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Design of location-enabled e-government services

European Union Location Framework

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Contents

Abstract

This document provides guidance on the design of location enabled e-Government services. It is part of the European Union Location Framework (EULF) toolkit that helps Member States to improve the use of location information in the context of e-Government. The document explains what location enabled e-Government services are, and how they can support the many G2G, G2B and G2C process interactions. Examples are given for the different types of e-Government services: information, contact, transaction, participation and data transfer services (Bekkers, 2007a). The document also provides an approach to describe and document e-Government business processes as a starting point for identifying where location enabled e-Government services could add value to the process by using process modelling techniques and standards. Finally, the document explains in detail the organisational and technological aspects related to the design, implementation and evaluation of location enabled e-Government services. A series of recommendations are provided in the form of 'to-do's' and 'not-to-do's'. Examples are given throughout the text to illustrate best practices.

This document should be read in conjunction with the companion guidance document "*EULF Improving the use of location information in e-government processes: methodology and use case*", which provides a methodology and worked example of improving an existing process.

Keywords: location information, e-government services, BPMN

1 Introduction

1.1 The European Union Location Framework

The European Union Location Framework (EULF) aims to maximise the potential of the vast amount of money spent on location-related information and services by governments across Europe by promoting a best practice approach for cross-sector and cross-border sharing and use of this information, based on user needs and priorities, and targeting actions that will deliver efficiencies, help improve digital public services, and contribute to job creation and growth. The vision for the EULF can be summarised as follows: *"More effective services, savings in time and money, and increased growth and employment will result from adopting a coherent European framework of guidance and actions to foster cross-sector and cross-border interoperability and use of location information in e-Government, building on INSPIRE".*

The EULF was established under the European Commission's Interoperability Solutions for European Public Administrations (ISA) programme, and now forms part of the European location Interoperability Solutions for e-Government (ELISE) action in the successor ISA[2] programme[1]. EULF guidance and actions are targeted at improving interoperability and use of location information in e-Government services, based on five focus areas:

Figure 1. European Union Location Framework (EULF) focus areas

Policy and strategy alignment: a consistent EU and Member State policy and legislative approach where location information plays a significant role.

Digital government integration: making location a key enabler in G2B, G2C and G2G e-government processes and systems.

Standardisation and reuse: adoption of recognised geospatial and location-based standards and technologies, enabling interoperability and reuse.

Return on investment: ensuring funding of activities involving location information is value for money, and taking action concerning this information to stimulate innovation and growth.

Governance, partnerships and capabilities: effective decision making, collaboration, knowledge and skills, related to the supply and use of location information in the context of digital government.

EULF outputs include:

- '**EULF Strategic Vision**' - a shared vision and rationale for a European Union Location Framework, defining the scope, governance and implementation approach;
- '**Assessment of the conditions for an EULF**' - an assessment of the state of play in the different focus areas of the EULF and the need for EULF action in these areas;
- '**EULF Blueprint**' – recommendations and guidance in the five EULF focus areas and role-based views for key stakeholder groups;
- '**EULF Guidelines**' – Detailed guidance on key topics introduced in the EULF Blueprint. This document, '**EULF Design of Location Enabled e-Government Services'** is one of those documents.
- '**EULF References**' - inventories, links and supplementary information related to the EULF;

[1] https://ec.europa.eu/isa2/home_en

- **'EULF Studies'** - assess the feasibility of EU action in various policy areas, involving the sharing and reuse of location information;
- **'EULF Pilots'** - create location interoperability solutions in various policy areas (e.g. transport, marine and energy) applying and informing EULF best practices in solving real-world problems.

1.2 Objectives, scope and target audience

1.2.1 Objectives

Based on the Assessment of the Conditions for the EULF and input from Member States a need was established for guidance on the design of location enabled e-Government services. This document *"EULF – Design of location enabled e-Government services" aims to address this need, and has the following objectives*:

1. To explain what location enabled e-Government services are, and how they are related to location enabled e-Government processes;
2. To understand and provide practical guidance in the analysis of e-Government processes and the potential services, as a starting point for the design and development of location enabled services;
3. To explain how the development of location enabled e-Government should take advantage of the implementation of INSPIRE and the reuse of INSPIRE components;
4. To support public authorities in designing, implementing and evaluating location enabled e-Government services;
5. To outline the organisational and technological aspects of designing, implementing and evaluating location enabled e-Government services.

1.2.2 Scope

The report focuses on the design of location enabled e-Government services, and deals with the development of new and innovative services to citizens, businesses and public administrations by taking advantage of existing location enabling components and INSPIRE data and services in particular. The design of location enabled e-Government services can take place at different administrative levels and in different thematic domains. The report aims to provide an answer to the following three key questions:

- What are location-enabled e-Government services?
- How to assess the potential for location enabled e-Government services?
- How to design and implement these location enabled e-Government services?

1.2.3 Target audience

The report is designed for use within public organisations by e-Government service owners, project managers, designers and implementers, ICT developers and system integrators, and data and geographic information specialists. It is also relevant for private sector organisations providing ICT and outsourcing services to public authorities and/or looking to provide innovative services through public-private partnerships.

1.3 Structure of the document

The report consists of five sections, including this introductory section in which the objectives, scope, target audience and structure of the document are described. Section 2 introduces what location enabled e-Government services are, and how they are linked to the processes of public administrations and to the development of e-Government in the public sector. Section 3 explains how the potential for designing and delivering location enabled e-Government services could be assessed, by identifying, mapping and analysing in detail the processes of public administrations. Section 4 deals with the different phases in the development of location enabled e-Government services, and provides some guidance on how the design, implementation and evaluation of these services can be organised in a user-centred and collaborative manner. The section also describes some best practices and provides recommendations for the design of location enabled e-Government services. Finally, Section 5 gives a number of conclusions to the report.

2 What are location enabled e-Government services?

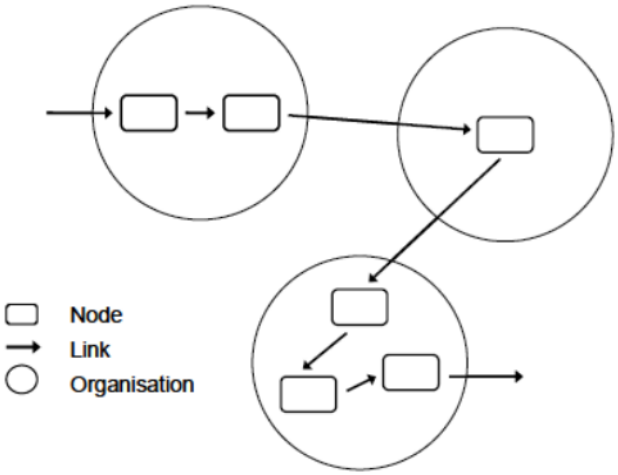
Understanding what location enabled e-Government services are and how they are related to traditional e-Government services and processes is essential for understanding the potential of the location enablement of e-Government. This section provides a definition of location enabled e-Government services and a discussion of the different types of location enabled e-Government services. It also provides some examples of location enabled e-Government services.

2.1 e-Government processes

In the public sector, the implementation of policies mainly takes place through processes, in which policy is translated into practice. A public sector process can be defined as a set of related activities which transform a certain input of resources (e.g. a (spatial) dataset, a register, statistical data) into an output of products or services (e.g. a decision, a permit or an answer), which often are delivered to citizens, businesses or other administrations. Usually the transformation requires the processing of the input data and information to generate the required output. In the context of each policy area, many processes are running. Each public administration is involved in a large number of processes. Moreover, many of the processes are inter-linked. This means that e.g. a process might need the output of another process as input. For example, the initiation of a building permit might depend on the result of checking the location of the cadastral parcel against the flood risk areas.

Public sector processes are often similar in structure, as their outcome is typically determined by law. Moreover, many processes involve different organisations (see **Figure 2**), at different administrative levels and/or in different thematic areas. Processes also comprise actions of and interactions among different government organisations as well as actors outside government.

Figure 2. The process as a chain of activities within and between organisations



Source: Dessers, 2011

In other words, most processes consist of different – intra and inter-organisational – process steps and involve several interactions and exchanges between stakeholders. These interactions can be divided into Government-to-Citizens (G2C), Government-to-Business (G2B) and Government-to-Government (G2G) interactions[2]. Each of these interactions can take place in different phases of the process: at the start, at the end or during the process. Many government processes often start with a G2C or G2B interaction, e.g. a request from a citizen or a company, and also end with a G2C or G2B interaction, e.g. the delivery of a product or permission to a citizen or a company. But these G2C and G2B interactions can also take place during the process (e.g. public consultations), while government processes also exist without any G2C or G2B interactions. The latter often correspond with so called back-office processes (Pignatelli et al., 2016).

[2] It should be noted that more and more B2B, C2C and B2C processes exist as well, but the focus in this document is on the processes for which government is responsible or the processes in which they are at least involved.

e-Government is about the use of information and communication technologies (ICT) to support the collection, processing, management, use and sharing of information within government (OECD, 2003). Information is one of the basic resources of public administrations, as it is both the primary input to and the primary product of government activity (Mayer-Schönberger & Lazer, 2007). Public authorities make use of ICT in support of their internal operations and processes and in their relations and interactions with external partners. E-Government processes refer to public sector processes that are supported by the use of information and communication technologies. Due to the widespread use of ICT in the public sector and the continuous development and adoption of new technologies, most public sector processes nowadays can be considered as e-Government processes. In most of the existing government processes several process steps are supported by the use of information and communication technologies, e.g. to allow citizens to formulate a certain request, to provide a certain product to a citizen or to support the internal exchange of information between different public administrations.

2.2 e-Government services

e-Government can also be described and analysed in relation to the electronic services or e-services that are provided to different users and stakeholders. In the context of e-Government, the term "service" is defined as the execution or result of an activity by a public administration which serves the citizen, businesses or another public agency (Federal Ministry of Interior of Germany, 2008). Many e-Government services nowadays take the form of web applications, although other channels might be used as well (e.g. email). A distinction can be made between five main types of e-Government services (Bekkers, 2007a):

- *Information services* are focused on the disclosure of government information or other information that is relevant for their citizens and businesses, for instance the possibility to view or download reports, data, brochures and other official documents
- *Contact services* refer to the possibility for citizens and businesses to contact public administration, for instance to ask questions to civil servants and politicians about the application of certain rules and programmes, or to make a complaint.
- *Transaction services* refer to the electronic intake and handling of requests and applications of rights, benefits and obligations, such as digital tax assessments, the granting of permits, licenses and subsidies.
- *Participation services* are services allowing citizens and other stakeholders to get involved in the formulation and evaluation of policy programmes, by informing them about different policy options and allowing them to provide input and participate in discussions on these options
- *Data transfer services* are often considered as a particular type of e-Government service, as they refer to the exchange and sharing of (basic and standard) information between public (and private) organisations, including the exchange of information between different processes.

An alternative view on e-Government is to consider it as an evolutionary phenomenon, distinguishing different stages of e-Government development. A commonly used stage model is the model of Layne and Lee (2001) in which four stages towards full e-Government are distinguished. In stage one, the electronic cataloguing stage, governmental organisations create their own website to provide government information online. Electronic transactions between governments and their customers become possible in stage two. At this second stage, citizens can fulfil their government requirements online (e.g. providing information for taxation). The third stage is the stage of vertical integration when government operations within functional areas are integrated. The focus thus moves from the automation and digitisation of existing processes towards a transformation of public administration. The full potential of e-Government is achieved in the fourth and final stage, where electronic services are horizontally integrated across functional areas.

In recent years, much attention has been paid to identifying and describing the e-Government services of public administrations. Many public administrations started setting up a catalogue of their products and services for use in communicating with citizens and businesses.

In the e-Government domain, efforts have been undertaken to identify key services. The EU e-Government Benchmark reports make use of a selection of 20 basic services to assess the progress in the deployment of e-Government solutions in EU Member States. These 20 basic services include 12 services related to citizens and 8 services related to businesses. Citizen services are income taxes, job search services, social security benefits, unemployment benefits, personal documents, car registration, application for a building permission, declaration to the police, public libraries, (birth and marriage) certificates, enrolment in higher education,

announcement of moving; and health-related services. Services related to businesses are social contribution for employees, corporate tax, VAT, registration of a new company, submission of data to statistical offices, customs declaration, environment-related permits and public procurement. These services can be grouped into four service clusters: (1) income generating, for government; (2) registration (3) service returns e.g. health, social, libraries and (4) permits and licences. Key characteristics of these basic services are the applicability in most EU Member States and their connection to 'life events', i.e. important stages in a citizen's life, such as school, marriage, or buying a property.

2.3 Location enabled e-Government services

Another way of defining and describing e-Government processes and services is by distinguishing different types of information within the public sector. The main types of public sector information include information on citizens and businesses ('who?'), information on public sector products and activities ('what?'), time-related information ('when?') and location information ('where?'). Location information thus is one type of public sector information, which is special in that it refers to a location on the earth (Masser and Crompvoets, 2015) and is of increasing importance for the execution of governmental tasks.

A lot of information in the public sector has a location component, so the use and integration of spatial information is of great importance to the further development and innovation of public administration practices. Many of the challenges of contemporary society, such as protecting the environment, increased security, better transport, socially just and sustainable development, risk management and enhanced service delivery to citizens require the integration of spatial information in the processes of public administration.

What makes spatial information so useful is that the majority of public sector information has a spatial component: a street address, place name, administrative unit, geographic or map coordinates, etc. This spatial component makes it possible to combine and integrate information on different topics and from different sources, which allows the creation and delivery of new products and services and opens new ways of policy development and implementation. Integration of spatial information in the processes of public administrations, and in their interaction with citizens, businesses and other stakeholders is essential for the creation of these new products and services.

