European Commission

JRC TECHNICAL REPORTS

Feasibility study for an EU Gazetteer common service

European Union Location Framework

Pignatelli, F.
Boguslawski, R.
Fernández de Soria, A.
Gielis, I.
Bargiotti, L.
Goedertier, S.

2017

EUR xxxxx xx

This publication is a Technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service. It aims to provide evidence-based scientific support to the European policymaking process. The scientific output expressed does not imply a policy position of the European Commission. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this publication.

Contact information
Name: Francesco Pignatelli
Address: Via E. Fermi, 2749, TP 262, 21027 Ispra, Italy
Email: francesco.pignatelli@ec.europa.eu
Tel.: +39 0332 78 6 19

JRC Science Hub
https://ec.europa.eu/jrc

JRCxxxxx

EUR xxxxx xx

Print	ISBN xxx-xx-xx-xxxxx-x	ISSN xxxx-xxxx	doi:xx.xxxxx/xxxxxx
PDF	ISBN xxx-xx-xx-xxxxx-x	ISSN xxxx-xxxx	doi:xx.xxxxx/xxxxxx

Ispra: European Commission, 20XX

© European Union, 20xx

The reuse of the document is authorised, provided the source is acknowledged and the original meaning or message of the texts are not distorted. The European Commission shall not be held liable for any consequences stemming from the reuse.

How to cite this report: Author(s), *Title*, EUR, doi

All images © European Union 20xx.

Printed in xxx (country name)

Contents

Abstract 1
1 Introduction 2
1.1 Context 2
1.2 Objectives 3
1.3 Approach 3
2 Scope Options for an EU Gazetteer Common Service 4
2.1 Content types of the EU Gazetteer common service 4
2.2 Data sources for an EU Gazetteer common service 4
2.3 Mechanisms for quality control 4
2.4 Linking with other base registers 5
2.5 Level of harmonisation 5
2.6 Licensing 6
2.7 Pricing mechanism 6
3 Demand side analysis: use cases for an EU Gazetteer common service 8
3.1 Generic use cases 8
3.2 Specific use cases 9
3.2.1 Geographical names 14
3.2.1.1 Organising news items based on their location aspects 14
3.2.1.2 Retrieve archived documents by location 14
3.2.1.3 Link datasets of data portals to a geographic location 15
3.2.2 Administrative units 15
3.2.2.1 Analyse the location dimension of statistical data 16
3.2.2.2 Law enforcement: analysis of crimes 16
3.2.3 Street names 17
3.2.3.1 Road maintenance 17
3.2.3.2 Location of traffic signs and infrastructure 17
3.2.4 Addresses 18
3.2.4.1 Locate companies and branches of a business register on a map 18
3.2.4.2 Cross-border multi-modal travel planner 18
3.2.4.3 Geocode postal addresses for postal services 19
3.2.4.4 Locate tourist and cultural heritage places 20
3.2.4.5 Validation of foreign addresses by public administrations 20
3.2.5 Buildings 21
3.2.6 Cadastral parcel 21
3.2.6.1 Provide situational awareness of emergencies and crises 21
3.2.6.2 Use of geodata by utility companies 22

3.2.6.3 Property tax 22
3.2.6.4 Attribute environmental permits 23
3.2.6.5 Calculate insurance risks 23
3.2.6.6 Urban planning 24
4 Supply side analysis 25
4.1 National initiatives 26
4.1.1 Open data coming from national mapping, cadastre, and land registry authorities 26
4.1.2 Denmark and France opened up their official address data, boosting the economy 27
4.1.3 Business Model Canvas () 28
4.1.4 Postal operators maintain comprehensive postal address databases 29
4.1.4.1 Business Model Canvas 30
4.2 European initiatives 32
4.2.1 EuroGeographics already provides an EU-wide gazetteer with administrative boundaries 32
4.2.1.1 Business Model Canvas 34
4.2.2 European Data Portal 35
4.2.2.1 Business Model Canvas 36
4.2.3 EULIS already provides access to cadastral parcel and land register information for professional users 37
4.2.3.1 Business Model Canvas 38
4.3 Global initiatives 39
4.3.1 Commercial data vendors already provide EU-wide products and services 39
4.3.1.1 Business Model Canvas 40
4.3.2 Crowd-sourcing initiatives like OpenStreetMap 41
4.3.2.1 Business Model Canvas 42
5 Intermediate conclusions on the demand and supply analysis 43
5.1 Content types 43
5.2 Data sources 46
5.3 Intermediate conclusion 47
6 Business case 48
6.1 Do nothing 48
6.2 Alternative 1 – Further developing existing pan-European data services 49
6.2.1 Scope options 49
6.2.2 Costs 52
6.2.3 Benefits 53
6.2.4 Risks 53
6.3 Alternative 2 – Prepare a public procurement to outsource to a third party 54
6.3.1 Scope options 54

6.3.2 Costs 56
6.3.3 Benefits 56
6.3.4 Risks 56
6.4 Alternative 3 – Federated model: establish common agreements with national authorities 58
6.4.1 Scope options 58
6.4.2 Costs 60
6.4.3 Benefits 61
6.4.4 Risks 61
6.5 Comparison of alternatives 62
7 Conclusions and recommendations 65
8 Next steps 67
References 69
List of abbreviations and definitions 70
List of boxes 71
List of figures 72
List of tables 73
Annexes 75
Annex 1. Stakeholder Interviews 75
Annex 2. Analysis of existing gazetteers 99
Annex 3. Analysis of existing applications 107
Annex 4. Datasets on the INSPIRE geoportal 112

Abstract

Gazetteers play an important role in enabling location-based services, for example to look-up the location of administrative units, streets, and addresses or find a description of a location on the basis of a given set of geographic coordinates. Public and private sector services already rely on a number of existing gazetteers, such as Geonames.org, OpenStreetMap, Google Maps. Depending on the product selected, gazetteers are available for free or against the payment of a fee, rely on authoritative or non-authoritative data and have different geographic and content coverage.

This study investigates the need for and feasibility of developing an EU Gazetteer common service by looking at demand and supply side aspects of such a service. First, it provides an overview of the key scope options for such a service. Secondly, it looks at the demand side by describing a number of generic and specific use cases, focusing on the most common content types (i.e. geographical names, administrative units, street names, addresses, buildings and cadastral parcels). Thirdly, it analyses a representative set of existing gazetteers at national, European and global level. Fourthly, it looks at the extent to which existing gazetteers meet the identified demand. Based on this outcome, three content types were retained: geographical names, administrative units and addresses. The study then presents alternative implementation actions that could be undertaken including: (i) do nothing, (ii) further developing existing pan-European data services, (iii) prepare a public procurement to outsource to third parties, (iv) put in place a federated model by establishing agreements with national authorities. The study concludes that while there is a need for an EU Gazetteer common service, there still are some questions to be answered by the European Commission and stakeholders before further action can be taken. These are further elaborated in the final sections of the report where recommendations and next steps are outlined.

1 Introduction

This study analyses the feasibility for EU action on establishing an EU-wide Gazetteer common service.

1.1 Context

A gazetteer is a register of features of a country, region, continent etc. containing information on their geographical position [ISO19112]. Gazetteers play an important role in public services and geospatial data analysis. Users of location-based services often consult a **gazetteer** to look-up the location of administrative units, streets, addresses, etc. This is known as **geocoding**. Conversely, finding a description of a location on the basis of a given set of geographic coordinates, is called **reverse geocoding**. Because these operations are commonly used, gazetteers are common building blocks that are used in many specific location-based services in both the public and the private sector.

Typically, national mapping agencies in the EU Member States maintain various gazetteers for use by public administrations or for reuse by the private sector. This document investigates the *need for* and *feasibility of* further alignment on creating an EU Gazetteer common service. Such an EU Gazetteer common service could leverage on already existing EU legislation and policy initiatives such as the INSPIRE Directive, the PSI Directive, the EU implementation of the G8 Open Data Charter, including the European Data Portal, and the European Commission Digital Single Market Strategy.

Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community (the **INSPIRE Directive**) presents a significant opportunity for providing an EU Gazetteer common service. INSPIRE is undoubtedly one of the largest efforts on spatial data harmonisation ever undertaken in Europe. It requires, for example, that, by 23 November 2017, all relevant datasets corresponding to the Spatial Data Themes in Annex I of the Directive have to conform to the implementing rules on interoperability of spatial datasets and services. This means that important public sector datasets containing information on administrative units, streets, addresses, etc. will become available in harmonised data formats.

Similarly, Directive 2003/98/EC on the Re-use of Public Sector Information (**PSI Directive**) encourages public administrations in the European Union to make government data available for reuse. The PSI Directive entered into force on 31 December 2003. It guarantees a level playing field for re-users of public sector information via - among other things - the prohibition of cross-subsidies and exclusive arrangements. It was revised by Directive 2013/37/EU which entered into force on 17 July 2013. This update provides further incentives for charges for reuse to be - in principle - limited to the *marginal* costs of the individual request.

Finally, an EU Gazetteer common service could help reinforce the 'Once-Only' principle for e-Government, which is referred to in the **European Commission Digital Single Market Strategy**. The 'Once-Only' principle requires that public administrations must make better use of information about citizens or companies that is already in their possession and avoid asking for the same information again. In 2016-17, the Commission will launch a pilot project for the 'Once-Only' principle for businesses and citizens. In this context, an EU Gazetteer common service could help provide harmonised data on features such as addresses, street names and administrative units.

1.2 Objectives

The objective of this document is to analyse the feasibility of an EU Gazetteer common service supporting the location-enablement of public services. It addresses the following research questions:

- **Scope**: What form should an EU Gazetteer common service take?
- **Demand side analysis**: What are the specific needs that an EU Gazetteer common service could address?
- **Supply side analysis**: What exists already and is there a need for additional EU action?
- **Business case**: What are the investment options? What are the associated benefits, costs, and risks?

1.3 Approach

This study was conducted in four steps. These steps correspond to the subsequent sections of this document:

- **Propose scope options**: Section ☐ explores the scope options for an EU Gazetteer common service. The scope can be set, for example, by the type of features to be included in the EU Gazetteer common service, such as geographical names, administrative units, street names, etc.
- **Analyse the demand side**: In section 3, the demand for an EU Gazetteer common service is analysed. The generic use cases of an EU Gazetteer common service are described in further detail. Additionally, specific use cases are proposed on the basis of **desk research**. These specific use cases are further validated via **interviews with relevant stakeholders**.
- **Analyse the supply side**: Section 4 contains an analysis of relevant gazetteers with national or EU coverage such as the European Data Portal Gazetteer with city names, the EuroGeographics gazetteer services under the European Location Framework (ELF) Project, Geonames.org, the most relevant national gazetteers listed on the INSPIRE geo-portal, etc. The analysis covers various aspects, including licensing, coverage of available datasets, relevant technical and semantic interoperability specifications, etc. The analysis is mainly done via **desk research**, enhanced with **targeted interviews**.
- **Develop intermediate conclusions**: Section 5 develops intermediate conclusions from the demand and supply side analysis, concerning content types and data sources, narrowing down the potential options ahead of more detailed examination of the business case.
- **Formulate a business case**: Section 6 formulates a business case by:
    - Identifying a number of viable alternative actions; and
    - Assessing at high-level the costs, benefits, and possible risks of each alternative action.
- **Conclusions and recommendations** are developed in Section 7.
- **Next steps** are highlighted in Section 8.

2 Scope Options for an EU Gazetteer Common Service

This section proposes potential scope options for an EU Gazetteer common service. Depending on the outcome of the demand and supply-side analysis, which is further elaborated respectively in Sections 3 and 4, viable combinations of the scope options elaborated in the remainder of this section will translate into a number of investment options. These investment options are analysed in Section 6.

