Finder	D2.3 SE02	Official in Standby	create a buffer around a selected point of interest (network analysis)	I can set a buffer distance to assess which activities that will get affected by a specific incident based on the selected location
SE02-4	Important	D2.3	Official in	to do an interpolation analysis	I can predict areas which will get affected by

	Facility Finder		Standby		heavy rainfall
SE02-5	Important Facility Finder	D2.3	City Office Administration	to do Hot Spot Analysis	I can identify clusters of crime
AT01-1	Top Topics	AT01	Municipal planner	have a search box to specify keywords or hashtags that I would like to see displayed	I can see how certain issues are discussed or presented on social media
AT01-2	Top Topics	AT01	Municipal planner	define filter conditions: chose a topic category from a predefined list	I can perform advanced search
AT01-3	Top Topics	AT01	Municipal planner	define filter conditions: chose media channel/streams from a predefined list	I can perform advanced search
AT01-4	Top Topics	AT01	Municipal planner	define filter conditions: chose a language from a predefined list	I can perform advanced search
AT01-5	Top Topics	AT01	Municipal planner	define filter conditions: chose the span of time (date range) from a calendar (from-to)	I can visualise and studying changes over time in a map, graph or a timeline
AT01-6	Top Topics	AT01	Municipal planner	refine my search (i.e. apply additional filter conditions, or edit existing ones)	I can prioritize, narrow and filter for more relevant descriptions to the investigated issue and data.
AT01-7	Top Topics	AT01	Municipal planner	sort results ascending (e.g. date, number of likes, number of comments)	I can see most recent posts or posts with the highest number of likes
AT01-8	Top Topics	AT01	Municipal planner	save filter conditions	I do not need to select the particular items again when opening the application later on
AT01-9	Top Topics	AT01	Municipal planner	have an overview of all search results (text lists)	I can see what posts have been made on a specific topic on different social media channels
AT01-10	Top Topics	AT01	Municipal planner	go to original source by clicking on the post	I can read more about the issue
AT01-11	Top Topics	AT01	Municipal planner	see a the total number of hits/posts	I can decide to choose to narrow or widen my search
AT01-12	Top Topics	AT01	Municipal planner	see the number of likes per post	I can identify the posts that gets high attention by the public
AT01-13	Top Topics	AT01	Municipal planner	see the number of comments per post	I can identify the posts that gets high attention by the public
AT01-14	Top Topics	AT01	Municipal planner	see most frequent sources	I can see where (on which channel) my topic is discussed the most
AT01-15	Top Topics	AT01	Decision Maker	see tables	I can see statistics about prominent topics
AT01-16	Top Topics	AT01	Decision Maker	see graphs and charts (e.g. stream	I get displayed the over time evolution of the

				graph)	currently displayed or selected social media content
AT01-17	Top Topics	AT01	Decision Maker	see a word cloud	I see the top words present in social media content for the current date range or search term
AT02-1	Organisation Follower	AT02	Municipal planner	aggregate news from different organisations (e.g. emergency organisations)	I get an overview on how organisations appear on which channels
AT02-2	Organisation Follower	AT02	Municipal planner	have a search box to specify organisations names or hashtags that I would like to see displayed	I can see how certain organisations are discussed or presented on social media
AT02-3	Organisation Follower	AT02	Municipal planner	define filter conditions: chose media channel/streams from a predefined list	I can perform advanced search
AT02-4	Organisation Follower	AT02	Municipal planner	define filter conditions: chose a language from a predefined list	I can perform advanced search
AT02-5	Organisation Follower	AT02	Municipal planner	define filter conditions: chose the span of time (date range) from a calendar (from-to)	I can visualise and studying changes over time in a map, graph or a timeline
AT02-6	Organisation Follower	AT02	Municipal planner	refine my search (i.e. apply additional filter conditions, or edit existing ones)	I can prioritize, narrow and filter for more relevant descriptions to the investigated issue and data.
AT02-7	Organisation Follower	AT02	Municipal planner	save filter conditions	I do not need to select the particular items again when opening the module later on
AT02-8	Organisation Follower	AT02	Municipal planner	have an overview of all search results (text streams)	I can see what posts have been made on a specific topic on different social media channels
AT02-9	Organisation Follower	AT02	Municipal planner	sort results ascending (e.g. date, number of likes, number of comments)	I can see most recent posts or posts with the highest number of likes
AT02-10	Organisation Follower	AT02	Municipal planner	go to original source by clicking on the post	I can decide to choose to narrow or widen my search
AT02-11	Organisation Follower	AT02	Municipal planner	see a the total number of hits/posts, likes per post, comments per post, most frequent sources and publishers	I can identify the posts, topics and organisations that get high attention by the public
AT04-1	Alert Sender	AT04	Municipal planner	set alerts for specific keywords (turn on/off) and the critical number of posts or comments on a specific topic or by a specific organisation	I get informed by E-Mail