In recent years, significant effort has been made to increase the availability of spatial data and spatial information through the development of spatial data infrastructures (SDIs) at different levels. The challenge now is to maximally take advantage of these data and information by integrating them in the decision-making and service delivery processes of governments and other societal actors. The concept of 'location enablement' or 'spatial enablement' refers to the use of location information to facilitate the realisation of societal, governmental and organisational objectives. Location enablement is about getting access to and integrating location data and information to improve processes.

e-Government processes can be defined as location enabled, when there is a well performing integration of location information (flows) in these processes. Location enabled e-Government services are services provided by public administrations that are supported by – digital – location data. The use and integration of location data helps make existing services more efficient and effective or supports the provision of new and innovative services.

Following the assumption that a major part of the information that is collected, managed and used by government is related to location, it means that the majority of public sector processes (could) make use of location information, and could be improved through a better uptake and use of location information. An examination of the 20 basic e-Government services shows that there are several services for which the use of location information is essential, such as the application for building permits, the granting of environment-related permits or the announcement of moving to another address by a citizen. For other services, and in other processes, the potential contribution of location information is less prominent. However, most of the basic services and their underlying processes in some way deal with a location.

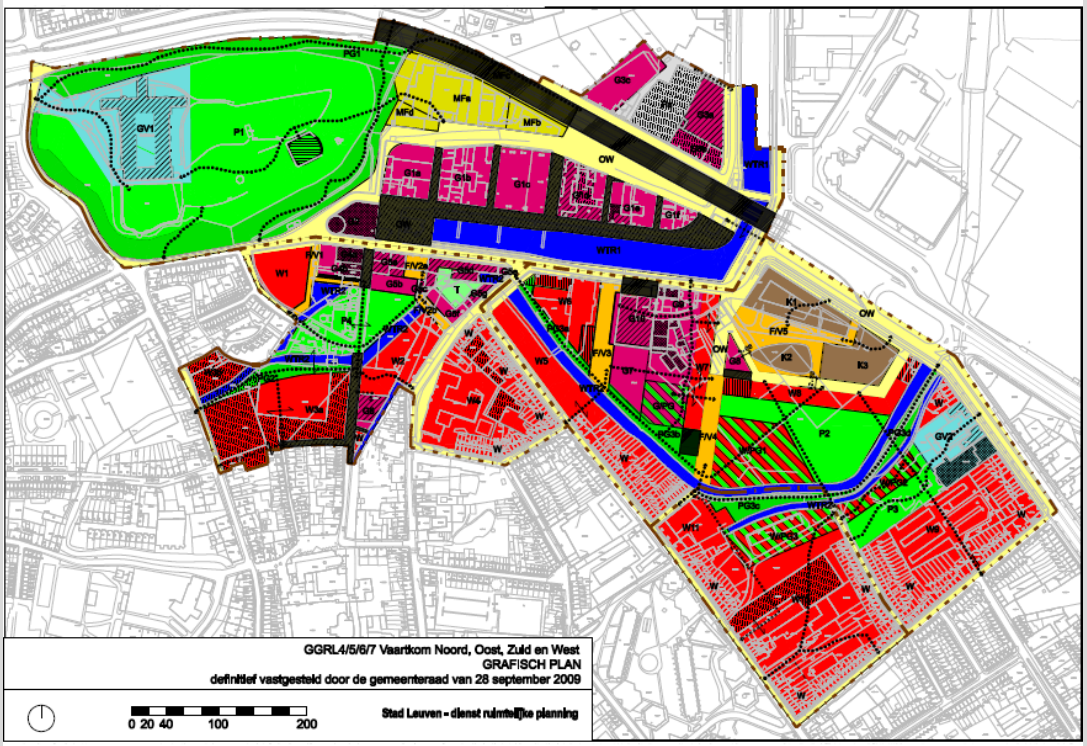
In addition to these basic services and their underlying processes, there are many public sector processes in which location information is fundamental to the entire process and relevant in most or even all process steps. This is the case, for instance, in the domains of environment, agriculture, spatial planning and transport. Here, the impact of location information in improving and optimising processes might be very high, because location information is fundamental to the entire process. Despite the existence of well-performing and successful SDI initiatives, the level of location enabled e-Government services in these domains is improving very slowly (Vandenbroucke, 2014).

Location data and information can 'enable' different types of e-Government services:

***Information services*:** Location data can help public administrations to make the information on their activities, processes and products available to citizens and businesses in a user-friendly and easily accessible manner. First, there are many points of interest of governments that can relatively easily be represented to citizens and business in the form of an interactive map: schools, hospitals, sports and recreation facilities, etc. This allows citizens to search for the location of an individual Point of Interest (POI) or to get an overview of all POI's. In addition to these POI's, location data and services can also be used to make information available on issues such as traffic congestion, land use plans, air and water quality and other publicly available information.

Box 1. Example: The publication of Land Use Plans on municipal portals

Figure 3. Land Use Planning maps of part of the city of Leuven



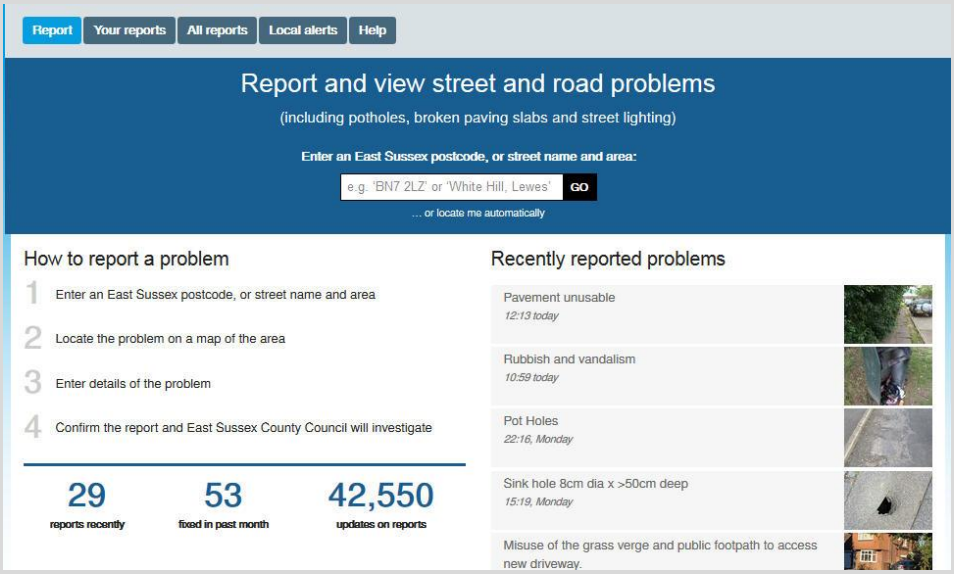
Source: City of Leuven, 2016

An example of a spatially enabled information service is the publication of land use plans at municipal level (**Figure 3**). Citizens and companies can visualise the planned land use, and get information on the applicable laws, restrictions and other useful background information. Citizens and companies can consult, but not interact, with the public authority.

Contact services: Public administrations could also use location information as an effective instrument for allowing citizens and services to contact them. More and more public administrations are providing applications based on location information to their citizens allowing them to report on different types of problems in the public domain. The best-known examples are the FixMyStreet websites and applications (sometimes developed by citizens) through which users can report potholes, broken streetlights and other problems at street or road level. Similar applications exist to allow citizens to report on illegal dumping, other garbage related complaints or cases of pollution. Another interesting example can be seen in the domain of flood policy, where applications using location information are used to collect information from citizens about recently flooded areas.

Box 2. Example: Reporting problems in public space at the street level

Figure 3: FixMyStreet for East Sussex (UK) example of a location enable contact service



Many applications exist which allow citizens to report problems in streets and on roads. The applications make use of a gazetteer service to visualise an area of interest. Tools allow citizens to indicate the exact location of the problem and to describe the problem. The application/service is then investigated by the public administrations and might eventually lead to an intervention to resolve the reported problem. In some cases, the public administration may report back on what has been done.

Transaction services: transaction services, which refer to the electronic intake and handling of requests and applications of rights, benefits and obligations, could also be supported through the use of location data. Because these transaction services demand two-way interaction between government and citizens/businesses, they are more complex and more difficult to realise than information services and contact services, which mostly are one-way services. However, transaction services provide more significant benefits to citizens and businesses, and to governments themselves. The use and integration of location data in providing these services will further improve these benefits. Recent examples of spatially enabled services are online applications for building and environmental permits, applications for requesting agriculture subsidies and applications for managing property rights.

Box 3. Example: Registration of public works and other events in view of obtaining the necessary permits

Figure 4: GIPOD, an example of location enabled transaction service

Source: AGIV, 2016

GIPOD is an e-Government service that enables registration of different types of events (spanning a specific period of time) such as public works, public demonstrations, cycling events, rock concerts, etc. The service includes the definition of the exact location (point or address, road segment ...) and description of the event characteristics (type of event, period). The back-office can then process the request, accept or reject it and

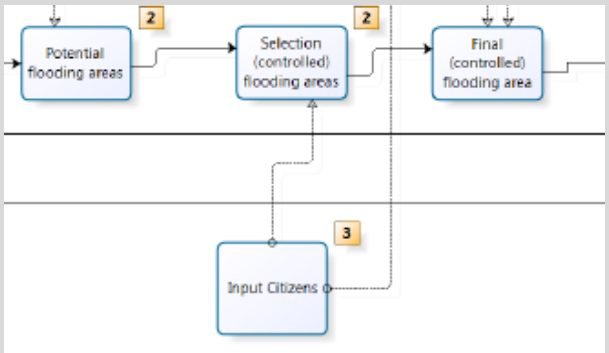
prepare the necessary permit(s). The current version of the system works very well and is also used by citizens to know where traffic jams or other difficulties might occur. However, at the time of writing this report, processing in the back office was not yet fully integrated in the service[3].

Participation services: Location data can also enable the participation of citizens in the formulation and evaluation of policies. Many examples of this can be seen in spatial development projects, in which location data is used to present citizens different alternative policy scenarios, provide them more information on the effects and implications of each scenario and give them the opportunity to express their views and concerns.

Box 4. Examples: Involvement of citizens to delineate flood buffer areas and to indicate planned extension of houses

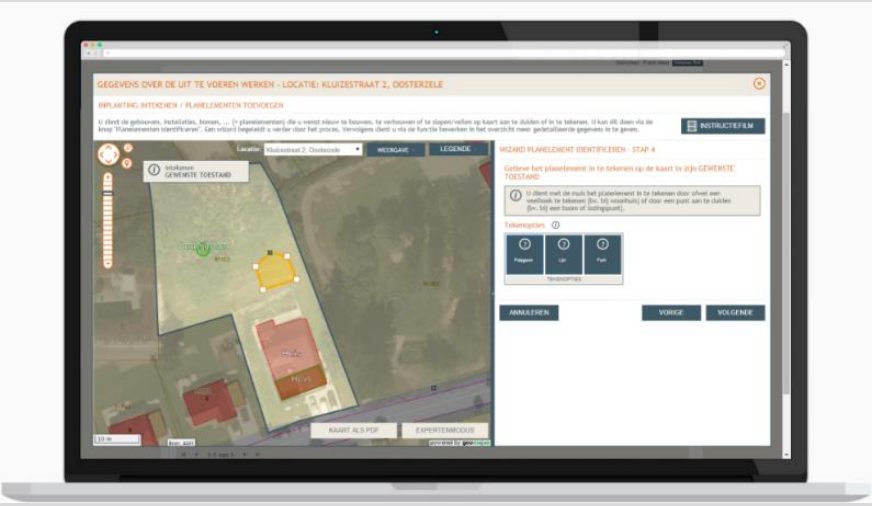
Several examples exist in which citizens or companies can use geospatial editing tools to indicate future or desired spatial objects on or close to their property. Two examples can be given. The first example is the process of delineating the boundaries of flood buffer areas, i.e. these are areas that will be given up in case there are excessive water quantities due to high rainfall and threatened infrastructure. These buffer areas are used, for example, to protect downstream urban areas. The decision on where these areas will be developed is taken by government, but input from and discussions with citizens living in the neighbourhood are part of the process. Currently, this is still happening with traditional public hearings and by making use of paper maps or by organising demonstrations on computers, but plans are on the table to provide an interactive service through which citizens can propose alternative delineations.

Figure 5: delineating potential flood buffer areas with the help of citizens



Similar examples can be found in spatial planning. The example below illustrates an e-Government service through which a citizen can design an extension of his house, or the addition of a small building in the garden, etc. As in the previous example, there is two-way communication, and active involvement of the citizen in the decision-making process.

Figure 6: e-Government service to draft the design of a building (Geosparc, 2016)



Source: Geosparc, 2016

[3] Currently events might even be registered and visible without having the permit(s) granted.

Data transfer services: Finally, public administrations could also use location data to support the exchange and sharing of data with other public administrations, e.g. in other policy domains or at other administrative levels. This often occurs in the back office, e.g. the public authority verifies the legal status of a particular location.

Box 5. Example: Use of the water survey (back office) in the context of the process of granting a building permit

Figure 7: Flood risk areas to be checked when a building permit is requested

Source: AGIV, 2016

Some processes require input from other processes. A good example is the process of granting (or not) of a building permit. Several checks have to be performed, for example whether the location of the parcel falls within a flood risk area. This is done by the same or another public authority and requires the use of another e-Government service. Currently, these checks are often still done by using a separate application. The next step would be to have an automatic check using a service that runs in the background.