2.1 Content types of the EU Gazetteer common service

A gazetteer is a directory of instances of a class or classes of features containing some information regarding their position. Therefore, it can contain various geographical features besides geographical names. The most common geographical features that a gazetteer may contain include, but are not limited to:

- Geographical names;
- Administrative units;
- Street names;
- Addresses;
- Cadastral parcels;
- Buildings.

2.2 Data sources for an EU Gazetteer common service

Data sources could be:

- **Public sector data providers** (e.g. national mapping agencies and other agencies and services that gather relevant data as part of their mission).
- **Private sector data providers** (e.g. EuroGeographics[1]), HERE, Geonames.org, ESRI Geocoding service, Google).
- **Crowd-sourced data providers** (e.g. OpenStreetMap. Data collected from a large group of people, especially from online communities rather than from traditional contractual relationships).

2.3 Mechanisms for quality control

The objective of an EU Gazetteer common service will depend on the use cases it should address. Therefore, the EU Gazetteer common service data should be of sufficient quality to guarantee that it is fit-for-purpose. There are various mechanisms possible for quality control:

- **Minimal agreements quality control:** There is a loose collaboration to harmonise data (e.g. exonyms, edge matching) and improving data quality. The collaboration is however insufficient to move towards a harmonised level of data quality.
- **Harmonised quality control**: A data integration and quality control workflow is ensured centrally. This requires common procedures for data collection and maintenance.
- **Quality feedback loop:** Users of an EU Gazetteer common service may be encouraged to/or required to provide feedback on quality issues related to the dataset. A correction self-service may help gradually to improve data quality (e.g. the traffic application Waze has a very good correction self service).

[1] For the purpose of the study, all data providers that are not public sector or crowd-sourcing initiatives are classified as private sector data providers. This includes not for profit organisations such as EuroGeographics, which is an association of public administrations.

2.4 Linking with other base registers

An EU Gazetteer common service can be interconnected with other authentic sources of government data. According to the European Interoperability Framework [EIF], *authentic sources (also called base registers) are a cornerstone of public services*. By sharing authentic sources of information between public administrations, citizens and businesses will no longer need to provide information to a public administration that was already provided to another public administration. The study 'e-Government and the Reduction of Administrative Burden' [EC12] indicates that - once implemented - this **'once-only' strategy** at EU level could generate a total net impact amounting to around 5 billion euro per year by 2017. During the public consultation on the e-Government Action Plan 2016-2020 [EC16], around 50% of the respondents indicated that not applying the once-only principle would be a serious obstacle for the future use of online public services.

An EU Gazetteer common service could be interconnected with various types of base registers. Those depicted in Figure 1 are the most common:

- **Interconnection with company registers**: the registered address of legal entities and their branches in company registers could be associated with an address object in a gazetteer. This would make it easier to locate companies and their branches, which is relevant in various (public) services. In an EU context, the Business Register Interconnection System (BRIS) could be interlinked with an EU Gazetteer common service. This is one of the identified use cases in section 0.
- **Interconnection with population registers**: the postal address and the address of residence of citizens and residents in population registers can be associated with an address object in an address gazetteer. This enhances the quality of the information in the population register and facilitates identifying the location of citizens.
- **Interconnection with land and building registers**: addresses continue to be a convenient way of locating cadastral parcels and buildings. An interconnection of registers of cadastral parcels and buildings with an address register is therefore a relevant scope option.

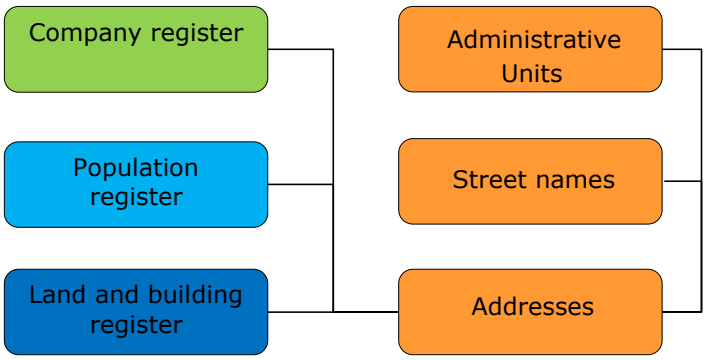

Figure 1: Interconnection of base registers

2.5 Level of harmonisation

The level of data harmonisation that can be obtained will greatly depend on how the EU Gazetteer common service will be constructed. It could either be a single centrally maintained instance, or it could be a loose federation of gazetteer services:

- **Single EU Gazetteer common service**: the EU Gazetteer common service would consist of an integrated data source of gazetteer data and a single point of access to use this data (as a service or as a dataset). The integrated data source will be obtained through harmonisation of all individual data sources.

- **Federation of European gazetteers**: the EU Gazetteer common service would consist of a loose 'federation' of gazetteers, each responsible for provisioning its own gazetteer data as a service. The federation is founded on a set of legal agreements (e.g. common licensing mechanism), technical specifications (e.g. based on INSPIRE download services, INSPIRE as linked data, etc.) and possibly common open-source software. Harmonisation of the data will depend on the agreements made by the Member States and on the data available in each Member State.

2.6 Licensing

The terms of use of an EU Gazetteer common service, will depend on the conditions under which the data providers participating in the EU Gazetteer common service, such as national mapping agencies, postal agencies, non-profit or commercial data providers agree upon to make their gazetteer data available. Among others the following options are possible:

- **Public domain dedication**. The EU Gazetteer common service can be used, modified or distributed, even for commercial purposes, all without asking permission. In this case the EU Gazetteer common service will be dedicated to the public domain by waiving all the rights to the work worldwide under copyright law, including all related and neighbouring rights, to the extent allowed by law.
- **Open licence**. The EU Gazetteer common service can be used, modified, redistributed, etc. free-of-charge under an open (permissive) licence with no restrictions.
- **Attribution**: A specific type of open licence could be an attribution licence. In this case, the licence agreement would require giving attribution, leaving others the right to distribute, remix and build upon what the EU Gazetteer common service offers as long as they provide credit to the responsible party for the original creation. It should be highlighted that the latter requirement is sometimes seen as a considerable restriction by users, who need to give attribution in any derivative work.
- **Commercial-use restrictions**: The EU Gazetteer common service can be made freely available for use by public administrations, citizens and businesses. Commercial use is however still subject to a licensing fee for a specific licence agreement that allows commercial use.
- **Grant-back requirement**: The licensee is required to disclose and transfer all improvements made to the EU Gazetteer common service (e.g. quality improvements to the data) back to the owner of the EU Gazetteer common service. This can be used as a legal way of enforcing the quality feedback mechanism.
- **Share-alike requirements**: The licensee is required to release adaptations of the EU Gazetteer common service under the same or similar licence conditions as the original one. This can be used to enforce the quality feedback mechanism, but puts less burden on the users than the grant-back requirement as it is only required upon redistribution of the derivative work.

2.7 Pricing mechanism

The most common pricing mechanisms for users among which to choose for an EU Gazetteer common service include:

- **Free-of-charge**. User could use the EU Gazetteer common service free of charge.
- **Recovery-based costs**: This pricing model may allow data providers to *partially* recover the actual costs incurred to produce and disseminate the data. The price should ensure that the total income from charging does not exceed the costs

incurred to produce and disseminate the information, together with a reasonable return on investment, as required by Directive 2013/37/EU, the revised PSI Directive.

- **Freemium pricing models**: This is a hybrid pricing model which combines free-of-charge and chargeable options. It is about offering the EU Gazetteer common service dataset or service under a dual or tiered licensing scheme, for example free-of-charge under a licence with commercial-use restrictions, and on a cost-recovery basis for commercial licences allowing commercial reuse, or free-of-charge for a certain scope of service or data and chargeable for the full scope of service or data.

3 Demand side analysis: use cases for an EU Gazetteer common service

This section analyses potential stakeholder requirements and needs for an EU Gazetteer common service. First, the generic uses cases of a gazetteer are outlined. Then, a number of specific use cases for an EU Gazetteer common service are stated. These specific use cases have been identified via desk research and validated via interviews with relevant stakeholders.

3.1 Generic use cases

Figure 2 depicts the generic use cases related to a gazetteer. There are three different entities to consider when talking about use cases of a gazetteer service: a name or a notation (e.g. an address, a geographical name or a street name), a feature or object identifier, and a geometry (a geometrical description). The generic use cases for a gazetteer are:

- **Disambiguate:** a user uses a gazetteer to disambiguate, eliminate uncertainty about the meaning of a geographical name or notation. This is needed, because the uniqueness of addresses or geographical names is not guaranteed.
- **Geocode**: a user consults a gazetteer to retrieve the location of a feature, expressed as a geometry.
- **Locate**: a user compares the geometry of features, e.g. by positioning them on a map or by calculating the geometric distance.
- **Reverse geocode**: a user finds a feature based on a given geometric location.
- **Link**: a user links two features via the use of common object identifiers.
- **Look up**: a user looks up additional information of a given feature, such as its name or notation.

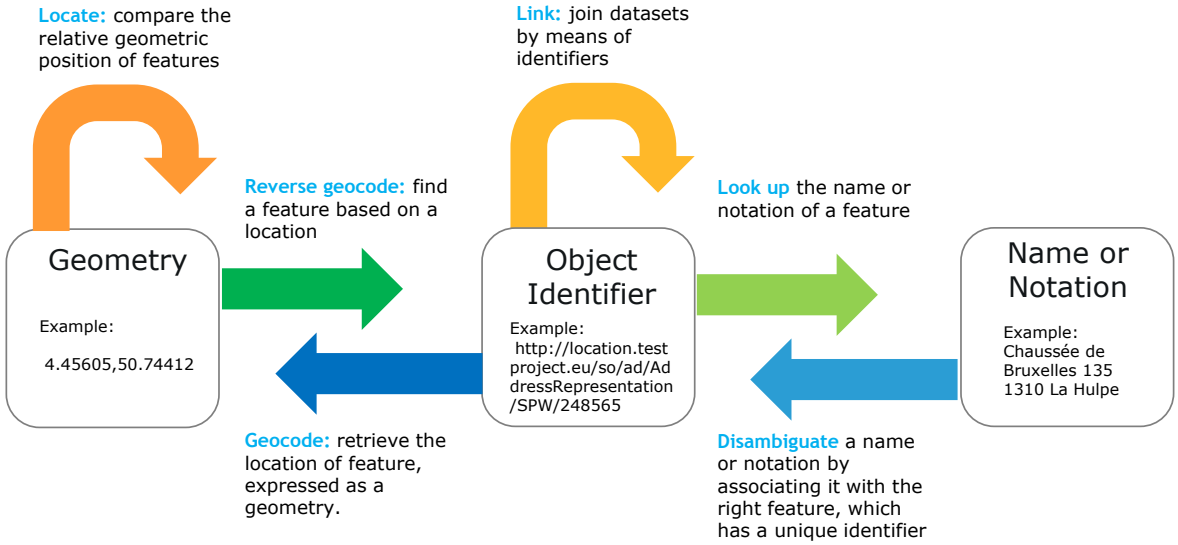

Figure 2: Generic use cases of a gazetteer

3.2 Specific use cases

Next to the generic use cases, there are also specific use cases that could possibly be addressed by an EU Gazetteer common service, depending on the scope of the service.

Specific use cases consist of one or more generic use cases and provide a solution to a specific business problem. The list of specific use cases presented below is the result of desk research (which includes among others a review of relevant INSPIRE data specifications), and interviews with several parties both from the demand and supply side. The list does not aim to be exhaustive. Rather, it provides an indication of the multitude of applications that could possibly benefit from an EU Gazetteer common service and of the value an EU Gazetteer common service could bring. While this list already provides the necessary overview to carry out the analysis, further investigation could lead to the identification of additional specific use cases.