AT04-2	Alert Sender	AT04	Municipal planner	have an alert overview in the form of a list	I can see previous and current alerts
AT04-3	Alert Sender	AT04	Decision maker	have the alerts displayed in a graphic way (charts, timeline, ...)	I can see how many alerts occurred when
AT05-1	Open Data Emergency App	AT05	Citizen or official	have basic map functionalities such as zoom in/zoom out, pan, information when clicking on a POI	I can navigate on the map
AT05-2	Open Data Emergency App	AT05	Citizen or official	see a table of content and turn on and off different thematic layers	I can show different thematic layers and support affected stakeholders with spatial information during the events of an incident or a crisis
AT05-3	Open Data Emergency App	AT05	City Office Administration	add additional open data layers to the map	I can see the location of different points of interest (e.g. police stations, hospitals, etc.)
AT05-4	Open Data Emergency App	AT05	Citizen or official	search for a location	I can mark out specific points of interest when an incident occurs
AT05-5	Open Data Emergency App	AT05	City Office Administration	connect to other services (e.g. Organisation Follower /Emergency Multi Stream)	I can see what is going on Social Media
AT07-1	Expert Integrator	AT07	Municipal planner	get expert's input / opinion on specific data and analysis	to make better decisions
AT07-2	Expert Integrator	AT07	Municipal planner	start a first delphi round	I can get experts answers on a specific issue
AT07-3	Expert Integrator	AT07	Municipal planner	prepare statements, questions or visuals	I can ask experts in a structure way
AT07-4	Expert Integrator	AT07	Municipal planner	select experts from the expert pool	I can ask the right experts for my specific issue
AT07-5	Expert Integrator	AT07	Municipal planner	contact the experts by E-Mail or text message	I can reach them and get a fast reply
AT07-6	Expert Integrator	AT07	Expert	see initial statements, questions or visuals	I can support with my expertise
AT07-7	Expert Integrator	AT07	Expert	click on the contribution button	I can contribute to the discussion with one statement
AT07-8	Expert Integrator	AT07	Expert	have a free text box	I can add comments
AT07-9	Expert	AT07	Expert	agree or disagree with statements	I can express my opinion on statements

	Integrator				
AT07-10	Expert Integrator	AT07	Expert	have a rating function	I can rate arguments on a scale from 1(strongly agree), 2(agree), 3(neither agree nor disagree), 4(disagree) to 5(strongly disagree)
AT07-11	Expert Integrator	AT07	Municipal planner	be able to choose to be notified via E-Mail in case a new statement has been made	I do not miss any new contributions
AT07-12	Expert Integrator	AT07	Decision maker	have the results displayed in a graphic way (tables, charts, ...)	I can quickly understand the results
AT07-13	Expert Integrator	AT07	Decision maker	sort statements according to agreement, rating, number of comments or date	I have a better overview
AT07-14	Expert Integrator	AT07	Municipal planner	start an additional delphi round (second, third,...)	I can get experts answers on a specific issue
AT08-1	Expert Integrator	AT08	Expert and Municipal Planner	have a argumentation tree	I can brainstorm and collect various ideas
AT08-2	Argumentation tree	AT08	Expert	have a short legend on the left hand side of the platform	I get information about the structure of the argumentation tree
AT08-3	Argumentation tree	AT08	Expert and Municipal Planner	start new issues or add issues to existing trees by clicking on "add your issues"	I can add own ideas / arguments to the argumentation tree
AT08-4	Argumentation tree	AT08	Expert and Municipal Planner	have a search function	I can quickly navigate the tree and read the argumentation of my topic of interest
AT08-5	Argumentation tree	AT08	Expert	have a rating function	I can rate arguments on a scale from 1(strongly agree), 2(agree), 3(neither agree nor disagree), 4(disagree) to 5(strongly disagree)
AT09-1	Expert pool	AT09	Municipal planner	search for experts in a database according to different domains	I can find the right experts to invite them to participate in AT07 (Expert integrator) or AT08 (Argumentation tree)and share their knowledge
AT09-2	Expert pool	AT09	Municipal planner	have the search results displayed in the form of a list of experts	I have an overview on relevant experts
AT09-3	Expert pool	AT09	Municipal planner	have tables, graphs and charts	I can see statistics about the number of relevant experts
AT09-4	Expert pool	AT09	Municipal planner	export the search results to any Microsoft Office format, Open Office format, PDF	I can share it with others