2.4 Developing effective location enabled e-Government services

Evidence of how the integration of spatial information can contribute to e-Government objectives and thus provide significant benefits can be seen in several good practices in certain countries and policy domains. These practices show how the integration of spatial information in organisational and especially inter-organisational processes leads to benefits in terms of efficiency, effectiveness, quality, transparency and innovation in several policy areas. These practices also demonstrate how the integration of spatial information helps governments to be more open and transparent about the outcomes of their policies and decisions (e.g. improved air and water quality information) or to involve citizens and businesses actively in decision-making processes (e.g. citizen participation in spatial planning processes). Integration of spatial information also allows governments to build services around the needs of citizens and businesses, by bringing information from different sources together based on the geographic component, and thereby realising vertical integration between different policy levels and horizontal integration between different policy domains.

The process of developing effective location enabled e-Government services can be split into three main stages: design, implementation and evaluation. As one of the core reasons for the lack of user take-up of e-Government services is the lack of user centricity in the services, user-centred development of location enabled e-Government services is essential to ensure take-up of these services, to guarantee users are satisfied with using the services and to realise the benefits of using location enabled services. Moreover, it is important to be aware that the context in which e-Government services are delivered is, in many cases, a multi-organisational context. Even if a certain service is delivered by a single organisation, in most cases this organisation is dependent on many other public administrations and/or is involved in several processes in

which other public administrations are also involved. A recent evolution is the open collaborative development of services, in which public services are electronically provided by government, citizens, NGOs, private companies and individual civil servants, in collaboration or not with government institutions, based on government or citizen-generated data (Osimo et al, 2012). This evolution increases the need for effective governance of the different stakeholders and their needs and demands, throughout the entire development process.

Before developing location enabled e-Government services, a decision should be made on which services are most valuable and should be given priority in the location enablement of services. The next section deals with the question of how to assess the potential for location enabled e-Government services.

3 How to assess the potential for location enabled e-Government services?

While the previous section explained what location enabled e-Government services are, this section discusses how the assessment can be made of which location enabled e-Government services will be the most relevant and most valuable, in order to decide on the services to which priority should be given in service development.

3.1 Identifying and mapping processes and their sub-processes

The identification of different public sector processes in which location information is or can be used is a first step in the identification of the potential for location enabled e-Government services. Existing and potential location information processes should be described in terms of some basic characteristics, such as the objective of the process, relevant legislation, the responsible persons/organisations, involved actors, input at the beginning of the process, the process steps, and the output(s) as the result of the process. As the activities and processes of European Member States are strongly determined by EU policies and legal acts, and citizens and businesses in different MS will have similar demands of their government, many location information processes will exist in all European member states, and often these processes will be organised and structured in an identical or at least similar manner. Table 1 provides an example of the processes in which address information is used and/or created, identified at the municipal level in Flanders, Belgium.

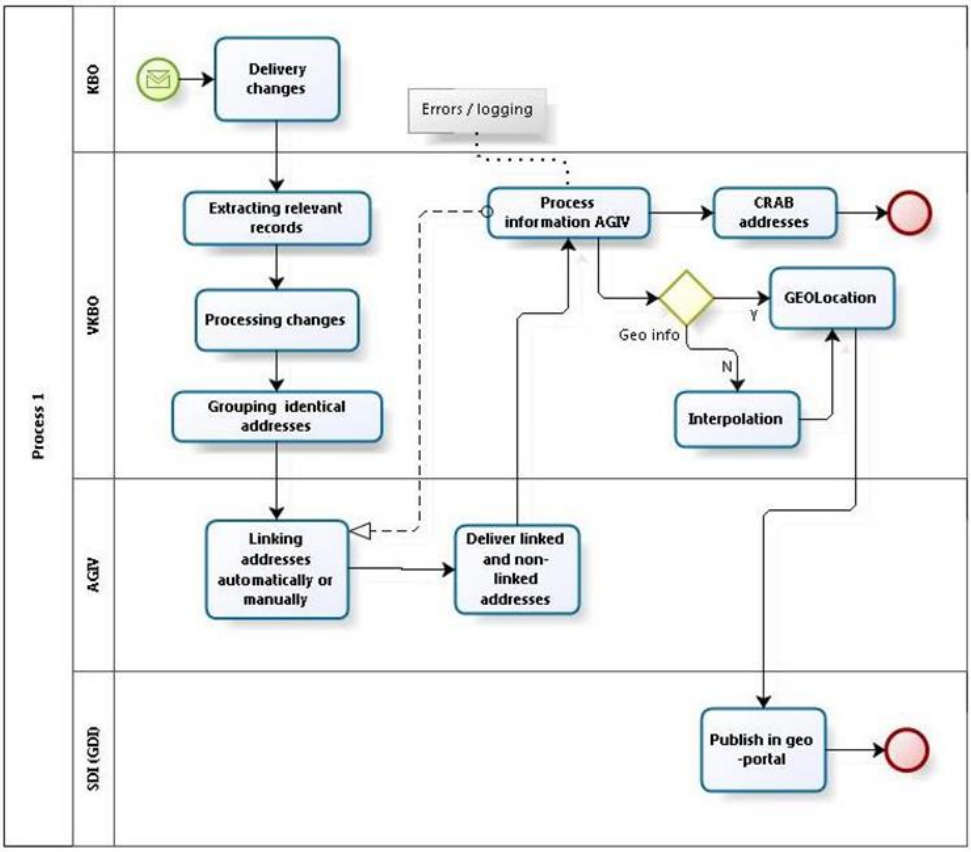
Table 1. Municipal processes in which addresses are used / created

	Process	Sub-process	Major actors
1	Registration of a citizen		Citizens
2	Processing an allotment request		Businesses
3	Processing a building permit request		Citizens, Businesses
4	Managing street data	Naming a street Renaming a street Correcting a street name Deleting a street name Splitting a street	Public administrations
5	Managing numbers of buildings	Numbering a building Renumbering a building Deleting the number of a building	Public administrations
6	Processing an environmental permit		Businesses
7	Processing a business request from a company	Processing a request for a company number Processing a request for a permit Processing a request for moving a company Processing a request to stop activities	Businesses
8	Sending taxation forms		Citizens

Source: AGIV, 2007

The analysis performed by AGIV, the Agency for Geographic Information in Flanders (2007) led to a revision of the overall process of maintaining a consolidated register of addresses known as the Central Reference Address Register (CRAB) which is an authentic source to be used by all public administrations. CRAB is the result of a complex integration process with information coming from different sources such as municipalities defining new addresses (e.g. in case of the construction of a new street), the federal government providing addresses of companies (federal business register - KBO), etc. **Figure 8** provides the Business Process Model and Notation (BPMN) schema representing the different steps in the integration process of those company addresses into CRAB (CORVE, 2008). This is an example of a more detailed sub-process as part of the overall address maintenance process (which is not shown here). The process (with several G2G interactions) is supported by a series of web services and a CRAB decree (legal act), with a graphical user interface to guide all actors involved throughout the process.

Figure 8. The address maintenance process



Source: CORVE, 2008

The creation of a catalogue of location information processes in Europe, both at national and EU level, might be a valuable instrument for comparing processes among different countries and learning from good practices in other Member States (or in another administration in the same Member State). Particular attention might be paid to the identification of the basic e-Government processes in which spatial data and information are – or potentially can be – integrated and/or to processes in Member States that are strongly or even fully determined by EU legislation, and thus strongly comparable among Member States. Typical examples of these are monitoring processes, in which Member States have to collect information on the status of development in a certain policy area such as the development of transport networks, the implementation of environmental directives …, and to provide this information to the EC.

To gain additional knowledge on these – existing and potential – location information processes, it is necessary to understand the entire process, i.e. the sequence of events and interactions between input and

output. Process mapping or modelling tools can be used to describe a process at a high level of abstraction, providing insight in the different process steps, the actors involved and also the use of location data and technology. A process map will provide a schematic overview based on a common language of all the steps of a process starting from the action that triggers a process to begin and the action that reflects the end of a process. In creating such a process map, it is important not only to describe the process as it is formally defined by legislation, but also the process as it is executed in reality. In the activity of gathering information about the process, it is essential to involve both the persons that are internally involved in the process and the external customers.

Process mapping can be useful for different reasons. It can increase the transparency of processes and improve the communication and interaction between individuals, organisations and policy makers. Moreover, it can provide information on the actual status of processes and enhance the involvement of individual actors in the processes. From the perspective of service design, process mapping allows us to truly understand the different steps in the process, the needs and requirements of a specific process, and the potential to improve the process through the implementation of location enabled services.

Mapping location information processes should be done using international business process modelling standards. Examples of these standards are:

- **Business Process Model and Notation (BPMN),** an Open Management Group (OMG) standard, is a graphical representation for defining business processes in a business process model. BPMN provides organisations and process owners with the capability of understanding their internal and external business procedures in a graphical notation and gives them the ability to communicate these procedures in a standard manner.
- **Business Process Execution Language (BPEL)** is an XML-based language that allows Web services in a service-oriented architecture (SOA) to interconnect and share data. Programmers use BPEL to define how a business process that involves web services will be executed. BPEL messages are typically used to invoke remote services, orchestrate process execution and manage events and exceptions. BPEL is often associated with Business Process Management and Notation (BPMN). In fact, a BPMN schema can be transformed 'automatically' in BPEL to make it executable. In many organisations, analysts use BPMN to visualise business processes and developers transform the visualisations to BPEL for execution.
- **ArchiMate®,** an Open Group Standard, is an open and independent modelling language for enterprise architecture that is supported by different tool vendors. ArchiMate provides instruments to enable enterprise architects to describe, analyse and visualise the relationships among business domains in an unambiguous way. ArchiMate offers a common language for describing the construction and operation of business processes, organisational structures, information flows, IT systems, and technical infrastructure.

3.2 Identify the actors, data flows and interactions

For processes dealing with policy preparation, monitoring and evaluation, decision-making, or service provision, the notion of data and information flows is crucial (Roche & Caron, 2004). To perform the different tasks in such processes, data and information are needed as input, in order to process them and to create new data and information that can serve other organisations, policy makers or even individual citizens. In order to improve processes through the design of location information services, during the mapping of a process it is necessary to identify and describe the data flows as well, and the location data flows in particular. The data flow analysis requires several questions to be answered:

- What are the major process steps and what is their sequence (order);
- Who are the major actors?
- What triggers the process, what ends the process?
- What existing information and data sets are used, and from what sources (organisations/actors)?
- What new information/data or other outputs are created throughout the process and by whom?
- In which process steps are location data used and/or created?
- How is the output distributed or used in other processes and by whom?

Particular attention should be paid to the interactions between different involved actors in the processes. In the context of e-Government processes, several types of interactions can take place:

- G2C interactions: between Government and Citizens
- G2B interactions: between Government and Businesses
- G2G interactions : between Government and Government

Each of these interactions can be of a different type: physical at a desk or in meetings, via phone calls and call centres, through regular mail or e-mail, or via websites or web applications. Within each e-Government process, such interactions can occur multiple times: a citizen can contact or be contacted by a public administration several times, e.g. in order to request additional information in the context of a building permit process. Moreover, some processes might entail several iterations before a decision is taken and the process comes to an end. Over the past few years, digital interactions, mainly through the Internet, have become more prominent. The development of location enabled e-Government services focuses especially in supporting and improving these interactions through the use of location information and geospatial technologies.

The modelling of the process should be handled with care, capturing the basic elements of the process, making it neither too complex (detailed) nor too simplistic. Several open source and commercial business modelling tools are available such as Enterprise Architect (often used by data modellers), Bizagi, HEFLO and OMNITRACKER.

Figure 9. Basic process elements of Business Process Model and Notation

Source: BPMN, 2016

The aim of this document is not to describe in detail how to use BPMN to model a process. However, some good practices and recommendations should be highlighted here (see **Figure 9** for the different BPMN elements):

1. The scope of the process should be clearly identified: 'who', 'what', 'when', 'where' and 'why' of the process. The process itself is the 'how'.
2. It is recommended to work top-down with different levels of detail; don't start with the very detailed activities but rather with an overview consisting eventually of a series of 'sub-processes' or high-level 'tasks'.

3. Major actors are best represented in different 'pools' which in turn might be sub-divided into 'swim lanes'. Each pool and swim lane can contain several sequenced activities. It is important to notice that actors are (types of) organisations rather than the individuals that perform the tasks.

4. It is necessary to clearly define what triggers the process. This can be an event that occurs, a decision taken by a public authority, a citizen/business that initiates a request, etc. Each process must also have an end.

5. It is recommended to try to fit the BPMN schema on one page, if necessary making use of sub-processes for more detailed schemas (one can even have several levels). Moreover, it is also recommended to organise the sequence flows horizontally and the data associations vertically (no zigzagging).

6. Splitting a process in different branches/flows (through 'gateways') should only be used where there is a clear need. Avoid creating a complex tree with too many branches.