To get a better understanding of whether there is a need for an EU Gazetteer common service, the specific use cases have been classified according to their content type, notably:

- Geographical names
- Administrative units
- Street names
- Addresses
- Buildings
- Cadastral parcels.

Table 1 below gives an overview of the **specific use cases** which are further discussed in the subsections below (see column called "Use case title"). For each use case, an overview of the following information is provided:

- **Content types** that are necessary to fulfil the use case (columns "Geogr. names", "Admin. Units". "Street names", "Addresses", "Cad. Parcels", "Buildings")
- **Applications** that already provide a (partial) solution to the use case that is described (column "Apps")
- Whether the **temporal aspect** of identifiers has to be taken into account, e.g. old street names or old town names (column "Temporal req")
- If **vernacular names** are important for this use case (column "Vernacular names")
- **Location accuracy** to fulfil the use case. Some applications require very high accuracy, meaning the location should not deviate more than 1 metre from the real location. High accuracy is defined as accurate between 1 and 5 metres, medium as accurate up until 50 metres, and low is over 50 metres. (column "Location accuracy")
- **Update frequency** relates to the timeliness of the data. Use cases requiring weekly updates are classified as high update frequency, those with monthly updates as medium update frequency and those where yearly updates will suffice as low update frequency. (col. "Update frequency")
- **Generic use cases** of a gazetteer needed to address the specific use case (columns "Disambiguate, "Geocode", "Locate", "Rev. geocode", "Link", "Look up").

Table 1: Overview of specific use cases

Use case title	Geogr. names	Adm. units	Street names	Addresses	Cad. parcels	Buildings	Apps	Temporal requirement	Vernacular names	Location accuracy	Update frequency	Disambiguate	Geocode	Locate	Rev. geocode	Link	Look up
Organising news items based on their location aspects	✓						Google News	Yes	Yes	Low	Low	✓	✓	✓		✓	
Retrieve archived documents by location	✓	✓					The Edinburgh Geoparser Demo	Yes	Yes	Low	Low			✓	✓	✓	✓
Link datasets of data portals to a geographic location	✓	✓					European Data Portal, INSPIRE Geoportal	Yes		Low	Low	✓	✓	✓	✓	✓	✓
Analyse the location dimension of statistical data	✓	✓					EuroStat Statistical applications	Yes		Low	Low	✓	✓	✓	✓	✓	✓
Law enforcement: analysis of crimes	✓	✓					Edinburgh Geoparser	Yes		Low	Low			✓	✓	✓	✓

Use case title	Geogr. names	Adm. units	Street names	Addresses	Cad. parcels	Buildings	Apps	Temporal requirement	Vernacular names	Location accuracy	Update frequency	Disambiguate	Geocode	Locate	Rev. geocode	Link	Look up
							Demo										
Road maintenance			✓				Verkehrsinfo Google Maps -Traffic	No		High	High			✓	✓	✓	✓
Location of traffic signs and infrastructure			✓				ArcGIS Sign Inventory	No		High	High	✓	✓	✓	✓	✓	✓
Locate companies and branches of a business register on a map				✓			Geocoding web tool on europa.eu	No		High	High	✓	✓	✓			
Cross-border multi-modal travel planner			✓	✓			Rome2Rio	No		Medium	Medium	✓	✓	✓		✓	
Geocode postal addresses for postal services				✓			Optimap Google Maps OpenStreetMap	No		High	High	✓	✓	✓			

Use case title	Geogr. names	Adm. units	Street names	Addresses	Cad. parcels	Buildings	Apps	Temporal requirement	Vernacular names	Location accuracy	Update frequency	Disambiguate	Geocode	Locate	Rev. geocode	Link	Look up
Locate tourist and cultural heritage places				✓			Open Smart Tourist Data Google Maps	No		High	High	✓	✓	✓	✓	✓	✓
Validation of foreign addresses by public administrations				✓			Google Maps	No		None	High	✓					
Provide situational awareness of emergencies and crises				✓	✓	✓	ITHACA Google Maps for Work - Government - Emergency Management	No	Yes	Very High	High			✓	✓	✓	✓
Use of geodata by utilities companies			✓	✓	✓	✓	Google for work - Utilities	No		Very High	High	✓	✓	✓		✓	
Property Tax				✓	✓		EULIS	No		Very High	High	✓	✓	✓	✓	✓	✓
Attribute				✓	✓	✓	Permit	No		Very	High	✓	✓	✓	✓	✓	✓

Use case title	Geogr. names	Adm. units	Street names	Addresses	Cad. parcels	Buildings	Apps	Temporal requirement	Vernacular names	Location accuracy	Update frequency	Disambiguate	Geocode	Locate	Rev. geocode	Link	Look up
environmental permits							Application Tracker			High							
Calculate Insurance risks				✓	✓	✓	FEMA Flood Map Service WATERINFO.be What's in Your Backyard?	No		Very High	High	✓	✓	✓	✓	✓	✓
Urban planning				✓	✓	✓	Google Maps for Work - Government	No		High	High			✓	✓	✓	✓

The following subsections provide a brief description of the identified specific use cases per content type. For most use cases, there are already applications trying to fulfil the use case. However, usually they only partially cover the requirements that applications using an EU Gazetteer common service could address, such as for example: cross-border use cases, use of authoritative data and non-commercial products. Further details and analysis of the existing applications can be found in Annex 3.

3.2.1 Geographical names

Geographical names are widely used in every-day communication for referring to various natural and man-made objects in the real world. According to INSPIRE, geographical names can be names of areas, regions, cities, suburbs, towns or settlements or any geographical or topographical feature of public or historical interest.

Geographical names can serve various purposes and therefore represent a valid content type for an EU Gazetteer common service. They are closely linked to other INSPIRE themes relevant in the context of a gazetteer, such as addresses and administrative units. Geographical names are also important in a multilingual context because names are often translated and therefore can support online search, geocoding and map visualisation.

3.2.1.1 Organising news items based on their location aspects

News items always have a location aspect related to them. Whether it is the name of a particular country, city or landmark, news happens at a certain location. Depending on the reader's location, certain news items may be more relevant than others and the same topographical feature might have different names. Therefore, news outlets can use a geographical names gazetteer to link news items consistently to a location using the most appropriate naming convention. If the geographical names gazetteer includes both endonyms and exonyms, location based search for news items can work regardless of the language spoken by the user.

Box 1. Existing applications.

Google News automatically recognises the location of the user, to display news items related to nearby places. Furthermore, it allows the user to search for news, based on the selected location, such as country or region.

News outlets could benefit from an EU Gazetteer common service containing geographical names, because it will be easier to access more complete, high quality data, which in turn will allow news agencies to use geographical names more consistently throughout their news items.

3.2.1.2 Retrieve archived documents by location

Official documents of public administrations are archived with appropriate metadata indicating the spatial extent of the archived document using the geographical name, or the administrative unit or in some cases even an address. Digital documents could also be scanned by applications looking for names. An EU Gazetteer common service based on geographical names could be used to geocode these names and visualise them on a map. Next to that, it could enable a feature, allowing a user to point to a location on a map and retrieve all documents related to this location.

One aspect to be kept in mind is the temporal aspect. Archives keep records of the past. As time goes on, things change. Borders are moved, names are changed, and languages become extinct. This has to be accounted for when considering this specific use case.

Box 2. Existing applications.

The **Edinburgh Geoparser** automatically recognises place names in a piece of text and disambiguates them if necessary. The application is designed to work with several gazetteers. The demonstration version uses Google Maps to visualise the output. The application is available as open source under the "The University of Edinburgh GPL license".

The Geoparser would benefit from an EU Gazetteer common service, as it would allow the application to use a high quality dataset of all administrative units in the European Union, including temporal changes and possibly include a look up in different languages. It would limit the need for the application to use different data sources with different types of quality. By using high quality data, the quality of the service in general will also improve.

The EU Gazetteer common service would also facilitate other similar initiatives, as it will be easier to access high quality data using the EU Gazetteer common service, as opposed to using different sources.

3.2.1.3 Link datasets of data portals to a geographic location

The main goal of data portals is to make it easier to find and re-use data. To allow users to find the information they need in the plethora of datasets, most portals offer a search function. Sometimes people do not know exactly what they are looking for, but they do know the country, region or city they are interested in. Visualising the datasets on a map allows users to browse through the datasets based on location rather than key words.

Box 3. Existing applications.

The **European Data Portal**'s mission is to harvest metadata of public sector information available on public data portals across European countries. Information regarding the provision of data, the benefits of re-using data and several use cases are also included on the website. One of the features offered by the European Data Portal is the ability to search and geo-locate the datasets and visualise them on a map. To put in place such a service, the European Data Portal relies on its own gazetteer. This gazetteer combines authoritative data on geographical names and administrative units, in combination with data from GeoNames.org.

Another example is the **INSPIRE Geoportal**. The INSPIRE Geoportal allows users to "search for spatial data sets and spatial data services, and subject to access restrictions, to view spatial data sets from the EU Member States within the framework of the INSPIRE Directive". Just like the European Data Portal, the INSPIRE Geoportal offers the possibility to visualise the coverage of a dataset on a map or to draw a bounding box on the map and receive an overview of all datasets related to the specified location. Currently, the INSPIRE Geoportal uses GeoNames.org as its gazetteer.

Both the European Data Portal and the INSPIRE Geoportal could benefit from an EU Gazetteer common service, either by using it as a source for their own gazetteer, or even by replacing their own gazetteer. As the European Data Portal selects authoritative data over non-authoritative, it should be clear where the data in the EU Gazetteer common service originates from.

3.2.2 Administrative units

According to the INSPIRE Directive, administrative units are "units of administration dividing areas where Member States have and/or exercise jurisdictional rights for local, regional and national governance, separated by administrative boundaries".

If an EU Gazetteer common service contained administrative units as a content type, it could possibly address the use cases elaborated in the following subsections.

3.2.2.1 Analyse the location dimension of statistical data

The most common way of understanding statistics is through visualisations, either by using graphs or, if there is a location aspect linked to the statistics, using maps. Citizens, businesses and administrations who consult statistical data may also wish to interlink it with other data sources. As statistical data is often related to a geographical location, common identifiers for geographical features (such as administrative units) can be used to facilitate the interlinking and analysis of data.

For this use case, it is important to consider the temporal aspect. Names and borders of administrative units, regions or countries may change over time, making some comparisons throughout time inaccurate. This must be taken into account when developing relevant applications.

Box 4. Existing applications.

Eurostat is the statistical office of the European Union. They provide the European Union with statistics at European level that enable comparisons between countries and regions. Eurostat does not collect data, but receives national data from the statistical authorities in each Member State. Eurostat harmonises data on several themes, like transport, economy and finance, international trade or environment and energy. By linking the data to statistical units like the NUTS and LAU ([2]), they can also visually present the statistics.

An EU Gazetteer common service on administrative units could aid Eurostat and other institutions developing similar applications by linking the NUTS and LAU codes to a geographical location on a map. There is currently no similar free and open solution available, meaning that organisations like Eurostat have to do the mapping themselves or make use of commercial solutions.

3.2.2.2 Law enforcement: analysis of crimes

All types of crime (except possibly for cyber-crime) have a location aspect related to them. Whether it is the address of a family that was victim of a burglary, or the location of a car accident, since incidents happen at a certain location. Visualising these incidents on a map can help police officers to discover patterns and possibly solve crimes. If the police services data is made available as open data, it could even be used by citizens who want to know the crime rate of their neighbourhood.

Box 5. Existing applications.

The **UK police services** publish open data about crime and policing in England, Wales and Northern Ireland on data.police.uk. This data is accurate up to street level, and is reused in many different applications, like Local Crime Map. This application loads the crime data for a given UK location and shows the number of instances and types of crime on a monthly basis since 2010, when the service was initiated.