AT09-5	Expert pool	AT09	Municipal planner	sort the experts by domain	I can filter the results
AT09-6	Expert pool	AT09	Municipal planner	sort the experts by average answer time	I can filter the results
AT09-7	Expert pool	AT09	Municipal planner	sort the experts by the date of last activity	I can filter the results
AT10-1	Picture and Video Monitor	AT10	Municipal planner	have a search box to specify keywords or hashtags that I would like to see displayed	I can see how certain issues are discussed or presented on social media
AT10-2	Picture and Video Monitor	AT10	Municipal planner	define filter conditions: chose a topic category from a predefined list	I can perform advanced search
AT10-3	Picture and Video Monitor	AT10	Municipal planner	define filter conditions: chose media channel/streams from a predefined list	I can perform advanced search
AT10-4	Picture and Video Monitor	AT10	Municipal planner	define filter conditions: chose a language from a predefined list	I can perform advanced search
AT10-5	Picture and Video Monitor	AT10	Municipal planner	define filter conditions: chose the span of time (date range) from a calendar (from-to)	I can visualise and studying changes over time in a map, graph or a timeline
AT10-6	Picture and Video Monitor	AT10	Municipal planner	refine my search (i.e. apply additional filter conditions, or edit existing ones)	I can prioritize, narrow and filter for more relevant descriptions to the investigated issue and data.
AT10-7	Picture and Video Monitor	AT10	Municipal planner	sort results ascending (e.g. date, number of likes, number of comments)	I can see most recent posts or posts with the highest number of likes
AT10-8	Picture and Video Monitor	AT10	Municipal planner	save filter conditions	I do not need to select the particular items again when opening the application later on
AT10-9	Picture and Video Monitor	AT10	Municipal planner	have an overview of all images and videos that were found	I can see what pictures and videos have been published on a specific topic on different social media channels
AT10-10	Picture and Video Monitor	AT10	Municipal planner	go to original source by clicking on the picture or video	I can read the metadata of the picture or video (author, date, etc.)
AT10-11	Picture and Video Monitor	AT10	Municipal planner	see a the total number of hits	I can decide to choose to narrow or widen my search
AT10-12	Picture and Video Monitor	AT10	Municipal planner	see the number of likes per picture or video	I can identify the pictures or videos that gets high attention by the public
AT10-13	Picture and Video Monitor	AT10	Municipal planner	see the number of comments per picture or video	I can identify the posts that gets high attention by the public

GENER AL01	General requirements	AT01, DK02, D2.3 MU	User	log in /log	I can access the system
GENER AL02	General requirements	AT01, DK02	User	select interface language	I can understand the system
GENER AL03	General requirements	AT01	User	do account settings (user rights, privacy, create/manage/customise/delete accounts)	I can personalise the system according to my needs
GENER AL04	General requirements	DK01	User	have meta description for the data that capture not only the type and structure of the data but also location, and annotations using themes and keyword, that can be extended by the team members	I can search, filter, explore data coming from different sources
GENER AL05	General requirements	D2.3 MU	User	use my smartphone, tablet and computer	I can access the standby functions from different (mobile) devices
GENER AL06	General requirements	D2.3 MU	User	have some functions of the application to be usable in an offline mode	I can work from anywhere at anytime
GENER AL07	General requirements	D2.3 MU	User	the possibility to create a private session where one stakeholder could invite other stakeholders	I can share information in real time
GENER AL08	General requirements	SE01 SE02	User	export the results to e.g. Microsoft Office format, Open Office format, PDF or PNG	I can share it with others