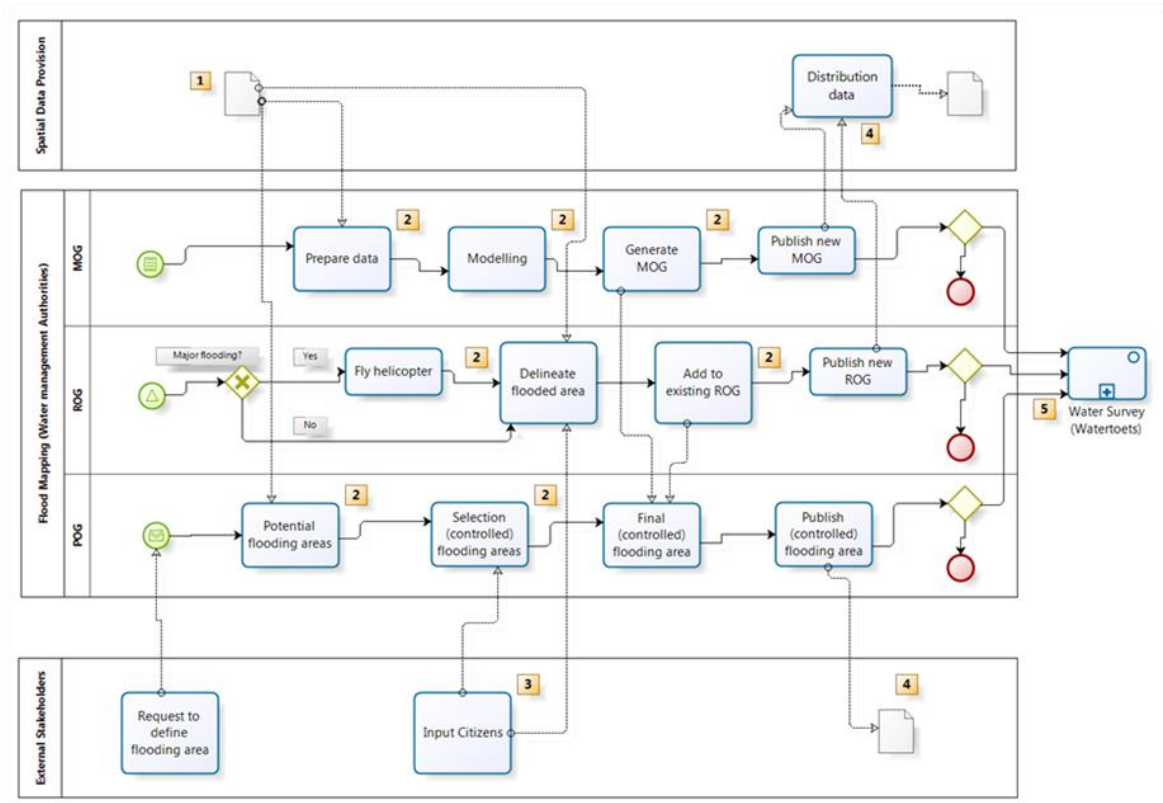
For more detailed recommendations and good practices see http://www.bpmn.org/.

Box 6. Recommendation

It is important to involve all the relevant actors who are part of the process when mapping the process. This is a first step in their involvement in the design of the location enabled e-Government service(s) that will support the process (see section 4). Mapping the process will also reveal inconsistencies in the process itself. Therefore, the mapping can also be useful to revise or streamline the process.

Figure 10 illustrates the use of BPMN for the particular case of the flood mapping and management process. The organisation performing the flood mapping has several departments working on different aspects of the mapping: mapping recently flooded areas (ROG), modelling floods (MOG) and designing flood buffer areas (POG). In this process, spatial data are accessed / obtained from external sources (1), the data are processed in the different process steps (2), citizens consult and provide feedback in some of the process steps (3) and the resulting output (new data) are published as part of the SDI (4) or used as input for another process (5).

Figure 10. Example of a BPMN schema for the flood mapping process



3.3 Identify the potential spatially enabled services

The mapping and analysis of existing processes, in terms of different process steps, sub-processes, data flows and interactions should be the starting point for the analysis of how the process can be improved. Although mapping a process can be already a complex task, even more challenging will be to use this knowledge for improving the process. The process mapping will give process owners and other stakeholders that are involved in the process insight on how the process actually works, and how the process performance can be improved, in terms of cost, time or quality.

In many cases, location enabling services will not cover the entire process, but will deal with one or a set of interactions within the process. This means some prioritisation of services will be needed, to identify which services should be given priority for e-enablement. However, even if the decision is made to focus on a particular interaction or process step, the impact on other interactions and process steps should be taken into consideration. Based on existing practices of prioritisation in e-Government, the following criteria could be used in the prioritization process (OECD, 2005):

- **Frequency of use:** how many people will benefit from a certain e-service and how many interactions could be supported through a service;
- **Added value for stakeholders:** what will be the added value of implementing a certain e-service to different involved stakeholders, including both the citizens and business but also the public organisations and public servants;
- **Tendency of potential users to use the service**: to what extent will users prefer the new e-service to traditional non-digital services.

In general terms, it can be argued that the focus should be on the most common interactions for which there is the maximum potential for benefit to users and government and on the potential for re-using solutions. For the prioritisation of location enabled e-Government services, some particular criteria could be added:

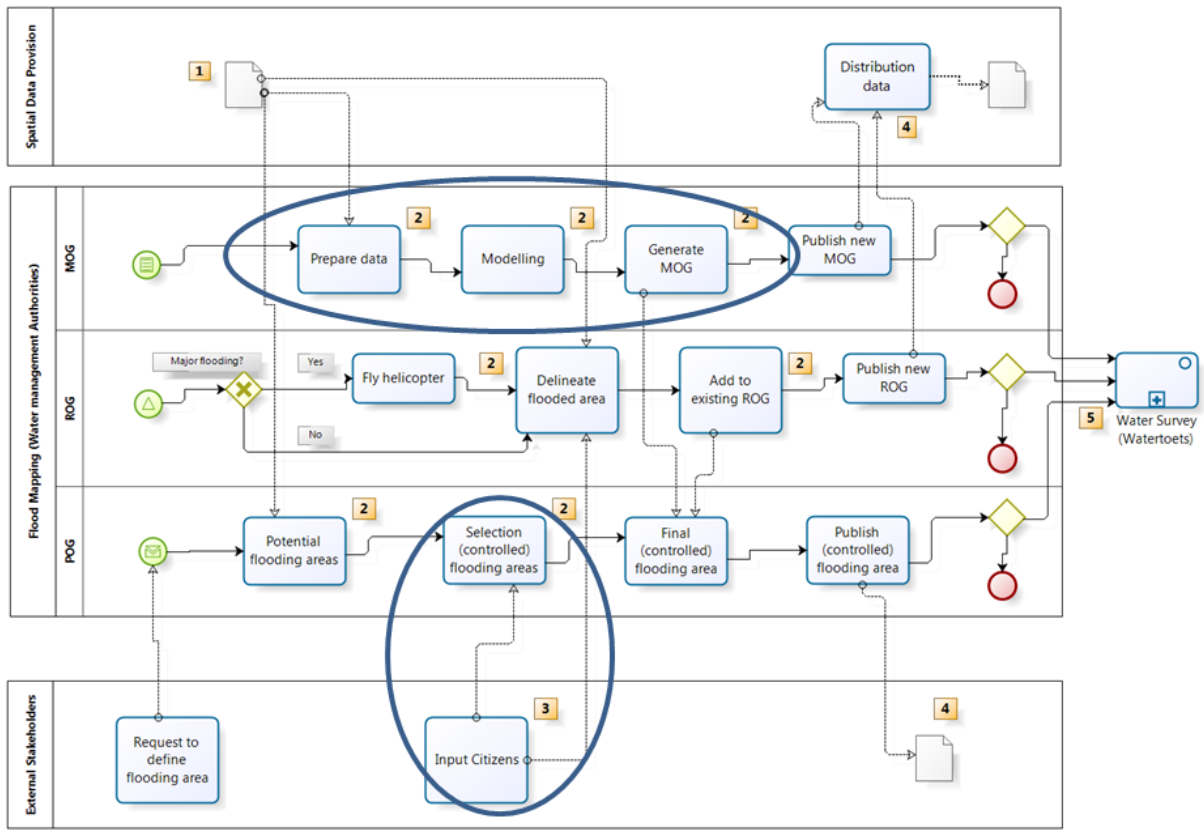
- **Relevance of location information:** priority might be given to interactions and process steps that rely strongly on or require location information;
- **Added value of location information:** priority might be given to interactions and process steps for which the benefits of location enabling them will be high;
- **Availability of location information:** priority might be given to interactions and process steps for which the required location data – and other necessary components – already are available.

Although the original focus of service design and delivery might be on individual services, it is essential to recognise the added value of integrated services. Integration is about the vertical – across policy levels - and horizontal – across policy areas – integration of e-Government services. The aim should be to provide seamless services, integrating the information and services across government agencies into single electronic systems, transcending the administrative and thematic boundaries of government agencies. Rather than making information and services available for each policy area separately, it is recommended to organise the provision of information and services to citizens and businesses around the needs of those citizens and businesses. An approach for doing this is to organise the provision of services around 'life events', i.e. important stages in the life of citizens, such as moving and changing address, buying or building a house or starting a business. This requires the integration of data and services from different policy levels (local, regional, national, European), from different policy areas (spatial planning, mobility, environment, education and many others) and cross-border. The result will be that users will have a single point of contact for services and will only be asked once to provide location-related information.

The above-mentioned principles can be illustrated with the same example that was explained in section 3.2: the flood mapping process. **Figure 10** indicates in which parts of the process spatial data are or could be used, created and/or distributed (numbers 1 to 5)[4]. This already provides a first indication of where in the process location enabled e-Government services could be implemented. **Figure 11** shows the same process with two examples of those potential services: one would be a service for citizens to provide input in the delineation of the flood buffer areas (POG), the other would be a service to automate the flood modelling process (MOG).

[4] For the sake of clarity, only numbers were used in the schema. BPMN provides a method to annotate the flows and interactions in more detail.

Figure 11. Potential e-Government services to support the flood mapping process



Example 1: G2C Service – The first example is a service to help citizens to formulate input in the governmental decision making process on where flood buffer areas (POG) would be located. Usually several alternative areas are proposed. Sometimes there are very detailed discussions on the exact boundaries of the buffer area (e.g. a farmer can propose to 'protect' his field by not including it in the area and by adding protective constructions such as dikes). This process is foreseen in the law and happens currently through the organisation of public hearings where citizens can have their say. The Flemish environment agency (VMM) originally planned to have a web-based tool to allow citizens to intervene in the discussion by using 'redlining' techniques, i.e. drawing alternative boundaries, putting annotations, etc. This is a good example of a location enabled e-Government service since it not only improves participation of citizens in decision making, but also enables the process to be simplified. Indeed, the service could also be used by other departments that currently provide their opinion on the proposed areas in separate processes: e.g. the department managing protected sites could evaluate the proposal(s) on their environmental value / potential, the spatial planning department could evaluate it on the potential impact on urban and rural development, etc. Technically speaking the solution can be developed relatively easily and its components can be re-used in other e-Government services (e.g. agriculture, spatial planning).

Example 2: G2G Service – The second example is a service to support the department responsible for preparing the flood modelling maps. The service would focus on the automation of the flood modelling sub-process. On the one hand, the model could be provided as a (geospatial) web-service so that it can be repeated multiple times (with other input parameters) or be re-used by external parties, i.e. specialised companies, who are often involved in this type of work. On the other hand, the whole sub-process could be supported by other web services such as access services to capture all the input data and pre-processing them in view of loading them into the model. Also, the output of the model could be offered in the form of a web service (e.g. visualisation). All the web services of the sub-process could be chained and the sub-process could be orchestrated in order to automate the different process steps[5]. Also, in this second example, (components of) the solution could be reused in other areas, especially in processes in which modelling is important.

[5] At the time of writing this report (Spring 2016), the Flemish Environment Agency (VMM) was working on this solution.

3.4 Taking advantage of SDIs and INSPIRE

Spatial Data Infrastructures (SDIs) and INSPIRE in particular can be considered as a part of the supporting e-Government framework dealing with the location aspects of e-Government services. INSPIRE has developed a platform for the distribution of location data, based on the infrastructures established in Member States and the data sharing actions and policies of government agencies creating and maintaining location data. In this way, INSPIRE is an important driver for promoting and enhancing the accessibility of and sharing of location data at different levels (European, national, sub-national, local and organisational).

SDIs and INSPIRE in particular provide several components that can be used as building blocks for the development of location enabled e-Government services:

- A series of spatial data sets on 34 themes;
- Web map services (WMS, WMTS) to visualise and web feature services (WFS)[6] to download data;
- Metadata on data and web services, metadata catalogues and catalogue services to discover, find and understand the data sets and web services;
- Other services to process data (e.g. Web Processing Service of the OGC), to transform data, etc.

Box 7. Warning: Use of the term 'service'

The term 'service' used in SDIs and INSPIRE refers to the web interfaces through which data are accessed. They are small building blocks that can be embedded in applications and/or can be used in desktop systems such as Geographical Information Systems (GIS). They are usually not meant for direct 'consumption' by end-users. On the other hand, the term 'service' used in e-Government refers to web-applications and other service channels meant for end-users.

In terms of e-Government development and e-Government maturity, it can be argued that INSPIRE itself provides a set of components that can be used in e-Government services. Besides *data transfer services*, supporting the exchange and sharing of (basic and standard) information between public (and private) organisations, INSPIRE also delivers *information services*, dealing with the disclosure of government information and data to citizens, businesses and other stakeholders, mostly through geoportal applications (which are in fact one form of web application). By making available data through services via geoportals, citizens and business can have access to the data and information they are interested in, in a much more efficient and effective manner. The geoportals, catalogues and catalogue services support the Search-Find-Bind paradigm: users can look for certain data sets and services, evaluate whether the data and services found are fit for use and eventually bind them in one or another application (e.g. desktop GIS).

In terms of e-Government maturity, these information services - and data transfer services - should be considered as relatively simple and basic e-Government services. In location enabled e-Government, the initial step is to make location data accessible, through different distribution channels. This will already be achieved through the establishment of an SDI. However, in order to use spatial data to interact or to complete transactions, standardisation and interoperability become crucial. INSPIRE also provides a basis for the development of these e-Government services at the maturity levels of interaction and transaction, through the harmonisation and interoperability of data sets and services. However, the levels of interaction and transaction will only be realised where new interactive and transactional e-Government services are built upon existing SDI services and the available SDI and INSPIRE components are integrated into e-Government processes. In other words, the added value of the geospatial web services becomes more evident when the web service is embedded in e-Government applications (services). One of the most successful INSPIRE web services in Spain is the one that visualises parcel boundaries. Some years ago, this service was not even documented in the geo-catalogue, but it was embedded in many e-Government applications and hence used very intensively.