The EU Gazetteer common service could enable police forces to correctly visualise international information, which might be relevant in solving crimes related to narcotics or human trafficking. The EU Gazetteer common service could be the basis for international applications or national applications with international coverage, which can be used by respectively international or national investigation teams.

[2] The NUTS (Nomenclature of Territorial Units for Statistics) is a hierarchical system for dividing up the economic territory of the EU for the purpose of:
1) the collection, development and harmonisation of European regional statistics;
2) socio economic analyses of the regions;
3) framing of EU regional policies.
The LAU (Local Administrative Units) have been set up by Eurostat to meet the demand for statistics at local level. This system is compatible with NUTS.

3.2.3 Street names

Street names are part of address data. While address data comprises the whole picture, not all elements of an address are necessary to implement certain use cases, like the ones listed in the following subsections.

3.2.3.1 Road maintenance

Road authorities, responsible for the maintenance of the road network, can use the EU Gazetteer common service to indicate all their current and future road works. This way, other road authorities can use the information to better schedule the road works they are responsible for, making sure not to schedule works on alternative roads at the same time to avoid unnecessary traffic jams or coordinating the work on the same trajectory. This application could even allow cross border coordination of road works. Travellers may use the EU Gazetteer common service to look-up the location of current road works across Europe and plan their route to avoid traffic problems.

Box 6. Existing applications.

Verkehrsinfo.de provides users with the current location of all roadworks in Germany. Travellers can use it to determine their preferred route, taking into account the current traffic, which is also visualised on the map.

Google Maps provides a traffic service, allowing its users to look at the current traffic information, including road works and traffic incidents on the main roads and calculate accurate travel time and showing possible alternatives.

3.2.3.2 Location of traffic signs and infrastructure

In every country, the national department of transportation is responsible for the placing and maintenance of traffic signs and traffic infrastructure. To keep track of all traffic signs installed, the transportation department keeps an inventory. Instead of just maintaining this as a list, the location and street name could be added, making it possible to visualise the inventory on a map using an EU Gazetteer common service. This allows maintenance crews to easily locate traffic signs they need to check or replace. Using the GPS signal of the maintenance crew, the central depot can coordinate their crews and better manage their resources.

Box 7. Existing applications.

The **ArcGIS Sign Inventory** is a configuration of the ArcGIS software development kit for GIS applications that allows public works operations staff to inventory their traffic signs along the roads. ArcGIS Online is a mapping platform hosted by Esri.

ArcGIS Online could benefit from an EU Gazetteer common service, giving them access to authoritative, high quality data, which will be beneficial for their services. The EU Gazetteer common service could also boost competition and allow start-ups to produce similar products, without having to gather street data from all different EU countries.

3.2.4 Addresses

According to the INSPIRE Directive (2007/2/EC), addresses are described as a "location of properties based on address identifiers, usually by road name, house number, postal code." Addresses are the extension of the street names, discussed in the previous section. All use cases that are covered in the previous section on street names could also be addressed by an EU Gazetteer common service based on address data. Further to this, five more use cases were identified whose main focus lies with address data.

3.2.4.1 Locate companies and branches of a business register on a map

Following the adoption of Directive 2012/17/EU, a system of interconnection of business registers is being set up at EU level, in a joint effort involving all EU Member States and the European Commission. The system is known as the Business Registers Interconnection System (**BRIS**). Thanks to BRIS, citizens, businesses and national authorities will be able to search, via the e-Justice portal, for information filed by companies in the national registers.

An interesting use case for the EU Gazetteer common service based on addresses could be BRIS because it would allow users to look up companies on the European e-Justice portal. One of the mandatory properties of companies that will be shown on the e-Justice portal is the registered address. An EU Gazetteer common service based on addresses could be used to geocode addresses and position these companies on a map. This will help users of the e-Justice portal to make more sense of the available information on potential business partners or competitors.

Box 8. Existing applications.

The **European Commission** is already operating a solution for geocoding of addresses to geographical coordinates and provides a location map in this regard. This geocoding web tool is provided via DG COMM and is based on the Esri World Geocoding Service. The Yahoo! Geocoding service was previously used, but Yahoo! stopped providing this service. Although this is not currently on the short term planning for the BRIS access point on the e-Justice portal, this service is already being used by the Find a lawyer and Find a notary Portal services, e.g.:

https://e-justice.europa.eu/content_find_a_notary-335-en.do

In this case, the DG COMM / Esri service provides an adequate service, addressing this use case. However, an EU Gazetteer common service containing the authoritative address data from the public administrations in the Member States might be a preferred alternative compared to the Esri Geocoding service, if the Esri Geocoding service requires a licence fee while the EU Gazetteer common service was authoritative and free for reuse.

3.2.4.2 Cross-border multi-modal travel planner

The EU's single market makes it easier for citizens to travel: delivering goods from one country to another, visiting clients in another country, going on holidays or travelling for other personal reasons. Citizens can travel by car, by plane, by train or by other means of public transport. These travel modes are not mutually exclusive. Travellers often use a combination of travel modes to get to their destination. To determine the fastest way to get to their destination, they may use a cross-border multi-modal travel planner, which can be based on the EU Gazetteer common service to look-up the location of train stations and addresses and to visualise the route from point A to point B on a map.

Box 9. Existing applications.

Rome2rio offers a global multi-modal, door-to-door travel search engine, combining itineraries for train, coach, ferry, planes and driving options to get from point A to point B. This Australian-based company provides the service as a web application, as well as a mobile app that is free to use. Rome2rio had to build their own Geocoding API to handle travel related destinations ranging from city and town names to popular attractions and destinations.

An EU Gazetteer common service could be used to support similar initiatives by giving them access to authoritative, high quality geographical names, street names and address data. The geocoding functionality would prevent them from having to write their own API, or limit the amount of code needed in their API. The reverse geocoding function could also allow users to search for a location on a map and translate this back to the nearest address.

3.2.4.3 Geocode postal addresses for postal services

Accurate address gazetteer data may facilitate the delivery of parcels and postal letters. Access to high-quality address data may promote competition in the postal services market.

Article 11a of the third Postal Services Directive (Directive 97/67/EC as amended by Directive 2002/39/EC and 2008/6/EC), requires Member States to '*ensure that transparent, non-discriminatory access conditions are available to elements of postal infrastructure or services provided within the scope of the universal service, such as postcode system, address database, post office boxes*'. A Commission staff working document from 2015 [EC15] points to the increasing importance of access to address databases. Only 10 EU Member States, have transparent, non-discriminatory access conditions to address databases.

As part of the Digital Single Market strategy, the EC wants to improve regulatory oversight and increase transparency in cross-border parcel delivery. An EU Gazetteer common service could help (online) retailers to check address data and reduce the risk of undeliverable shipments. It could help parcel delivery operators to more easily enter parcel delivery markets.

The need to enhance the quality and affordability of cross-border parcel delivery has been identified as a priority in the EU's policy to facilitate e-Commerce, and to create a Digital Single Market for the European Union. The Commission launched measures and promote further action by industry in the first half of 2016 to improve price transparency and enhanced regulatory oversight of parcel delivery [EC17].

Article 11a of the third Postal Services Directive also requires Member States to give all postal operators access to 'elements of postal infrastructure' - facilities and information resources used in providing postal services - 'whenever necessary to protect the interest of users and/or to promote effective competition'.

Box 10. Existing applications.

Optimap calculates the fastest route to visit up to 20 destinations, solving the travelling salesman problem that postal services encounter every day. Delivery services that have to drop off 20 packets in a city want to know the fastest way to drop off all 20 packets and get home. Optimap shows them in which order they need to visit the different locations in order to be the fastest.

Google Maps and **OpenStreetMap** also allow users to look up addresses and get directions to travel to the location. It is also possible to add multiple destinations to your itinerary, but the applications will not calculate the optimal order to visit them.

The applications above would benefit from an EU Gazetteer common service, allowing them to base their applications on authoritative data, improving quality and reliability. An EU Gazetteer common service on address data could also stimulate start-ups providing delivery services, like local stores or restaurants. They would also have access to high quality address data. They could work together with software developers developing travel optimisation applications, allowing them to deliver their goods as efficiently as possible.

3.2.4.4 Locate tourist and cultural heritage places

In the digital age, where almost every tourist has a smartphone, tourist offices and attractions are changing from providing information in paper brochures to interactive websites and mobile applications. These websites and applications make it more convenient for the tourist to find, for example, places in the vicinity and, more generally, get more information tailored to their interests and current location.

Box 11. Existing applications.

Open Smart Tourist Data was a Czech project focussed on collecting, integrating and presenting tourism-related data. The project resulted in two datasets. The Smart Points of Interest is a collection of existing points of interest, covering almost all European countries. The other dataset consists of the underlying data of the OpenTransportMap (OTM), which was developed together with the OpenTransportNet project. The OTM provides users with routing and traffic information.

An EU Gazetteer common service could be used in developing a similar, EU-wide application, allowing the developers to locate Points of Interest throughout Europe based on their addresses. Local tourism offices could contribute to this application and offer a subset of the data to their customers.

3.2.4.5 Validation of foreign addresses by public administrations

Many public administrations need to look for foreign addresses, for example when handling files of asylum seekers and citizens working or living abroad. One example is the Ministry of Finance that needs to verify the address where the tax statement should be sent. Failure to identify the correct address may lead to delays in the payment of taxes, which might have important consequences for both the citizens and public administrations. Contacting foreign administrations and validating the addresses takes time and resources. An EU Gazetteer common service would allow public administrations to validate all addresses using a single point of contact. The main benefits for public administrations would be that they do not have to deal with errors themselves, they do not have to maintain the data and they do not have to buy additional data to complete their dataset.

Box 12. Existing applications.

The **ELF GeoLocator** service provides functionality for performing geocoding and reverse geocoding. It has a web application where users can select a location on a map and the application will return the place name or nearest address. It also allows users to search for a place name or address. The application then returns the coordinates of the location, and if the web application is open, it locates the point on the map. This feature allows users to verify addresses in the Czech Republic, Denmark, Portugal and Spain, based on the authoritative data of the respective countries. **Google Maps** is a commercial product that offers the same type of service. Key differences include the fact that Google has worldwide coverage, whereas the coverage of the GeoLocator service is limited to European territory. However, the GeoLocator data sources are exclusively authoritative while Google Maps has both authoritative and non-authoritative data sources. Finally, although both Google Maps and the GeoLocator are currently services embedded in their products, they could potentially be made available as a standalone component for other applications.

An EU Gazetteer common service on address data could be used to extend the current GeoLocator, adding more countries while maintaining the same high quality. For this use case, it is important to public authorities that the data originates from authoritative sources. Otherwise, the application would not provide an advantage over the current situation, because administrations will still need to contact foreign administrations to validate the address data.

3.2.5 Buildings

The buildings data theme is closely linked with cadastral parcels. Buildings are always located on one or more adjacent cadastral parcels. When looking at the identified use cases, there was only one example in which there was no need for building information, but only a need for cadastral information. Therefore, buildings and cadastral parcel use cases are combined in the next section.

3.2.6 Cadastral parcel

According to the INSPIRE Data Specification on Cadastral Parcels, "cadastral parcels should be, as much as possible, single areas of Earth surface (land and/or water) under homogenous real property rights and unique ownership, where real property rights and ownership are defined by national laws."

It is important to emphasise that, next to building and cadastral parcel information, the use cases that rely on cadastral parcel often also need address information to work properly.

In the following subsections, each related specific use case is explained in more detail.