To develop interactive and transactional e-Government services, the SDI building blocks should be combined with existing e-Government building blocks, such as data sets on persons and businesses, data sets on the activities of governments, metadata according to e-Government standards and application profiles, core vocabularies, and several types of business services (e.g. event services, authentication/authorisation services, validation services).

[6] Or Atom feeds

3.5 Example: Water abstraction authorisations in the context of the Water Framework Directive

The European Water Framework Directive (WFD), which was adopted in 2000, fundamentally changed water management in all Member States of the European Union. The goal of this Directive was to ensure that the quality of surface water and groundwater in Europe meets high standards (sound ecological status) by the year 2015. The European WFD is based on a river basin district approach to make sure that neighbouring Member States assume joint responsibility for managing the rivers and other bodies of water they share.

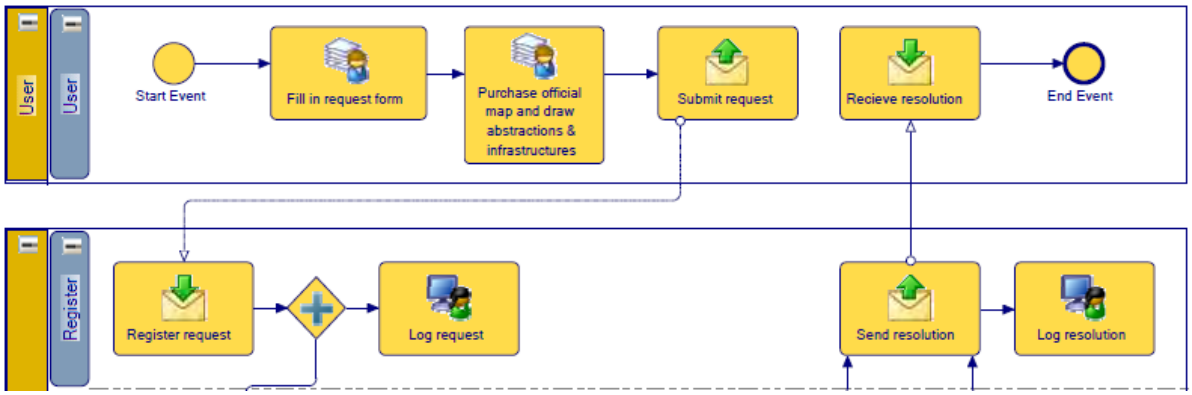
As a result of this Directive, in most countries the river basin authorities become responsible for granting the authorisation of water abstraction, i.e. giving citizens, companies and other stakeholders the permission to use water for private purposes under certain conditions. To obtain such a permission, citizens or companies need to apply for obtaining this authorisation. Based on the information provided in the request and taking into account certain criteria (e.g. to prioritise some water uses over others), the river basin authorities approve or reject a certain request. As the process of requesting, analysing and authorising such water abstraction deals significantly with location information, the traditionally paper-based processes can be made more efficient and effective through the development of location enabled e-Government services.

Figure 12 shows the BPMN process model of the G2C interactions in the traditionally paper-based process for requesting a water abstraction authorisation as organised by the Ebro River Basin Authority (Latre et al, 2013). A user applying for a water abstraction permit, first needs to get the forms and related instructions for the authorisation. These forms can be obtained personally at the River Basin Authority offices or can be downloaded from their website. In these forms, the user should add his or her personal data, a justification of the amount of water requested and a description of the infrastructure works to be carried out. In the application form, several types of location information also need to be provided:

- The location of the planned abstraction (river, bank and municipality);
- All areas that will be irrigated (where a farmer would use the water for irrigating a plot of land);
- The location of the required infrastructure (piping, pumps, systems to control the volume of water);
- Ownership of the irrigated area.

In reality, this often means the user has to purchase a specific sheet of the 1:50.000 map of the Spanish Mapping Agency and draw a detailed sketch of the abstraction, the irrigating plot and the required infrastructure on it. Also, a copy of the cadastral map has to be submitted. Each request should be registered in the offices of the Ebro River Administration or in another valid registry, after which it will initially be handled by the River Policy Department. Here, the data in the request are checked, and the administrative process is initiated. Within the complete process of handling the request, only one additional interaction with the user takes place: at the end of the process the user receives a confirmation of whether the permit is granted or not.

Figure 12. G2C interactions in the paper-based water abstraction authorisation process



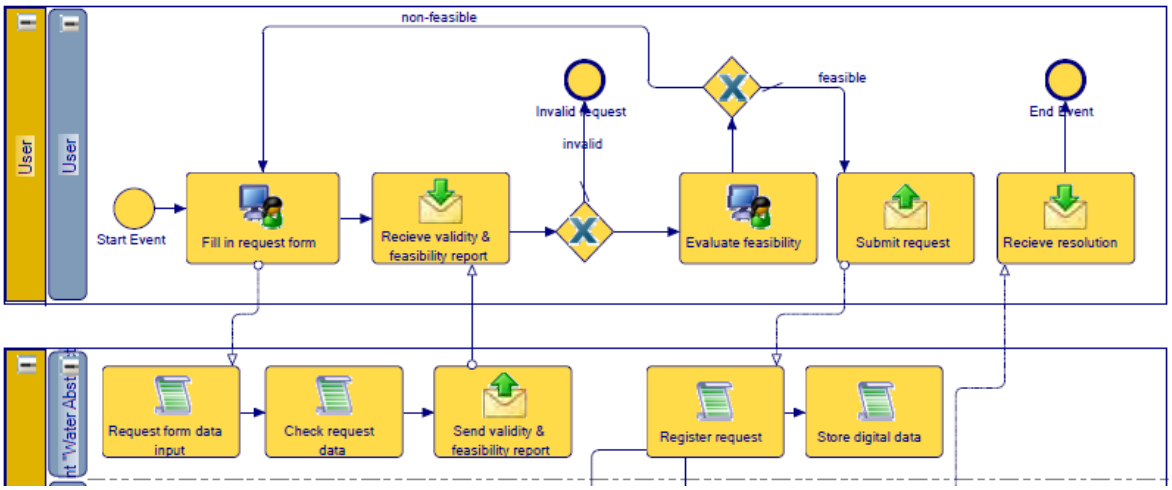
Source: Latre et al, 2013

To automate the existing paper-based processes, an e-Government service was built on top of the services provided by INSPIRE and other SDIs. This service, which is provided as a web tool called « Water Abstraction Service » coordinates all the G2C interactions with the user: the acquisition and storage of data, the generation of a feasibility report, the validation of the electronic signature, and the management of the feedback the user receives. The traditionally paper-based service was location enabled in many different ways, taking advantage of several data sets and components of different SDIs:

- The location of the area of interest is found by querying gazetteer services[7] from the local and national SDI;
- A visualisation tool allows the selection and use of the reference data that are most suitable for providing all the required location information: e.g. administrative boundaries, settlements, river network or transport network. This information can be accessed from the most suitable sources, including services from different hydrological authorities and services from the mapping agencies;
- Raster images and orthophotos are used as background, together with cadastre parcels;
- The determination of geographic elements that might have an impact on the request, such as municipalities, river sub-basins, hydrogeological domains and aquifers is done automatically by making requests to web feature services from the hydrological authorities and mapping agencies.

Several other components, services and functionalities increase the usability of the tool. All information obtained during the request is automatically integrated in the information system of the Ebro River Basin Authority and is included in the feasibility report the user receives after his request. The integration of an electronic signature applet using a certification tool administratively formalises the entire process. Users are informed about the administrative status and update of their requests as they are processed, via the web application or via email or mobile phone.

Figure 13. G2C interactions in the location enabled water abstraction authorisation process



Source: Latre et al, 2013

Figure 13 shows the different process steps in which the user is involved, and the interactions of the user with the River Basin Authority, in the location enabled process. A first key difference is the digitisation of all process steps and interactions in which the user is involved, as the user no longer has to submit his request on a paper form. Another key difference – and benefit to the user – is the additional requests between the submission of the request and the receipt of the outcome of the authorisation process (i.e. a permit or a rejection). Immediately after the user has entered the required information into the system, initial feedback on the request can be provided, as the system will point out mistakes or explain the reasons why the request would be rejected automatically. The system could also inform the user about the feasibility of his request being granted. Important to notice is that the « Water Abstraction Service » focuses mainly on the G2C interactions in the front office, while in the back office many G2G take place that could benefit from location enabled e-Government services as well.

[7] A gazetteer service provides a mechanism to search for place names.

4 How to design and implement location enabled e-Government services?

The process of developing location enabled e-Government services includes three main phases: design, implementation and evaluation. In this section each of these phases is briefly addressed, discussing how each of these phases can be organised and managed in a user-centred, open and collaborative manner.

Box 8. Warning: Timing of design and implementation phases

It should be noted that the phases are not necessarily organised in a strict consecutive order. Because of the highly interactive and collaborative way of working with the user communities the phases overlap and are strongly interconnected: e.g. some development and implementation already occurs during the design phase to have early feedback on the design, the evaluation also starts already during the design phase for the same reasons, while oppositely the design might continue or be improved during the implementation and evaluation phases.

4.1 Design of location enabled e-Government services

The processes of designing location enabled e-Government services is about taking into consideration and reconciling the needs and demands of two stakeholder groups: the users of the services and the stakeholders involved in developing and delivering the service. Therefore, location enabled e-Government services requires a user-centred and collaborative design process.

4.1.1 What is a user centric design?

Service design is crucial to the success of e-services, and of e-Government services in particular, as e-Government services will only be used if they are well designed (Kotamraju & van der Geest, 2012). From a service perspective, this means that e-Government services will only be used if they are at least as good as traditional services in terms of service quality. From a system perspective, citizens will expect e-Government services to be just as user-friendly as the web applications and non-governmental e-services they are familiar with. A user-centred design processes is needed to ensure high-quality and user-friendly services are developed.

A user-centric design always starts from the functional and non-functional requirements of the service. In software, service and systems engineering, a functional requirement defines a function of a system or its component(s). A function is described as a set of inputs, the behaviour, and outputs. This matches very well with what a software, a service, a system (component) … ought to do when supporting the input-throughput-output steps of the process. A non-functional requirement specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. The functional requirements are usually detailed in the system design, while the non-functional requirements are usually detailed in the system architecture because they are usually similar or even identical for different systems (components) of a governmental solution.

Error! Reference source not found. provides some examples of non-functional requirements. Different criteria can be defined for each of these requirements. For example: performance of a service can be defined in terms of how fast a location enabled e-Government service provides the maps on the screen; accessibility can be defined as a % of the time a service is online; licensing might define the different types of licences that are supported by the system, etc.

Table 2. Examples of non-functional requirements

Non-functional requirements		
Accessibility	Extensibility	Usability
Compliance	Maintainability	Quality
Performance	Security	Open source
Disaster recovery	Scalability	Audit and control
Documentation	Reusability	Licensing

Non-functional requirements		
Testability	Configuration management	Price

For the functional requirements, the design should start from the process mapped (see section 3). The central starting question is: what are the process steps that should be supported by the service (one might have different services for different process steps, but ideally an integrated service would be designed). Key elements in the design will be the activities/tasks, the required functions to support these activities, as well as the data/information needed to perform the tasks/activities. Often, several types of matrices are developed:

- Activity/task(s) – data matrix: what are / is the data / information needed as input to the process steps. The data/information can be administrative information (about persons or businesses), it can be geospatial information, statistics, etc.
- Activity/task(s) – functions matrix: what are the operations needed to perform the tasks in the process. This might be entering of administrative information in a form, the panning and zooming on a map, delineation of an area, etc.
- Function – data matrix: Which functions defined use/generate which data/information?

This analysis performs the basis of the requirements analysis which in turn will provide the input to the elaboration of the technical specifications.

One of the main service attributes that will influence citizens' intention to use an e-Government service is the usability of the service. Usability is about the ease of use of a service, or the extent to which using a service is free of effort. Usability is not only a key driver of service use, but also the most important element in which users will evaluate a service and the most important determinant of service quality and user satisfaction. In the context of location enabled e-Government services the terms user friendliness, usability and ease-of-use require particular attention. It is difficult to provide universal rules to design user friendly location enabled e-Government services. Nevertheless, it is possible to provide some recommendations in the form of 'to-do's' and 'not-to-do's'.

Box 9. User friendly location enabled e-Government services

Many location enabled e-Government services have a graphical interface for visualising location aspects. For this particular graphical interface, designers / developers should:

— Use existing gazetteer functions to find and zoom to particular areas of interest based on existing European (or national) gazetteer services and by making use of authentic sources such as address registers. 'Free text' options for searching/finding place names should be avoided. Typically, the service would guide the user to select the right name, address, etc.

— Simplify the content of what is mapped. Especially when intended users are citizens/businesses – who are usually not GI-experts – a map should only provide the spatial objects that are relevant for the service. On the one hand, this would include a clear and easy to understand background map that they are familiar with using in other web applications such as a topographic map, google earth/maps, orthophotos, etc. On the other hand, only relevant spatial objects should be added on top of the base map, e.g. cadastral boundaries and building footprints, or particular POI's that are relevant to the service.

— Use symbols and colour schemes that are as simple as possible and are preferably 'suggestive'[8]. For example, mapping the quality of bathing waters is best represented with a three-colour flagging scheme: green for 'safe bathing', red for 'bathing prohibited' and orange for 'potential danger'. Details on the chemical and other statistical measurements which are behind should not be shown.

— Avoid unnecessary functionality. The functions should support the required actions / tasks that are part of the process, not more. If, for example, the user should be able to delineate a zone (for example in the context of defining potential flood buffer areas), it is not recommended to add more advanced editing functionalities. Instead it is recommended to add basic editing functionalities such as free drawing of

[8] e.g. using different type of cars in services related to traffic, specific symbols for POI's (hotels, gasoline stations ...).

curves or adding of polygons by defining points (vectors), such as is done in MS Paint and Google Earth respectively.

Some location enabled e-Government services also need to collect information from the user, and in other cases the service also needs to process this and other information. The design should take three particular aspects into account:

— When input is requested from citizens/businesses or any other users, asking for information that is already known should be avoided. For example, when a citizen is already logged in as a user, basic information such as name, address, and other related information should only be presented for confirmation, instead of requesting the re-entering of the same information.

— In the case of processing, the processing of the information/data should run in the background as much as possible, and for heavy processing this should be done 'off-line'. For example, the control of a particular location against location-based legislation could be done in the back-office and de-coupled from the main services if necessary - for example, checking an address against spatial land-use plans or against risk zones (e.g. flooding) ...

— Location enabled e-Government services should make use of other existing ICT components and/or implement specific requirements such as secure access mechanisms to protect where relevant personal or other sensitive information (see also section 4.2 implementation phase).

4.1.2 Methods for user-centred design

When designing e-Government services, it is essential to know who the users of the service are as well as their needs. E-Government services should be designed with a clear view of the user's prior knowledge, the context of use and the expectations users have of a certain service. Designing user-centred e-Government services requires a full user-centred design process, rather than a single usability survey or user satisfaction evaluations (Van Velsen et al, 2009; GOV.UK, 2016). User research and user involvement should be included during every stage of the design processes. A user-centred approach can be applied in many different ways, using different methods or combinations of methods. Three main data collection methods can be distinguished:

- The use of existing evidence, such as analytics, previous research reports, search logs, etc.;
- Input from people within the public sector who deal with users;
- Input from users themselves.

Input from the users themselves is essential and can be collected in many different ways. Users may be interviewed about their needs that the services should address, observed when completing tasks for which the service will be designed, be asked to contribute directly to the design and/or evaluate a draft or prototype of the service (Kotamraju & van der Geest, 2012). Besides interviews, user requirements and feedback might be collected during workshops, demonstrations, expert[9] and user panels, etc.

Ideally, these different methods and techniques are combined and applied in a logical order. An example of a chronological application of different methods and techniques to collect information on user needs and requirements is provided by van Velsen et al (2009):

- *Interviews:* During interviews, questions can be asked on the current form of service provision, the problems that exist, the goals, and the potential impact of digitisation in improving the service provision. Two main stakeholders should be involved in the interviews: citizens who recently applied for the service and civil servants directly involved in handling the application and delivering the service. A semi-structured interview is the most frequently recommended approach, focusing on key topics such as a description of the chronological application (citizens view) or supply processes (public servants view), experiences of citizen with the application process and expectations of both citizens and public servants of the digitisation of the process.
- *Interview analysis:* the interviews need to be transcribed and further analysed, using existing systematic analysis techniques, such as critical factor analysis, decision analysis and human factor analysis. Critical factor analysis, focusing on revealing all factors that are critical for citizens to

[9] For example, one can use Delphi and other techniques to identify and prioritise requirements from the perspective of the process owner requirements.

complete a process or make a decision successfully. Decision analysis focuses on the different decisions citizens have to make during the service processes, the steps involved, and the information needed to take these decisions. Human factor analysis focuses on the identification of issues that may hinder successful interaction between user and system. Each of these three elements – critical issues, decisions to be made and human factors – are valuable input for the design process.

- *Translation into user requirements:* all critical factors, i.e. the steps in the decision process and human factors to be taken into account, should be formulated as user requirements. Again, several formats for the documentation of requirements exist. For each requirement, it is important to write down the rationale behind each requirement and to include criteria for evaluating whether a certain requirement has been successfully implemented in the e-service design or not. The user requirements should cover functional as well as non-functional requirements as explained above.
- *Specification development:* the user requirements from the previous step are usually in narrative format. The requirements should be 'translated' into technical specifications using 'neutral' language, i.e. language avoiding terms that are used only by a certain data, system or service provider. The requirements should be clear and concise and if necessary become part of a procurement document. Guidelines for public procurement of geospatial technologies have been developed as part of the EULF ISA action (Pignatelli et al., 2016).
- *Low-fidelity prototyping*: an evaluation should be made of the initial set of user requirements, their relevance for stakeholders and the form in which they will be implemented in the e-service interface and interaction. A prototype version of the system can be used in combination with a real-life scenario to facilitate the discussion between the requirements engineer and the stakeholders. This low-fidelity prototype can be in the form of a set of pictures, displaying the main screens and functionalities of the system.
- *User walkthrough*: during a user walkthrough, a participant is shown the low-fidelity prototype version of the e-service, and is asked to provide comments on the functionality, the interface and the interaction design. The walkthrough should be supported by a scenario, i.e. a story about a fictional character who uses the e-service, in order to make the prototype functionality and usefulness more tangible. The data collected through the user walkthrough process should be analysed focusing on different aspects: the user's overall perception of the e-service process (process analysis), the typical feature of the e-service, as derived from the user requirements (functional analysis), but also on issues that are not interface-specific, such as trust in the system and intention to use it.
- *Requirement document as input to the design process*: after the user walkthrough, reviewing and possibly revising the initial requirements is needed. Some of the initial requirements might not be as important as expected, and new requirements might be added (and tested again through an updated prototype and a new walkthrough). When the requirement engineering stage is completed, a requirement and specifications document should be created, which will serve as starting point for designing and programming of the service. Also here, several test rounds should be organised with prospective users and other stakeholders that are involved.

Besides the needs and requirements of the actual users of the services, it is important also to take into consideration the needs and requirements of the organisations involved in developing and delivering the e-Government service. From that perspective, the design of location enabled e-Government services should also be considered as a governance challenge, in which the needs and requirements of different stakeholders have to be aligned (Bekkers, 2007b).

Involving and engaging these stakeholders from the beginning of the design process is crucial for the success of the design and development processes. A primary requirement is the identification and recognition of the rationalities and needs of the different stakeholders. Stakeholders need to know how and to what extent their needs and demands will be taken into account. Next, it will be important to define a common goal among all partners, based on creating a win-win situation in which all partners could benefit. Here, a user-centred perspective on service development, in which the central focus will be on improving the relationship between governments and citizens and businesses, might contribute to unifying the goals of different stakeholders. Building and maintaining a consensus on user-centricity as the key objective in location enabled e-Government services, will be essential in the design and development of e-Government services in a multi-stakeholder environment.

4.2 Implementation of location enabled e-Government services

Also, in the implementation phase of location enabled e-Government services, it is important to maintain a user-centred and collaborative focus. Implementing e-Government services in a user-centred manner starts with building the service in accordance with the outcome of the user-centred design processes and involving users and participants in testing the implemented service in an environment identical to the live (operational) service. The same users that have contributed to the design phase can be involved in the implementation and usability testing. However, testing could also be conducted with other potential users outside the original input group, in order to validate the design.

4.2.1 Organisational points during implementation

A successful user-centred and collaborative implementation will depend to a significant extent on the organisational approach made during the design and further developed during the implementation phase. Even if many approaches are possible, some recommendations can be given.

1. Create a **multi-disciplinary team** to develop, test and follow-up the implementation of location enabled e-Government services. Since location information and location-based web services are a key part of such services it is recommended to have, besides ICT practitioners, involvement of one or more geographic information experts. Depending on the functional and non-functional requirements, these can be experts regarding the data, the standard interfaces to be used, the portrayal of data, etc. The business analyst(s) involved during the design phase should also be involved during implementation. In gov.uk, each service also has a service manager who is the point of contact for the users (feedback). In addition, thematic experts that understand the process / policy area well, also need to be involved.
2. Many e-Government services, including those that are location-enabled will **involve cross-administration** interactions, and in some cases even cross-border interactions. Cross-administration not only means different departments/agencies, but also different levels of administration, from local over (sub-)national up to the European level. Users of e-Government services usually do not differentiate between the national and sub-national levels. Instead citizens and businesses tend to expect standardised and consistent solutions (SAGA, 2008). It is also recommended in this context to keep track of and document existing solutions / components, in order to re-use what exists already and fits the functional and non-functional requirements. From this perspective, the Assets Descriptor Metadata Schema can be very helpful.
3. An **Agile development approach** is highly recommended. Although it requires a lot of iterations (with user feedback moments) and requires also more flexibility from the programmers, there are many advantages: it is easier to meet user needs; the development can easily be changed (e.g. in case of policy or technology changes); it allows step-wise improvement (e.g. based on user feedback) and it costs less. It also allows continuous testing of the implementation and, where feasible and relevant, trying out new solutions. In this context the set-up of persistent testbeds should be envisaged (see box below).
4. The implementation of location enabled e-Government services can and probably will reveal some inconsistencies in the way the e-Government business process is actually working. Although it is not the ultimate goal of the implementation of such a service to change the existing process, it is recommended to formulate proposals to improve and **optimise the process**. Processes are usually the result of historical developments and choices made at a particular point in time. Processes might also have evolved over time because of, for example, new legislation or changed policies (SAGA, 2008). Ideally the inconsistencies will emerge during the analytical phase when mapping the process and the process should be improved where possible before implementing the service(s). Improvement might involve, among other things: simplification and/or shortening of process steps, reduction/elimination of 'dead times' or 'bottlenecks'; reduction of the number of interactions and interfaces; etc.

Box 10. Implementing persistent testbeds as a basis for agile development of services

One way of developing according to the agile method is to set-up, as early as the design phase, a persistent testbed environment (see for example https://agile-online.org/index.php/initiatives/finished-initiatives/persistent-testbed). This allows module-based development, direct testing and validation, and

involvement of the users. The scrum development framework is often used and is a good way to work gradually. Scrum is an iterative and incremental agile software development framework for managing and monitoring product development (Scrum Alliance, 2016). The scrum framework allows flexibility. It challenges the assumptions of the traditional, sequential approach to product development. It enables a team to self-organise by encouraging physical co-location or close online collaboration of all team members, as well as daily face-to-face communication among all team members and disciplines in the project. In such a method several sprints (or iterations) are organised. These are the basic units of development in scrum. The duration of a sprint is fixed in advance and is normally between one week and one month.

The OGC has developed a consistent approach for testing implementations of standards within real-world contexts as part of their interoperability programme. OGC makes the distinction between testbeds, pilots and interoperability experiments. Test beds are fast-paced, multi-vendor collaborative efforts to define, design, develop, and test candidate interface and encoding specifications. Pilot projects apply and test OGC standards in real world applications using Standards Based Commercial Off-The-Shelf (SCOTS) products that implement OGC standards. Interoperability Experiments are brief, low-overhead, formally structured and approved initiatives led and executed by OGC members to achieve specific technical objectives that further the OGC Technical Baseline (OGC, 2016).

4.2.2 Technical points during implementation

The functional and non-functional requirements are defined during the design phase and might lead to procurement of particular tools and software components. Although it is difficult to have one set of tools or software solutions defined for all location enabled e-Government services, some general recommendations can be formulated.

1. Develop a common **baseline of tools and systems** that can be used and re-used in service development across sectors: check any risks or constraints associated with them; avoid contracts that create lock-in situations; build a sustainable system that can easily be managed after the service goes live. A good method to monitor and evaluate continuously specific geospatial tools and software that can be used for implementing location enabled services is provided by CASCADOSS, a 7FP project (see http://cascadoss.gridw.pl/en/).
2. Location enabled e-Government services should be completely independent from the users' selected platforms, the configuration of the user systems or the ability of the users (SAGA, 2008). Location enabled e-Government services should therefore use **web browsers** at the front-end, preferably without using active content (in order not to reduce the browser's security settings) and avoid storing software components or data on the users' computer beyond the users' control.
3. Services should be based as much as possible on **open source** solutions. It is important to assess the communities surrounding the solutions and it is also worthwhile to monitor and evaluate best practice implementations. Implementing open source solutions allows other services to reuse the solutions that are created; avoid duplication of work and avoid starting technology contracts that can't be ended easily.
4. The chosen solutions should make use of **open standards** from known standardisation bodies such as W3C, OASIS, OGC, etc. Most geospatial open source and proprietary software solutions provide documentation about (versions of) open standards supported: e.g. *"ESRI Support for Geospatial Standards: OGC and ISO/TC211"* (ESRI, 2015). Standardisation organisations also provide facilities to check whether particular systems support certain standards successfully: e.g. the OGC CITE (Compliance Interoperability & Testing and Evaluation) programme.
5. Perform **end-to-end service testing** in an environment identical to the operational version (accessible to the public), including tests on all common browsers and devices, and using dummy accounts and a representative sample of users. Testing the end-to-end service allows to find problems and check that the service will work for the number of people who want to use it.

Two other aspects should get particular attention in the implementation phase: security and secure access mechanisms for location enabled e-Government services, and the chaining and orchestration of service components in the context of the processes in which the location enabled e-Government services will be embedded.

Box. 11. Security and the handling of sensitive information

It is necessary to evaluate what user data and information the digital service will be providing, storing and/or processing. Therefore, it is essential to address the security levels required, the data/information that is sensitive and that should be protected, the potential legal implications and responsibilities, and the privacy issues and risks associated with the service (consulting with experts where appropriate). Users won't use the service unless confidentiality can be guaranteed, and they can access their own information in the service when needed.