3.2.6.1 Provide situational awareness of emergencies and crises

Dispatchers of emergency alert centres use gazetteer services to locate the geographical position of an emergency. Similarly, information managers of a crisis cell use gazetteer services to create a better situational awareness of a crisis, e.g. a train collision, a terrorist attack, a fire. A better linking of government datasets to location data enables simplified identification and localisation of citizens who are affected by a crisis and the creation of, for example, evacuation plans.

In the case of an emergency situation, it may be useful to know the number of houses in a given area so as to identify how many should be evacuated and where they are located exactly. By using the EU Gazetteer common service, this information could be extracted more easily compared to extracting it from satellite images or cartographic data.

For this use case, it is important to consider vernacular names as part of the EU Gazetteer common service. People who call emergency services may use common – or

vernacular- names to denote a location or use old street names while emergency call centre operators might not always be aware of all vernacular names in a region.

Box 13. Existing applications.

The non-profit association **ITHACA** (Information Technology for Humanitarian Assistance, Cooperation and Action) in cooperation with the World Food Programme delivers methodologies, analytical services and technical tools to improve the capacity of the international humanitarian community in early warning, early impact assessment and other risk management related areas.

Google Maps for Work offers an emergency management service for Governments. It provides governments with situational awareness of disaster sites, which can aid in decision making. It also allows governments to visualise information from different emergency services on a single map.

An EU Gazetteer common service, including addresses, cadastral parcels and buildings would be beneficial for both applications, as it will allow them to make use of high quality, potentially open data, adding quality to their services. Furthermore, it could boost other companies who want to build emergency services on top of the EU Gazetteer common service, but currently do not have access to open initiatives.

3.2.6.2 Use of geodata by utility companies

Exact address location information can help utility companies to plan their work on the infrastructure. An example could be a new house that needs to be connected to the utility infrastructure. By knowing the exact address, the utility company can better estimate the distance between the address and its own infrastructure, and estimate the necessary materials. Additionally, the information contained in the EU Gazetteer common service could help utility companies to better maintain their infrastructure.

Box 14. Existing applications.

Google Maps for work allows utility companies to maintain safety and regulatory compliance, manage outages, and coordinate field teams by overlaying utility information on google maps.

Google Maps for work could benefit from an EU Gazetteer common service, giving them access to authoritative, high quality data, which will be beneficial for their services. The EU Gazetteer common service could also boost competition by facilitating access to open, high quality EU-wide data.

3.2.6.3 Property tax

Tax authorities already use detailed parcel information to calculate property taxes. An EU Gazetteer common service based on addresses and cadastral parcels would help taxation administrators to look up the necessary parcel information based on map searches or visualise other tax related data linked to the cadastral parcels on a map. Additionally, an EU Gazetteer common service could also be used in different applications oriented towards citizens. These applications could be developed to visualise statistics on property tax in different regions or per parcel. This information could be valuable to citizens who are looking to buy a house and who wish to compare properties based on taxes. The parcel information could be linked with other statistical data sets, giving citizens more information on properties in different areas.

Box 15. Existing applications.

EULIS provides an online service for professionals, allowing them to access local land registers throughout the EU. It enables professionals to retrieve information easily online, direct from official land registers. One example of these professionals are tax authority

employees. They can use EULIS to verify the ownership of foreign property and other relevant information needed for taxation purposes.

EULIS could make use of the EU Gazetteer common service to provide additional services to its users, like locating addresses on a map or allowing users to look up information based on a location on the map. Next to this, EULIS can benefit from an EU Gazetteer common service based on cadastral parcels, if it would be developed as a harmonised and integrated registry containing all information of the national land registers of the EU.

3.2.6.4 Attribute environmental permits

Environmental permits are usually linked to a location via bounding box coordinate or an address. By using the EU Gazetteer common service, public administrations can geocode the addresses and pinpoint the environmental permits on the map. This use case is also valid for emission credits. Furthermore, by using reverse geocoding, the EU Gazetteer common service can be used to show all emission credits in a certain location. This information can be useful while carrying out checks about pollution.

Box 16. Existing applications.

The ***Permit Application Tracker*** allows permit applicants and the public more generally to check the status of pending environmental permits all over North Carolina, USA. The system allows search by location, permit type, facility name, permit number, etc. All permit are visualised on a map using Google Maps.

A similar EU initiative could be developed, and would benefit from an EU Gazetteer common service, having access to authoritative data on administrative units, addresses and possibly cadastral parcels. If the EU Gazetteer common service were made available for free and under an open licence, this would limit the investment required by the application developer.

3.2.6.5 Calculate insurance risks

Insurance firms calculate the insurance fee for a building or property taking into account a number of criteria: risk of flood in the area, risk of earthquake, history of the property, environmental information, soil information, etc. To do this, they consult many different databases. To easily combine all information, they could make use of an application that displays the different statistics on a map, making it possible to link the information to the specific location of the property.

Box 17. Existing applications.

Both the **US FEMA Flood Map Service** and **WATERINFO.be** provide regional flood maps, allowing users to estimate the risk of flood in the area of their interest. Insurance providers can use these to look up the flood risk in the area of the house they need to insure, and calculate an appropriate price according to the risk.

The **"What's in Your Backyard"** application from the Environment Agency of England and Wales also provides comprehensive information on flood risk areas that can be used by prospective house purchasers and insurance companies. It also provides flood warning alerts when risk turns to reality.

An EU Gazetteer common service could encourage developers to come up with a similar, EU-wide solution, by giving them access to high quality, authoritative address data, street data, etc. allowing them to build on top of a reliable set of base data. This would allow insurance firms, as well as citizens to look up information like flood risk of a specific area of property.

3.2.6.6 Urban planning

Europe's urban areas host a significant proportion of the population, representing an important aspect of the economy. They are also areas characterised by a number of issues including unemployment, segregation and poverty. While urban planning has traditionally happened within political boundaries at local level, with the rise of megaregions characterised by economic opportunities and challenges, for example in the domain of transport, urban planners need to widen their approach, by working across borders.

As urban planning becomes more collaborative, an EU Gazetteer common service could help promoting the exchange of relevant data and the development of value added services combining data from mapping and cadastral national agencies with other datasets.

Box 18 Existing applications.

Google Maps for Work provides a solution for governments, allowing them to combine data from different public works agencies into a single map to facilitate decision making and optimising resources.

Google Maps for work could benefit from an EU Gazetteer common service, giving them access to authoritative, high quality data, which will be beneficial for their services. The EU Gazetteer common service could also boost competition by facilitating access to open, high quality EU-wide data.

4 Supply side analysis

This section gives an overview of the existing supply landscape of gazetteer data and service providers. To discover opportunities where the EU Gazetteer common service could add value or fill in gaps in the market, these findings will be further analysed in the intermediate conclusions section. This section looks at the following questions:

- Are there EU wide gazetteer services provided by Member States or international organisations in Europe?
- What information is covered in terms of content type?
- What type of data sources are currently being used by existing gazetteers?
- What are the terms and conditions to access and use the information?

To answer to these questions, over 30 providers of gazetteer data and services were analysed. To get a better understanding of the extent to which the current landscape of gazetteers justifies the introduction of an EU Gazetteer common service, the gazetteers identified have been classified according to their geographical coverage, namely: national, European and global. This classification helps to highlight existing European-wide gazetteers, potentially excluding the need for EU intervention in this domain. Furthermore, this classification gives the opportunity to better understand the overall availability of national gazetteers on which an EU initiative could leverage.

For this analysis, various characteristics of the gazetteer data and services have been examined, including: the type of content offered, the openness of the content and service as well as the authoritativeness, language coverage, INSPIRE compliance and format of data.

One general observation was that not all the gazetteers shown in Table 28 are INSPIRE compliant. Only 2/3 of the gazetteers analysed clearly reference INSPIRE in their documentation. In addition, the Interview on the European data Portal (**Table 27**) revealed that not all datasets claiming to be INSPIRE compliant are indeed INSPIRE compliant. This creates differences in data formatting and data quality and, as a result, datasets need to be accessed manually and transformed into the right format.

For each level (national, European and global), 2 or 3 cases are highlighted in the subsections below, describing their activities and summarising their business model using a Business Model Canvas. A summary of the full analysis can be found in Table 29 in Annex 2. This analysis was supplemented by interviews with domain experts, for which summaries are included in Annex 1.

4.1 National initiatives

At national level, several initiatives were identified, providing gazetteer services under an open or commercial licence, targeting different audiences.

As a first example, national mapping, cadastre and land registry authorities provide a wealth of heterogeneous, increasingly open gazetteer data and services. Their target audience usually consists of other government institutions and private organisations; these are examples of a combination of Government to Government (G2G) and Government to Business (G2B) business models. The data that is provided gives an indication of what data types could easily be harmonised into an EU Gazetteer common service, and which content types are more difficult to obtain from an open data perspective.

Next, the study takes a closer look at Denmark, which opened up its official address data, boosting the economy and providing a return on investment via the taxes created by the economic growth. This is an example of a Government to Business data model, but as the data can be reused by end users and other parts of government as well, this case is classified as an example for G2B, G2G and G2C. An open address data service, more recently introduced in France, is also described.

To conclude this section, the business model of postal services is analysed. Maintaining a postal address database is one of the most important supporting activities of a postal service. Verifying addresses before sending a postman to them prevents postmen having to search for a postal address that does not exist. This postal address data is usually not available as open data, but can often be reused by organisations via commercial services or commercial data licences. Therefore, this case is an example of a commercial B2B and B2G business model.

4.1.1 Open data coming from national mapping, cadastre, and land registry authorities

In Europe, public authorities like national mapping agencies, cadastre and land registry authorities hold a wealth of geospatial data that – to a large extent - is already accessible for reuse under legislation for public sector information reuse. Following the INSPIRE Directive, description metadata for these datasets is made available, together with view and discovery services.

Despite the harmonisation that was brought by the PSI and INSPIRE Directives, the following problems remain:

- Diversity of data sources;
- Mixed content;
- Varying timeliness/resolution;
- Heterogeneous formats; and
- Heterogeneous conditions for use.

Table 30 in Annex 4 provides examples of differences with regard to source, content, scale and use conditions across Europe.

What clearly emerges from the analysis is that the supply of data which might fall within the scope of a gazetteer varies greatly depending on the country and the type of data. For instance, the resolution of the data ranges from 1:1000 to 1:1100000. In addition, some datasets are available under an open data licence while others cannot be used for commercial purposes. The interview on the European Data Portal also made it clear that there are still issues with compliance from all Member States. While some countries (Germany, UK) are practically fully compliant, other Member States publish datasets lacking basic descriptions.

This situation makes it difficult for data consumers who wish to use an authoritative, EU-wide dataset to aggregate the data from the various sources.

4.1.2 Denmark and France opened up their official address data, boosting the economy

In 2002, the official Danish address data was made available free of charge. A study, conducted in 2010, investigated the value of free-of-charge address data in Denmark used for public and private sector services like emergency services, police services, postal services, transport services, etc. The study estimated the direct societal benefits in the period 2005 – 2009 amounted to €62 million, whereas the costs were estimated to be at €2 million. 70% of the benefits were realised in the private sector. In 2012, Denmark decided to continue investing in improving data quality, back-end services, and delivery of its address through its address programme which was part of the 'basic data for everyone' strategy, with an anticipated annual net societal benefit of €30 million.

In 2015, France also published their national address database (*Base Adresse Nationale*) under an Open Data Commons Open Database License. The collaboration between national organisations like IGN and La Poste, local actors like villages and citizens (through the use of OpenStreetMap) resulted in a database containing over 16 million French addresses and their latitude and longitude. The national authorities work together with OpenStreetMap France to allow citizens and users to improve the data directly in the OpenStreetMap application. These amendments are immediately visible on OpenStreetMap and are included in the next update of the address database. The French National Address Database also offers an API, simplifying the incorporation of the database in other applications.

4.1.3 Business Model Canvas ([3])

Table 2: Business Model Canvas for the Open Address data service, run by the Danish Agency of Data Supply and Efficiency

<table>
<tr><th>Business model for:</th><th colspan="4">Danish Agency of Data Supply and Efficiency (SDFE) - Focus on Open Address data</th></tr>
<tr><td rowspan="2">Key partners:

• OpenStreetMap
• Danish Municipalities</td><td>Key Activities:

• Provide and maintain address data free of charge
• Draw attention to the potential of public data
• Facilitate communication between public sector and private reusers of data</td><td rowspan="2">Value proposition:

• Free, high quality address data, open to everyone.
• Enables the public sector to be more efficient and to provide better services for citizens and for business</td><td>Customer relationships:

No information collected</td><td rowspan="2">Customer Segments:

• G2C: Citizen
• G2G: Municipalities
• G2B: IT organisations</td></tr>
<tr><td>Key Resources:

• Municipalities</td><td>Channels:

AWS suite, OIS</td></tr>
<tr><td>Cost Structure:

• Initial set up costs: compensation package for municipalities
• Costs for distribution of address data through the public data server</td><td>Licence:

Obligatory credit line. Worldwide, free, non-exclusive, and otherwise unlimited right to use the data</td><td>Social Good:

The study[4] estimated that the direct societal benefits in the period 2005 – 2009 amounted to €62 million, whereas the costs were estimated to be at €2 million. Around 30% of the benefits are in the public sector and around 70% in the private sector.</td><td colspan="2">Revenue Streams:

No direct revenue streams identified.</td></tr>
</table>

[3] Sources: http://odimpact.org/case-denmarks-open-address-data-set.html; http://danmarksadresser.dk/file/389699/0_CountryReport_2010_DK_EN.pdf http://www.adresse-info.dk/Portals/2/Benefit/Value_Assessment_Danish_Address_Data_UK_2010-07-07b.pdf http://danmarksadresser.dk/ http://sdfe.dk/media/2916171/sdfe_aarsrapport-2015.pdf http://docplayer.dk/997011-Aarsrapport-2014-ministeriet-for-by-bolig-og-landdistrikter-gode-boliger-bedre-byer-udvikling-og-vaekst-i-hele-danmark.html

[4] http://www.adresse-info.dk/Portals/2/Benefit/Value_Assessment_Danish_Address_Data_UK_2010-07-07b.pdf

4.1.4 Postal operators maintain comprehensive postal address databases

In some countries, traditional national postal operators, like Royal Mail in the UK or Bpost in Belgium, have high-quality address data, which they are obliged to make available to other postal operators under non-exclusive and transparent market conditions, as required by Article 11a of the third Postal Services Directive 2008/6/EC.

On a global level, the Universal Postal Union (UPU) provides a Universal POST*CODE DataBase to its members. The database contains address information of the 192 member countries worldwide, allowing its members to look up or validate addresses. Up until now, this database does not contain any geometry information

A study conducted in 2013 by Copenhagen Economics [CE13] reveals that there is still insufficient access to address databases. An EU Gazetteer common service focused on address data from public authorities (which do not represent the traditional postal operators) could help (online) retailers to check address data and reduce, for example, the risk of failure to deliver shipments. Of course, inclusion of data from postal operators either directly or as a source of validation would no doubt help improve overall quality. Furthermore, it could help parcel delivery operators to geocode addresses and thus optimise delivery routes.

4.1.4.1 Business Model Canvas[5]

Table 3: Business Model Canvas for Bpost, national Belgian postal operator

<table>
<tr><th>Business model for:</th><th colspan="4">Bpost – focus on address master data</th></tr>
<tr><td rowspan="2">Key partners:

Bpost is self-sufficient for address master data.</td><td>Key Activities:

• Update address master data database
• Provide services like address formatting and address validation</td><td rowspan="2">Value proposition:

Limit the risk of deliveries to wrong or non-existent addresses</td><td>Customer relationships:

Self-service</td><td rowspan="2">Customer Segments:

• C2C: validation of addresses
• B2B: validation of addresses to limit risk of delivery to wrong or non-existent addresses</td></tr>
<tr><td>Key Resources:

• Historical information on address data in Belgium (assumption)
• Feedback collected from postmen</td><td>Channels:

API integration with other Bpost services</td></tr>
<tr><td>Cost Structure:

Marginal cost limited to maintaining address master data</td><td>Licence:

Individual non-exclusive non-transferable right to use the Customer's websites. The Formatting and Validation Services may only be used by the Client, to the exclusion of any other person. Technical Documentation is "read-only", which implies that it cannot</td><td>Social Good:

No information collected</td><td colspan="2">Revenue Streams:

There is no direct revenue stream through address master data for Bpost. Indirect revenue streams are possible by allowing corporate customers to integrate address validation into their workflow. Corporate revenue accounts for 1.64% of total Bpost revenue.</td></tr>
</table>

[5] Sources: http://corporate.bpost.be, https://www.bpost.be/sites/default/files/pagina/bpost_Webservices_Validation_Address_API_fr.pdf Annual report: bpost annual report 2015_EN.pdf; Conditions of use: http://www.bpost.be/site/fr/envoyer/adressage/webserviceaddress/conditions-g%C3%A9n%C3%A9rales

	be modified or used by the Customer for purposes other than the use of the Formatting and Validation Services. In addition, the Customer (i) may not distribute, resell or decompile the Technical Documentation or make it available to a third party, in whole or in part; (ii) may not transfer, sell, assign, lease, negotiate or encumber the Formatting and Validation Services in whole or in part, or (iii) access the source code of the Formatting and Validation Services.		

4.2 European initiatives

At a European level, few initiatives were identified. The most important players appear to be EuroGeographics, the European Data Portal and EULIS.

EuroGeographics develops the EuroBoundaryMap, EuroGlobalMap and EuroRegionalMap for businesses and other governments, making its business model to be B2B and B2G.

The European Data Portal promotes the sharing and reuse of open data in Europe. It enables access to a large number of datasets across Europe, including geospatial data sets, and has its own gazetteer to facilitate searching for datasets.

EULIS offers professional users a central portal to lookup land registry information in different European countries. As they only target professional users, the appropriate business models are B2B and B2G.

4.2.1 EuroGeographics already provides an EU-wide gazetteer with administrative boundaries

EuroGeographics[6] is the representative body and membership association of the Mapping, Cadastre and Land Registry Authorities of Europe. With its data products **EuroBoundaryMap** and **EuroGlobalMap**, EuroGeographics already provides gazetteer data. EuroBoundaryMap contains local administrative units for over 40 countries and is available under a commercial licence. EuroGlobalMap is available free-of-charge under an open licence, but does not contain the information on administrative units.

In the context of the European Location Framework project [ELF] EuroGeographics has developed the GeoLocator service which currently provides access to the following data:

- Data on INSPIRE/ELF administrative units (FI);
- Geographical names (DK, PO, UK, NO, SE);
- Addresses (CZ, DK, PO, ES); and
- Data that was part of the EuroGeoNames (EGN) service (a predecessor to GeoLocator) for various countries (AT, BE, CY, CZ, HR, EE, FI, FR, DE, GR, IT, LV, LT, SI, ES, CH, UK).

Although additional datasets are likely to be added in the coming months, currently the GeoLocator does not provide an EU-wide gazetteer containing **geographical names and addresses.**

Nevertheless, the work on the GeoLocator service offers a high potential for (re)use with regard to:

- GeoLocator software: the software of the GeoLocator service could be made available as open-source software. The ELF project expects to make its source code available as open-source software.
- GeoLocator data: the aggregated dataset behind the GeoLocator service could be made available for reuse to third parties. However, this would potentially require different licence agreements with the data providers, since only some data providers make the data available under an open licence.
- GeoLocator Data-as-a-Service (DaaS): the ELF project currently provides this service and is investigating the necessary steps to sustain it.

Figure 3 shows the status of the ELF GeoLocator arrangements of national web services of Geographical Names (in colours), Addresses (AD) and Administrative Units (AU).

[6] EuroGeographics is an international non-profit association under Belgian law. For the purpose of this study, the categorisation of business models was limited to government, consumers and businesses. Non for profit organisations are therefore classified in the category "Businesses"

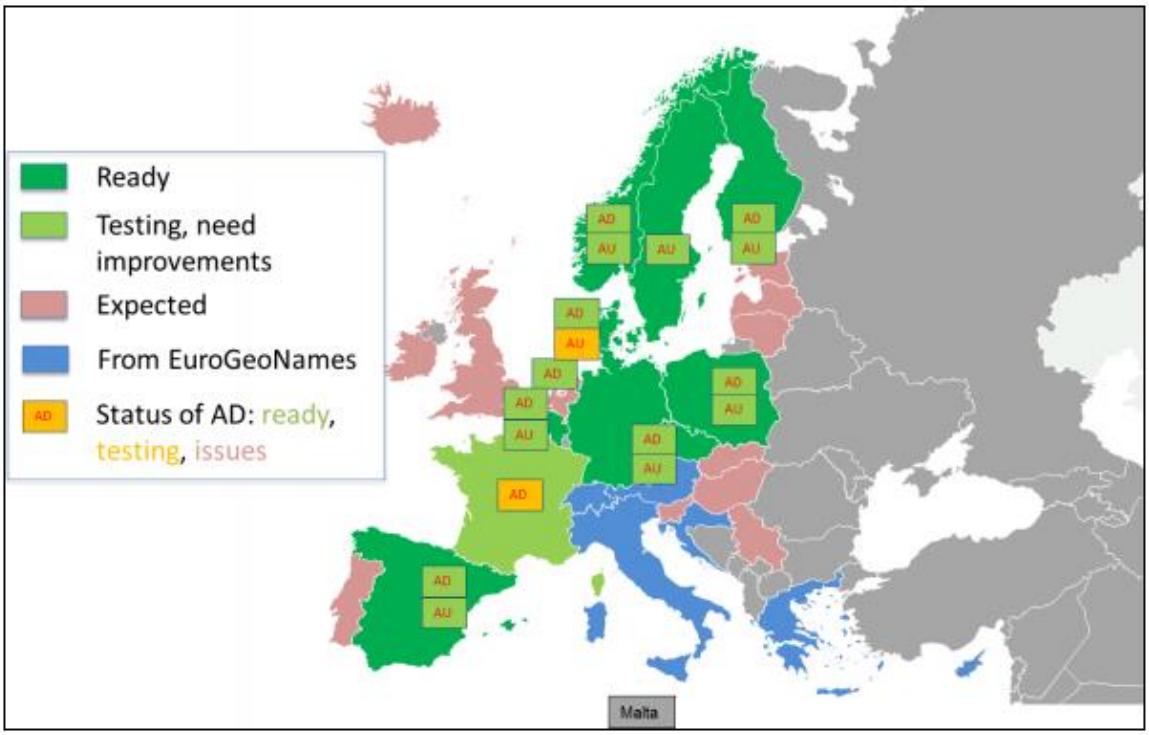

Figure 3: Status of ELF GeoLocator arrangements of national web services of Geographical Names (in colours), Addresses and Administrative Units.

Source: UNITED NATIONS GROUP OF EXPERTS ON GEOGRAPHICAL NAMES, Status Report on the EuroGeoNames (EGN) transition to the GeoLocator service in the European Location Project (ELF), Twenty-ninth session Bangkok, Thailand, 25 – 29 April 2016, p.6.