In the context of location enabled e-Government services, there are particular challenges as well. Particular spatial objects (locations) might be sensitive and require protection: e.g. military installations might not be shown on a map. In other cases, the location might be shown, but the details of its content might be protected: e.g. certain protected sites (Natura 2000) might be shown but the details of the species and habitats inside the site might be hidden for the public.

It is recommended to implement secure access mechanisms based on generic ICT security standards: e.g. SAML (Security Assertion Markup Language), XACML (eXtensible Access Control Markup Language). Authentication preferably relies on single-sign-on access mechanisms and citizens might get access via the use of their e-ID. Authorisation mechanisms will depend on the data and service policies of the data and service providers and on the requirements regarding the sensitiveness of the information (including privacy rules and regulation).

Security on specific spatial objects or their content can be implemented by using geoXACML. The Geospatial eXtensible Access Control Markup Language (GeoXACML) is a standard from the Open Geospatial Consortium (OGC) that defines a geo-specific extension to XACML v2.0. It extends the XACML Policy Language by the new data type "Geometry" and several geo-specific functions that allow the declaration and enforcement of access rights that can be associated with the geometric characteristics of the resource.

For more information on the implementation of secure access mechanisms for geospatial data we refer to the work done under the ARE^{3}NA ISA Action (https://joinup.ec.europa.eu/sites/default/files/document/2016-01/are3na-aaa-geoportal_resources_analysis.pdf).

Box. 12. Chaining and orchestration

The design and implementation of location enabled e-Government services is based on a series of components, usually web services that are integrated in an application that may run on several platforms (such as PC's, mobile devices ...). Moreover, e-Government services rely on input (data/information) from other services and can in their turn also generate output (a map, a figure ...) that can be used in other processes. From this perspective, the e-Government services are not isolated but inter-connected and the web services on which they are based should be able to communicate with each other. In order to make the e-Government services work fluently, the web-services must be chained and orchestrated.

As can be seen from some of the examples of location enabled e-Government services (see section 2.3) the above-mentioned principles apply as well. Service chaining has also gained attention in the geospatial (standardisation) community. In this context, service chaining is the process of combining or pipelining results from several complementary and interoperable geospatial web services to create a customised solution. Chaining can be organised in different ways: client-coordinated – the client defines and controls the order of execution of individual services in a chain; static – use pre-defined chains of services but present them to the client as one (aggregated); and mediated chaining – combining static services with the flexibility and control inherent in client-coordinated service chaining (Alameh, 2001).

In order to implement service chaining and orchestration several standards are relevant. Standards such as Universal Description, Discovery and Integration (UDDI) can facilitate service chaining and orchestration of services. UDDI is a protocol that includes a registry by which organisations can list themselves on-line and allow for third parties to register and locate web service applications. Electronic Business using eXtensible Markup Language (ebXML) includes XML-based standards sponsored by UN/CEFACT and OASIS and allows reuse of (electronic) business and location information by all collaborators. The OGC has developed CSW-ebRIM Registry Service: a profile of the CSW of the OpenGIS® Catalogue Service Implementation Specification (v2.0.2, OGC-07-006r1). It applies the CSW interfaces to the OASIS ebXML registry information model (ebRIM

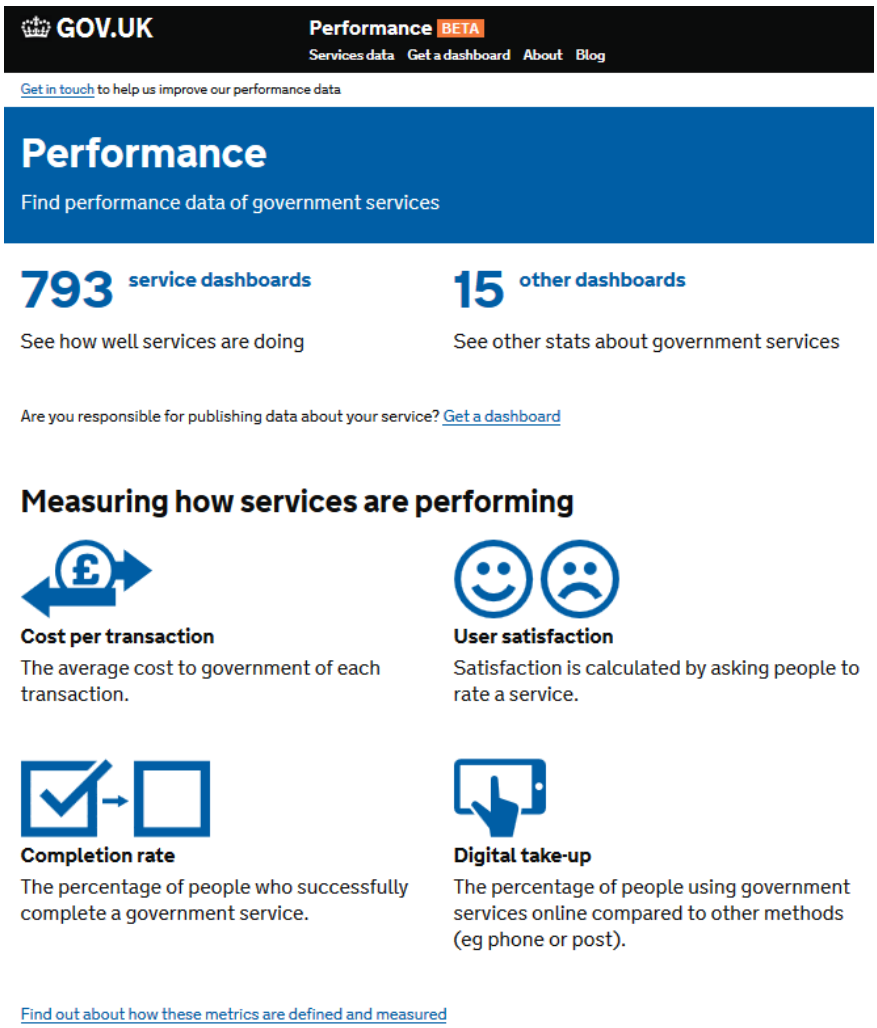
3.0) so as to provide a general and flexible web-based registry service that enables users—human or software agents—to locate, access, and make use of resources in an open, distributed system; it provides facilities for retrieving, storing, and managing many kinds of resource descriptions.

4.3 Evaluating location enabled e-Government services

Evaluating e-Government services, and location enabled e-Government services, is a useful and necessary activity for several reasons. From a retrospective view, evaluation of e-Government services provides decision makers insight into whether the services are successful, and whether the objectives of developing these services have been realised. From a prospective view, the results of evaluations can help decision makers in making future decisions on the development of new or additional services. In general, it can be argued that evaluation is for ensuring returns from the enormous investments of governments in delivering e-Government services.

A good example of monitoring the performance of e-Government services is given by gov.uk. There is a particular website where everyone can follow the usage of the services and users can provide feedback (**Figure 14**).

Figure 14. GOV.UK provides performance dashboards for all its services



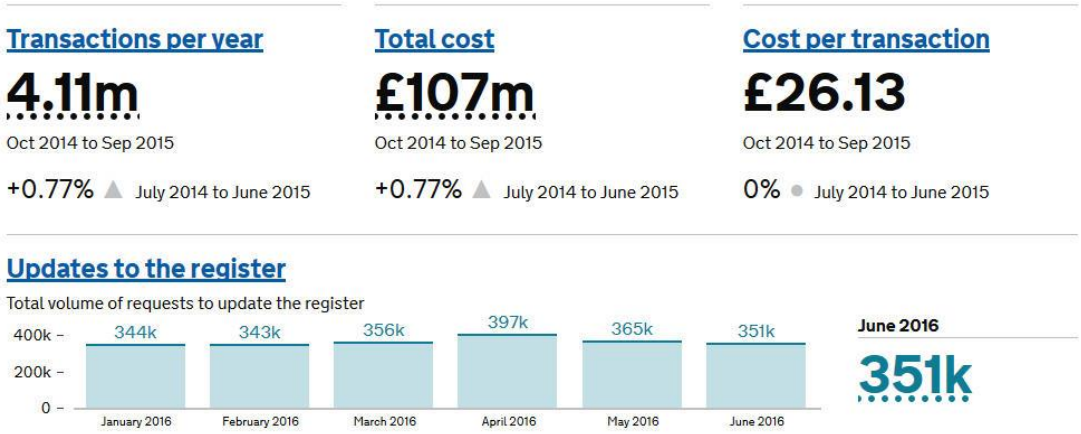
Source: GOV.UK, 2017

In monitoring and evaluating e-Government services, the focus can be put on several aspects (OECD, 2009). For monitoring the status of e-Government development at a general level, it can be valuable to put the focus on the ***availability*** of location enabled e-Government services, i.e. to measure which location enabled e-Government services are available in a certain country. This approach is used frequently to monitor the progress of e-Government development in a certain country, or to compare the status of e-Government

development between different countries. Starting from a pre-defined list of services, such as the list of 20 basic e-Government services, an assessment is made which of these e-services are available in a certain country, and how the availability of services has changed in recent years. In a more extended application of this approach, besides the availability of the services also the level of sophistication of each service is measured and taken into account in the evaluation.

Although this approach has its value, especially for comparisons over time and between countries, no insight is gained into the actual use of the available services. Besides the availability and sophistication of services, ***user take-up*** is also an important element that should be taken into consideration in evaluation location enabled e-Government services (see **Figure 15**).

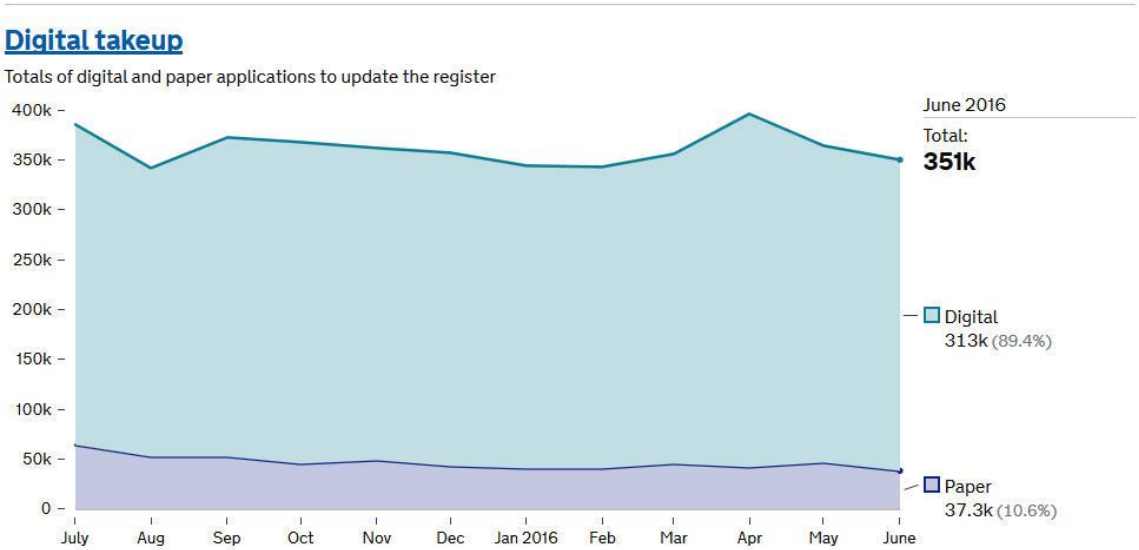
Figure 15. Performance of the Land Registry service: updates to the register



Source: GOV.UK, 2016

Much of the information on the take-up and use of e-Government services can be collected automatically but should be made available in an easily understandable and standardised manner to responsible managers and decision makers. This includes key performance indicators such as the number of users and the number of successfully completed transactions, but also more detailed usage statistics, e.g. on how users respond to variations in service design. A key indicator is the level of digital take-up, which is the number of completed digital transactions divided by the total number of transactions from all available channels over any fixed period (**Figure 16**) (GOV.UK, 2016).

Figure 16. Digital take-up of the Land Registry service: updates to the register



Source: GOV.UK, 2016

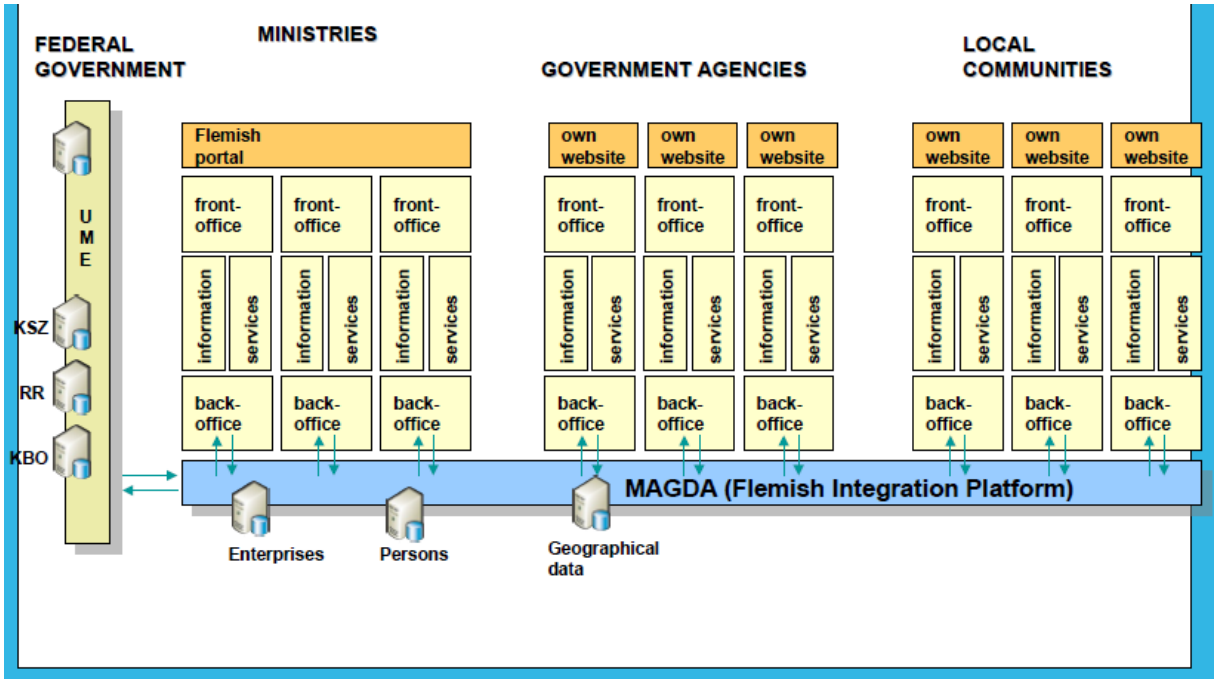
Another key performance indicator for measuring the performance of location enabled e-Government services is ***user satisfaction***. Monitoring and measuring user satisfaction is about finding out what users think about a certain service and which potential problems they face in using this service. Information on user satisfaction can be collected in many different ways. Feedback from users on a particular service can be collected via satisfaction surveys, once the user has finished using it, or via in-service feedback pages in each phase of the service delivery process. But also, users that do not complete the survey have to be involved in the user satisfaction measurements. In many countries e-Government user satisfaction is measured annually – or even continuously – in a more general way, covering many different services within one single survey.