The interview (**Table 18** in Annex 1) with the ELF project on the GeoLocator service identified that the current business model does not consider maintaining the GeoLocator as a standalone product, but rather as an additional application to existing services. Data providers sign a data provider agreement, allowing the data to be used in the context of the ELF project for evaluation purposes only. The data providers have to provide the data in a format that conforms to the ELF/INSPIRE data specifications. The ELF project does not apply any data transformation on the provisioned data, other than a transformation of the coordinate reference system into ETSR89. Data providers must provide a dataset as a single file; the combination of regional data (e.g. Belgium) should be done by the data provider. Upon data import, there is a quality check, whereby the imported place names are compared with the EGN exonyms database and discrepancies are reported back to the data providers. The data provisioning process requires manual intervention to propagate data updates.

The ELF Project ended in October 2016, and is now in a two-year transition to an operational service, with ownership transferred to EuroGeographics and its members, European National Mapping, Cadastre and Land Registry Authorities. EuroGeographics and its members are investigating sustainability options and opportunities for further evolution of the service For instance, it has not been decided yet whether the GeoLocator will be a public service free of charge or a product for which a specific licensing scheme will apply. This will depend on the agreements with data providers.

EuroGeographics and its members are assessing the costs of making the service available, together with possible funding models. One option is to guarantee continuity of service under the EuroGeographics membership organisation. EuroGeographics members have already agreed initial funding of the GeoLocator service during the two year transition period. This is an important factor in considering the feasibility of further EU action.

4.2.1.1 Business Model Canvas[7]

Table 4: Business Model Canvas for EuroGeographics

<table>
<tr><th>Business model for:</th><th colspan="4">EuroGeographics</th></tr>
<tr><td rowspan="2">Key partners:

• National mapping, cadastre and land registry authorities within the European Union
• Network of distributors
• European Commission
• Standards Bodies (ISO, CEN, OGC)</td><td>Key Activities:

• Bringing together different national mapping, cadastre and land authorities.
• Representing members' interests
• Facilitating knowledge transfer between members
• Creating and implementing interoperability projects
• Producing pan-European products</td><td rowspan="2">Value proposition:

EuroGeographics is the membership association of the European National Mapping, Cadastre and Land Registry Authorities. It currently brings together 60 organisations from 46 countries and aims to further the development of the European Spatial Data Infrastructure. EuroGeographics provides access to quality-checked official pan-European data.</td><td>Customer relationships:

• Community based
○ Knowledge exchange networks
○ Events such as webinars, conferences, keynotes
• Personal assistance through sales manager</td><td rowspan="2">Customer Segments:

• Segments based on customer size (small, medium, unlimited).
• B2B oriented
• Niche segment of Value Added Resellers</td></tr>
<tr><td>Key Resources:

• Member organisations
• Knowledge exchange networks
• Support from European Commission</td><td>Channels:

Online distribution:
• Direct sales
• Sales through distributors and Value Added Resellers</td></tr>
<tr><td>Cost Structure:

Overhead consisting mainly of:
• Salaries
• Project related costs
• Travel expenses
And direct production costs (13% of total costs)</td><td>Licence:

EuroGlobalMap: Open licence with attribution

Other: proprietary licence</td><td>Social Good:

Commitment to provide easy access to authoritative data from member organisations.</td><td colspan="2">Revenue Streams:

• Membership subscriptions
• Product sales
• Projects funded by the European Commission</td></tr>
</table>

[7] Sources: Annual report: EGAR2015 final web.pdf, http://www.eurogeographics.org/

4.2.2 European Data Portal

The European Data Portal harvests the metadata of public sector information available on public data portals across European countries. Information regarding the provision of data and the benefits of re-using data is also included.

The Portal is developed and operated by the European Commission with the support of a consortium led by Capgemini, including INTRASOFT International, Fraunhofer Fokus, con terra, Sogeti, the Open Data Institute, Time.Lex and the University of Southampton.

One of the features offered by the European Data Portal is that it has its own gazetteer. Thanks to this capability, users can search and geolocate datasets and visualise the data extent on a map. Furthermore, thanks to reverse-geolocating a user can indicate a region and the service will display all datasets that are relevant to that region. This allows the user to browse through the available datasets.

The search capabilities mainly cover the populated places of Geographical Names (INSPIRE Annex 1) – however data quality varies widely, and so do licensing conditions. To the extent possible, authoritative data about geographical names from Member States is used. However, when this data is not available openly, Geonames.org is used instead. Besides geographical names, Geonames is also used to look up exonyms. Exonyms are usually not provided by Member States, but from a user's perspective they are important and useful. Exonyms enable users to find the place they are looking for using the geographical name of a place in their own language.

4.2.2.1 Business Model Canvas

Table 5: Business Model Canvas for the European Data Portal

<table>
<tr><th>Business model for:</th><th colspan="4">European Data Portal</th></tr>
<tr><td rowspan="2">Key partners:

• European Commission
• Consortium partners (Capgemini, INTRASOFT International, Fraunhofer Fokus, con terra, Sogeti, the Open Data Institute, Time.Lex and the University of Southampton)
• MS public authorities (portals, metadata / data providers)
• Geonames.org</td><td>Key Activities:

Harvesting the metadata available on public data portals</td><td rowspan="2">Value proposition:

• Gathering and structuring datasets
• Single access point for pan-European data
• Promoting open data</td><td>Customer relationships:

• Training
• E-learning environment
• Sharing user stories
• Contests</td><td rowspan="2">Customer Segments:

• G2C
• G2B
• G2G</td></tr>
<tr><td>Key Resources:

Public data portals
For Gazetteer service:
• National authoritative sources
• GeoNames.org</td><td>Channels:

Online</td></tr>
<tr><td>Cost Structure:

• Employees
• Service maintenance</td><td>Licence:

Licences to use the data depend on the originating country</td><td>Social Good:

No information collected.</td><td colspan="2">Revenue Streams:

No direct revenue streams are identified.</td></tr>
</table>

4.2.3 EULIS already provides access to cadastral parcel and land register information for professional users

The EULIS Service (European Land Information Service) is an online portal enabling access to land registries of different European countries. Currently, EULIS provides access to land and property information of 20 European countries, but the aim is to provide world-wide access to national Land Register and Cadastre information services.

It provides quick and easy access to land and property information for professionals in Europe. These legal professionals or people who work for a financial institution, estate agency, enforcement agency, government or credit agency can register themselves via their national land registry. The EULIS service allows e.g. lending institutions to confirm ownership of land and property in another country; estate agencies to search for property information for a second home abroad for their client; investigations on property and land characteristics on behalf of companies to find appropriate overseas operations.

Since EULIS is built on official European National Land and Property registries, there are differences in the way information can be searched, depending on the country. Some countries allow users to search by address or name of the owner, others allow them to search via a map. There are also differences with regard to the available information. Some countries provide land register information like the owner, mortgages etc. others also provide cadastral information and building information. Some countries charge for searches; others provide the information for free. In addition, according to Rik Wouters[8], the Managing Director of EULIS EEIG, potential members are reluctant to join EULIS because of high recurring costs compared to low revenue levels due to legal, IT or organisational challenges.

[8] http://www.eurocadastre.org/pdf/vilnius_oct2013/reuni%C3%B3n%20de%20PCC%20en%20vilnius/Session%20V/EULIS_RWouters.pdf

4.2.3.1 Business Model Canvas[9]

Table 6: Business Model Canvas for EULIS

<table>
<tr><th>Business model for:</th><th colspan="4">EULIS</th></tr>
<tr><td rowspan="2">Key partners:

EULIS is a European economic interest grouping (EEIG) governed by members.

EULIS is supported by:
• European Commission
• EuroGeographics
• European Business Register
• European Land Registry Association (ELRA)
• European Mortgage Federation (EMF)
• Joinup
• Verband deutscher Pfandbriefbanken</td><td>Key Activities:

• Provide access to official land registers in Europe (cadastral parcels)
• Support development of EU-policies in relevant fields (open data, privacy)
• Training for end-users</td><td rowspan="2">Value proposition:

The service is aimed at professional customers who use land registry information to assist them in their day-to-day work life. It provides:
• Quick and easy access to land and property information from member countries.
• Retrieval of information online, direct from official land registers.</td><td>Customer relationships:

Self-service basis</td><td rowspan="2">Customer Segments:

• Niche market of professional customers such as:
○ Banks
○ Lenders
○ Estate agents
○ Notaries
○ Lawyers
• Citizens</td></tr>
<tr><td>Key Resources:

• Contributions (data) of the Member States
• All the supporters listed in the key partners section</td><td>Channels:

Direct services to users using the official website (online portal)</td></tr>
<tr><td>Cost Structure:

Main costs:
• Management
• Business Development
• IT infrastructure and software</td><td>Licence:

Proprietary: “Unless otherwise specified, the Services are for your personal and non-commercial use. You may not modify, copy, distribute, transmit, display, perform, reproduce, publish, license, create derivative works from, transfer, or sell any information, products or services obtained from the Services.”</td><td>Social Good:

Not-for-profit organisation with the goal of informing professional users on land and property information and facilitating cross border lending and transfer of land titles.</td><td colspan="2">Revenue Streams:

• Subscription fees, consisting of:
○ Membership contribution: €20,000 from each of the 9 members with level-4 status
○ Membership fee from 1 member with level-2 status: €5000
• Projects (largely EU funded)

Note: level-1 members do not pay a membership fee.</td></tr>
</table>

[9] Sources: http://eulis.eu , EULIS-Conditions-of-use.pdf
Annual report: EULIS-Annualreport2014_final07-04-2015.pdf, EULIS_2.Annual_Report2015_PPT_.pdf

4.3 Global initiatives

Almost all organisations with global coverage are commercial organisations, targeting a wide range of customers. They offer basic functionality for free, letting users get used to their service, and charge customers for using additional services. Their business models are classified as a combination of open and commercial B2B, B2G and B2C.

One exception to this is the case of OpenStreetMap. This organisation is a crowd sourced initiative, allowing its customers to make use of and build on the application. Again, this organisation targets a very wide customer base, resulting in their business model being classified as open B2B, B2G and B2C.

4.3.1 Commercial data vendors already provide EU-wide products and services

HERE, Google Maps, Geonames, ESRI are providers of EU-wide gazetteer data products and services. The data from these products to a large extent originates from public sector mapping agencies, with in some cases data validated by the organisation in question or through interaction with their customers.

In the context of HERE, selling data and providing a gazetteer is only part of what they do. They also provide additional services on top of the gazetteer service, like navigation maps, products and services most notably for the automotive industry, locating "Points of Interest" on their maps or building search algorithms. With regard to the supply side, the different legal provisions that apply across Europe requires HERE to negotiate access and reuse conditions on a bilateral basis. A key challenge lies in the fact that HERE needs perpetual rights to the data to be able to make it available openly, but also to sell a service and resell the data, and this is not always easy to achieve.

For HERE, the development of an EU Gazetteer common service would be both an opportunity and a risk. On the one hand, it would allow HERE to make use of new authoritative data sources. But on the other hand, it could reduce the competitive advantage that HERE has over other companies because everybody will have access to the same quality of data. What is more, the EU Gazetteer common service could to a certain extent become a competitor of existing similar services. Thus, an EU action on an EU-wide gazetteer should not lead to unfair competition with these commercial initiatives.

4.3.1.1 Business Model Canvas[10]

Table 7: Business Model Canvas for HERE

<table>
<tr><th>Business model for company:</th><th colspan="4">HERE</th></tr>
<tr><td rowspan="2">Key Partners

• Co-owned by German automotive companies, Audi, BMW, and Daimler
• HERE Resellers
• ESRI</td><td>Key Activities:

• Collect location information from different sources
• Develop and market location-based products and services
• Provide a look up service for users to look up address, POI (e.g. restaurants, monuments and hospitals)</td><td rowspan="2">Value proposition:

Providing real-time, content rich location applications and experiences with high precision.