Finally, it is also important to measure the **impact** of location enabled e-Government services, in terms of efficiency, effectiveness and democracy. With regard to the efficiency of e-Government services, it can be assumed that where the unit cost for a delivered service is less for an e-Government service than using traditional channels and mechanisms, it is clear that each completed transaction already represents a cost saving. However, to define precisely the cost savings realised through a location enabled e-service, it is essential to measure the *cost per transaction*, i.e. the cost to government each time someone completes the task a service provides. But efficiency might also be about realising cost savings for citizens, in the situation where the cost of using an e-Government service is lower compared to the cost of using a traditional service. From the perspective of effectiveness, e-Government services often aim to reduce the administrative burden and/or improve the quality of service delivery. Monitoring and evaluation efforts should make clear whether these aims of reduced administrative burden and improved quality have been realised.

4.4 Example – Design and implementation of location enabling e-Government services in Flanders

In 2006 the need emerged within the Flemish administration to provide a generic solution for embedding geospatial components into e-Government processes. A new project was launched, called geGIS (generic GIS) based on relatively simple specifications.

Figure 17. SOA based platform for integrating and sharing data and services



The solution(s) had to:

1. Provide a generator for e-Services that can be deployed in a web browser allowing access to view and manage the information;
2. Allow location-based data sources to be adaptable and independent from any GIS software used to create them;

3. Provide a link to and be embeddable into the existing SOA-based e-Government platform of Flanders called MAGDA[10] (see **Figure 17**).

The approach was quite new. The project was conceived as an experiment, trying to bring innovative solutions into play. It was component-based and completely open. A number of risks were identified (**Error! Reference source not found.**).

Table 3. geGIS - Risks identified and how they were mitigated

Risk	**Mitigation**
Completely new technology	Experienced multidisciplinary team put in place
Sustainability not guaranteed	Long-term commitment to develop and support the technology as an open source platform
Reusability jeopardised	Project steering committee and open source steering committee set up and worked in parallel Start of a community around the technical solutions
Large and diverse group of stakeholders	Setting up a small and efficient project task force with experienced and committed stakeholders
⬇ ⬇ ⬇ ⬇ ⬇ ⬇ ⬇	
In parallel, the process of writing a business plan started outside the project	

The challenges of the project were multi-fold but overcoming them turned the challenges into key strengths. First the geGIS project was highly consumer driven: the required features were clearly defined by the user community; the work was organised around use cases supporting different processes and short-term results were required as well. Secondly, the project filled not only particular needs, but was set-up in an innovative way: a technical architecture was designed fulfilling the needs; a validation took place of the most innovative technological parts in the course of project execution and also the long-term benefits were addressed during the project life-time. The final challenge was to distribute the available budget in two contradicting interests: 1) to focus on the direct consumer wishes with a small part of the budget dedicated to test some innovative parts (but without focusing too much on the modularity and re-usability of the components) and 2) to focus more on the innovative parts and re-usability, rather than fulfilling the direct user needs. In the end, a good balance was found, and an environment was created in which new solutions could be tested and further developed after the project life-cycle.

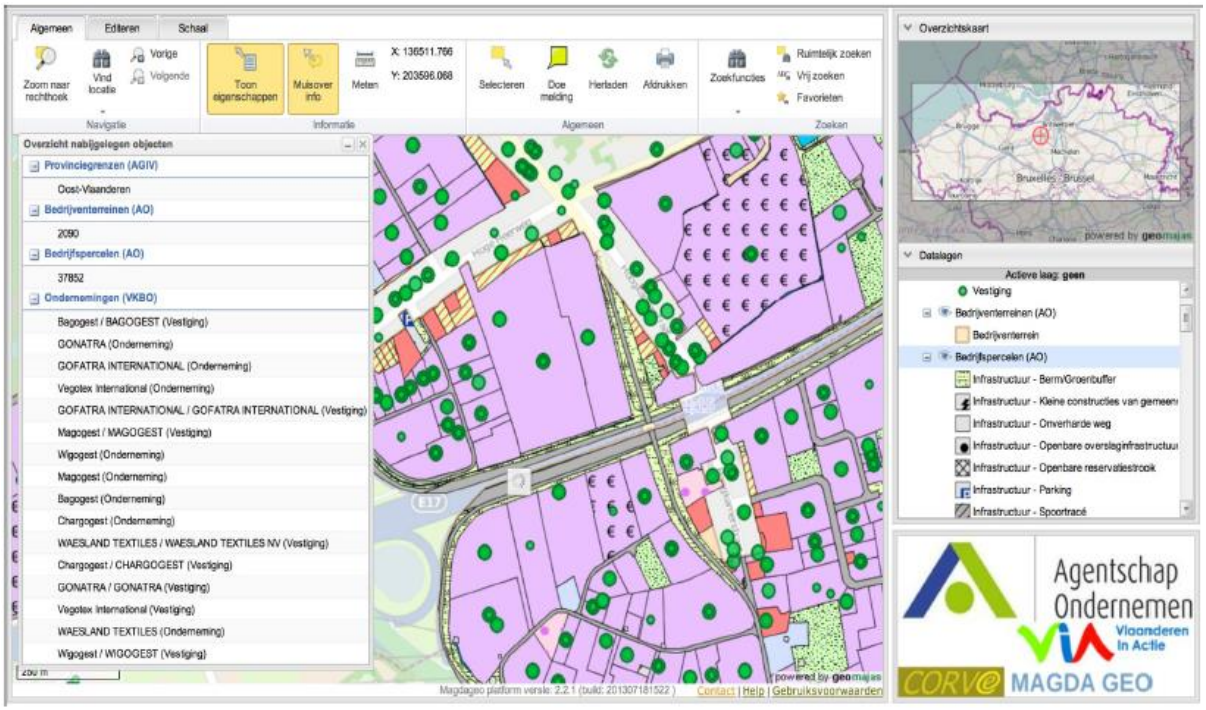
Sustainability of the project was tackled from both the government and the partners' perspectives. From the government perspective several questions had be answered:

1. How to support the future of the new implemented technology and promote its re-use within other administrations?
   - Create follow-up projects building on the same technology
   - Promote Agile development techniques
2. How to make sure the investments made are valuable and sustainable?
   - Promote the project to other administrations
   - Disseminate know-how and lessons learned
3. How to avoid vendor lock-in?
   - Build upon open source licences

[10] Maximum Data Sharing between Administrations

- Hire people from different companies working together on the same project
- Support community events, open to everybody

Figure 18. MAGDA Geo Platform linking information on businesses with other information (parking, transport,...)



From the partners' perspective several questions had to be answered:

1. How to support and further develop this new technology and how to promote its re-use?
   - Develop a well-thought out and concise business plan
   - Publish the project results as open source
   - Involve and consult the open source community and explain the rationale for the initiative, and why it is unique and of added value (also for them)
   - Be very open
2. How to make sure the investments made are valuable and sustainable?
   - Offer sustainable support for the new technology
   - Organise training
   - Organise and support community events, open to everybody
   - Convince others to use the technology and collaborate
   - Persist in the ideas put forward
   - Look for funding

In the meantime, the project not only resulted in take-up in the context of several other administrations, but also a new (spin-off) company was created and new businesses were set-up in other countries and continents (Geosparc, 2016).

5 Conclusions

Using INSPIRE and SDI data for designing and delivering location enabled e-Government services will contribute to reducing administrative burden and delivering new and better services to citizens, businesses and public administrations. The aim of this document was to introduce to e-Government implementers and project managers what location enabled e-Government services are and how they should be designed on top of SDI services and components. At the same time, the document aimed to show geographic information specialists and managers how the delivery of e-Government services is a key factor in realising the benefits of the production and management of location information in the public sector and of the development of an SDI to enhance the accessibility of location data in particular.

The document provides an answer to three central questions about the design of location enabled e-Government services. First, the document explains what location enabled e-Government services are, and how they are linked to the day-to-day processes of public administrations, and to the products and services they deliver to citizens, businesses and other public administrations. It shows that several of the basic services that public administrations deliver to citizens and business deal with location aspects and could significantly benefit from location enablement. Moreover, in certain policy domains, such as environment, mobility, and spatial planning, e-Government services could only be designed and be successful when they are location enabled.

Second, the document provides an answer to the question of how to assess the potential for location enablement of services. The starting point for detecting potentially effective location enabled e-Government services is having insight into the processes in which public administrations are involved, including the decomposition of these processes into different process steps, and also the different information flows and interactions. It is in these flows and interactions, between public administrations and citizens, businesses and other public administrations that the potential of location enablement is situated. In the situations in which these interactions deal with location aspects and the flows of information also include location information, location enablement could be considered as a way of improving the flows of information and the interactions through the design and delivery of location enabled services. In particular, where required location data are accessible through SDI services, building location information services on top of existing SDI services might dramatically reduce administrative burden and improve the quality of service delivery in the public sector.

The third issue covered in this document is the design, implementation and evaluation of location enabled e-Government services, and how to do this in a user-centred and collaborative manner. User-centred design of location information services is about maximising the usability of the services delivered, in order to guarantee services in the end are actually used. The need for collaborative development of location information services essentially stems from the high level of interdependencies between public administrations, and also non-government organisations in the delivery of services and products. Collaborative design means that the needs and requirements of all relevant stakeholder groups are taken into account, and effort is made to define a common goal among all stakeholders and create a win-win situation for each stakeholder. This common goal might be found in improving the overall relationship between citizens and businesses and public administrations. Collaborative implementation of location enabled services deals especially with the re-use of existing data and services and creating and delivering new data and services in a way they can easily be integrated into existing and new processes of different parties.

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List of abbreviations and definitions

AGIV	Agency for Geographic Information in Flanders
ARE^{3}NA	A Reusable INSPIRE Reference Platform (ISA)
BPEL	Business Process and Execution Language (Web Service BPEL)
BPMN	Business Process Model and Notation
CASCADOSS	CASCADed learning Open Source Software
CITE	Compliance Interoperability & Testing and Evaluation programme of OGC
CORVE	COöRdinatiecel Vlaams E-Government – Coordination Cell Flemish e-Government
CRAB	Central Address Reference Register
CSW	Catalog Service for the Web
DG DIGIT	Directorate General for Informatics
ebRIM	ebXML Registry Information Model
ebXML	Electronic Business Extensible Markup Language
EC	European Commission
ELISE	European Location Interoperability Solutions for e-Government
EULF	European Union Location Framework
G2B	Government to Business
G2C	Government to Citizen
G2G	Government to Government
geGIS	Generic GIS
GIPOD	Generiek Informatieplatform Openbaar Domein – Generic Information Platform Public Domain
GIS	Geographic Information System
GMES	Global Monitoring Environment and Security
ICT	Information and Communication Technology
INSPIRE	Infrastructure for Spatial Information in Europe
ISA	Interoperable Solutions for Public Administrations
ISA^2	Interoperability Solutions for Public Administrations, Businesses and Citizens
ISO	International Organisation for Standardisation
IT	Information Technology

JRC	Joint Research Centre
KBO	Kruispuntbank ondernemingen – Central Register for Companies
MAGDA	MAximale GegevensDeling tussen Administraties - Maximum Data Sharing between Administrations
MOG	Gemodelleerde Overstromingsgebieden – Modelled Flood Areas
OASIS	Organisation for the Advancement of Structured Information Standards
OECD	Organisation for Economic Co-operation and Development
OMG	Object Management Group
OGC	Open Geospatial Consortium
OWS	OGC Web Services
POG	Potentiële Overstromingsgebieden – Potential Flood Areas
POI	Points of Interest
ROG	Recente Overstromingsgebieden – Recently Flooded Areas
SAGA	Standards and Architectures for eGovernment Applications
SAML	Security Assertion Markup Language
SCOTS	Standards-based Commercial Off-The-Shelf products
SDI	Spatial Data Infrastructure
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
UDDI	Universal Description, Discovery, and Integration
VKBO	Verijkte Kruispuntbank Ondernemingen – Enriched Central Register for Companies
VMM	Vlaamse Milieu Maatschappij – Flemish Environmental Agency
W3C	World Wide Web Consortium
WFD	Water Framework Directive
WFS	Web Feature Service
WMS	Web Map Service
XACML	eXtensible Access Control Markup Language
XML	Extensible Markup Language

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