Focus on trust (reliability of data)</td><td>Customer relationships:

• Dedicated personal assistance through sales representatives and support desk.
• Self-service for developers seeking to use HERE APIs</td><td rowspan="2">Customer Segments:

• Diversified:
○ Automotive
○ Enterprise
○ Consumer</td></tr>
<tr><td>Key Resources:

• Proprietary data collection system
• Map making teams
• Community teams (user feedback)</td><td>Channels:

• Direct sales
• Reseller network</td></tr>
<tr><td>Cost Structure:

Value driven business structure. i.e. less emphasis on cost.</td><td>Licence:

Proprietary licences per product/service.</td><td>Social Good:

Helps the non-profit CyArk with creating a digital catalogue of at-risk historic sites by sharing location information collected by HERE cars.

Provides free city navigation for consumers.</td><td colspan="2">Revenue Streams:

• Licensing
○ HERE Map Data
○ Navigation services
○ Traffic information
• Subscription basis
○ HERE Platform offering a suite of features covering maps, directions, traffic, geocoding and points of interest</td></tr>
</table>

[10] Sources: https://company.here.com, https://en.wikipedia.org/wiki/Here_(company)

4.3.2 Crowd-sourcing initiatives like OpenStreetMap

OpenStreetMap offers an editable map of the world, available under a Creative Commons licence. Its Nominatim service can be used for geocoding. As the data of OpenStreetMap is collected by volunteers based on personal observations, but also based on open-source data from public authorities, the quality of its data varies from region to region. OpenStreetMap has a large number of quality control mechanisms[11] in place, often via cross-referencing with other datasets.

Because OpenStreetMap is based on editable data, it cannot be considered as an *authoritative source* of data by public authorities, which may limit its use in the public sector. However, it could be used alongside authoritative sources whenever an open data service is needed and public authorities charge for their data.

[11] http://wiki.openstreetmap.org/wiki/Quality_assurance

4.3.2.1 Business Model Canvas[12]

Table 8: Business Model Canvas for OpenStreetMap

<table>
<tr><th>Business model for company:</th><th colspan="4">OpenStreetMap</th></tr>
<tr><td rowspan="2">Key partners:

• Hosting is supported by the UCL VR Centre, Imperial College London and Bytemark Hosting, and other partners.
• Contributors providing data: government bodies, state-owned enterprises, local councils, non-profit organisations and individuals.</td><td>Key Activities:

• Sharing map data including road, trails, railways and points of interest for reuse.
• Providing geographic maps covering the world.</td><td rowspan="2">Value proposition:

The principal activity of the company is that of an initiative to create and provide free geographic data, such as street maps, to anyone.</td><td>Customer relationships:

• Focus on community and co-creation
• Annual State of the Map community event</td><td rowspan="2">Customer Segments:

No specific segment, as the product is open to everyone, open for consultation and contribution to the content.

OpenStreetMap data is, however, used by many commercial initiatives that target different customer segments.</td></tr>
<tr><td>Key Resources:

• Raw data provided by contributors and volunteers
• Volunteers processing the data and generating the maps.
• Data servers</td><td>Channels:

Online distribution:
• Direct download
• API</td></tr>
<tr><td>Cost Structure:

Overhead consisting mainly of:
• Travelling and Entertainment
• Telephone and Computer charges
• Professional Fees</td><td>Licence:

All uses (private, commercial, government or humanitarian) of the data are equally permissible, as long as the user gives proper attribution, and shares back to the OSM community any improvements to the map that he makes public.</td><td>Social Good:

OpenStreetMap is a not-for-profit organisation seeking to provide geographic information to everyone.</td><td colspan="2">Revenue Streams:

• Membership
• Corporate membership
• Public/Private Donations
• Server donations</td></tr>
</table>

[12] Sources: https://www.openstreetmap.org/ , http://wiki.openstreetmap.org/wiki/Contributors
Annual report: OpenStreetMap_Financial_Statement_2014.pdf , OpenStreetMap_Income_QI-QIII_2015.pdf

5 Intermediate conclusions on the demand and supply analysis

This section takes a closer look at the link between the demand and supply sides. More specifically, it aims at identifying opportunities for an EU Gazetteer common service by answering the following questions:

- What content type(s) is/are valid options for an EU Gazetteer common service? Why are these content types relevant and why are they a priority? (section 5.1)
- What data sources could be used for an EU Gazetteer common service? Where is supply of data already meeting demands in terms of content, and where are the gaps? (section 5.2)

The answers to these questions will identify gaps between demand and supply and discover whether there is a need for an EU Gazetteer common service. This analysis is based on the information gathered from interviews and desk research on supply and demand and the proposed specific use cases. At the end of this section, preliminary conclusions are made regarding the content types and data sources that will be considered in the business case (section 6).

5.1 Content types

The first analysis aims to determine what an EU Gazetteer common service could cover in terms of content type. The content types taken into account are those proposed in section 2.1.

The following criteria are used:

- **Number of potential applicable use cases**: for each specific use case of the demand side, the content types, necessary to fulfil the use case, were identified in Table 1. The table below summarises how many use cases make use of the specified content type.
- **Existing gazetteers**: the analysis of existing gazetteers reveals which content types are used in the different gazetteers that were identified in Table 28. Table 9 below shows how many of the existing gazetteers that were analysed use the specified content type.
- **Existing gazetteers using authoritative sources**: when looking at the existing gazetteers using this content type, do they generally use authoritative data, a mix of authoritative and non-authoritative or non-authoritative data?
- **EU wide, open data initiative available:** is there already an initiative in place providing an open data gazetteer service, covering all EU countries regarding this content type? The initiative must make the data available under an open licence, but the data source does not have to be authoritative.
- **EU wide initiative based on authoritative data is available**: is there already an initiative in place providing a gazetteer service covering all EU countries regarding this content type, using authoritative data? This initiative must use authoritative sources, the licensing and pricing mechanism are of no interest in this row.
- **Suitable for an EU Gazetteer common service:** to conclude, this row indicates whether the specified content type would be a suitable content type for an EU Gazetteer common service or not.

Table 9: Analysis of possible content types for an EU Gazetteer common service

	Geographical names	Administrative units	Street names	Addresses	Cadastral parcels	Buildings
DEMAND						
Number of use cases covered	5/18	4/18	4/18	11/18	6/18	5/18
SUPPLY						
Existing gazetteers[13]	Widely (18/32)	Commonly (10/32)	Rarely (3/32)	Uncommonly (8/32)	Rarely (3/32)	Rarely (2/32)
Using authoritative data	Mixed	Auth.	Auth.	Mixed	Auth.	Mixed
EU wide, open data initiative available	Yes (Geo-names.org, Open-StreetMap)	Yes (Open-StreetMap)	Yes (Open-StreetMap)	Yes (Open-StreetMap)	No	No
EU wide initiative with authoritative data available	Partial (EuroGeoNames)	Yes (Euro-Boundary-Map)	No	No	No	No
CONCLUSION						
Suitable to start an EU Gazetteer common service	More likely	More likely	Less likely	More likely	Less likely	Less likely

[13] Some of the data in the gazetteers that were analysed consisted of a combination of multiple content types. Therefore, the total of the individual counts exceeds 32.

Options excluded:

Based on this analysis, cadastral parcels and buildings were excluded as content options for an EU Gazetteer common service because few existing gazetteers were encountered, they only cover a limited amount of specific use cases, authoritative data is not always available[14] and data coming from different sources might not always be easy to harmonise. Looking at the remaining content types, street names and addresses are closely linked to each other. As more use cases will benefit from an address gazetteer compared to a street gazetteer, street names was deemed not to be a suitable starting option for an EU Gazetteer common service.

Options retained:

Geographical names could be a suitable starting option for an EU Gazetteer common service. Even though several initiatives already exist, for example the European Data Portal, GeoNames.Org or EuroGeographics' EuroGeoNames which currently covers geographical names of some EU countries, an EU Gazetteer common service could further extend these services to reach full EU coverage, as the data can fairly easily be obtained and combined from authoritative sources. (We refer to Table 27 for more details)

Just like geographical names, the administrative units content type remains a suitable starting option for an EU Gazetteer common service. Administrative units cover less use cases, but the use cases covered are complementary to the use cases covered by address data. Next to this, it should take less time to set up an EU Gazetteer common service based on authoritative administrative units data compared to address data, as this was for instance already done by EuroGeographics for the EuroBoundaryMap.

As mentioned before, the street names option was excluded, with the intent to retain the address option. Addresses are used as identifiers of individuals and businesses and thus a valuable source of information in most use cases. Therefore, they should be considered as an option for the EU Gazetteer common service. It should be noted that this option will be more complex to implement compared to the administrative units case, as address data is openly available in some countries, like Denmark, but highly protected in others, like e.g. the United Kingdom. Next to that, differences in data formats and data quality exist between different Member States.

All three content types are covered by OpenStreetMap, but since this data is often crowd sourced and data can be edited, the data cannot be relied upon for certain use cases, like the validation of addresses by government authorities. The same holds true for Geonames.org, providing non-authoritative data for geographical names. Therefore, there is an opportunity for an EU Gazetteer common service to fill this demand.

[14] The Permanent Committee on Cadastre in the European Union lists all cadastral portals of EU Member States that can be accessed at http://www.eurocadastre.org/eng/products_i.asp

5.2 Data sources

Besides a gap analysis on content type, an analysis was performed of possible data supply options. An assessment was made of the three possible data sources that were identified in section 2.2. For each alternative, the following factors were assessed in Table 10:

- **Authoritative**: Is data from this source authoritative or not?
- **Openness**: Is the data from this source available under an open licence or will it likely be a commercial product?
- **Homogeneity of the data**: Will the structure of the data be the same throughout the EU?
- **Number of involved parties**: Could one party supply all the necessary data?
- **INSPIRE:** Is the data, provided by this type of data source, usually INSPIRE compliant?

In addition, the analysis performed on existing applications provides the reader with a sense of what options are being used today. The underlying services and data sources used by each application were mapped to the 3 options listed below. Further detailed information can be found in Annex 2.

Table 10: Analysis of possible data sources for an EU Gazetteer common service

	Public sector data providers	Private sector data providers[15]	Crowd-sourced data
Pros	• Authoritative data • Possibly open • Often INSPIRE compliant	• Homogeneous (if one party) • Possibly one party involved	• Open • Homogeneous • One party involved • Can be organised to be INSPIRE compliant
Cons	• Possibly commercial • Heterogeneous • Multiple parties (national mapping agencies or postal authorities of each country)	• Not completely based on authoritative data • Commercial • Heterogeneous (if multiple parties) • Possibly multiple parties • Possibly not INSPIRE compliant	• Non-authoritative data • Greater potential for data gaps

[15] Please note that for the purpose of this study, private sector data providers include non for profit organisations like EuroGeographics.

	Public sector data providers	Private sector data providers[15]	Crowd-sourced data
Applications[16]	5 out of 26	21 out of 26	4 out of 26
Suitable for an EU Gazetteer common service	Yes	Yes	Yes

5.3 Intermediate conclusion

Based on the high level analysis of demand and supply, it can be concluded that there are opportunities for an EU Gazetteer common service that focusses on geographical names, administrative units and address data, based to the extent possible on authoritative datasets.

It should be noted that the market is very complex, with data providers coming from different sectors, having different alternatives for business models, licensing and pricing conditions and data coverage. It is difficult to predict how an EU initiative will impact this complex ecosystem.

Furthermore, the business models in the supply side analysis revealed that:

(a) Public sector driven initiatives are all highly dependent on their member organisations.

(b) A quality feedback loop mechanism is a key resource or activity for all organisations that were analysed in the supply side analysis.

(c) Most organisations encountered do not provide data under a true open data licence. Few examples that do provide data under a true open data licence are Geonames.org, the Danish Address Programme, the French Address Service, and OpenStreetMap.

There are different roads that could lead to an EU Gazetteer common service. Some core elements to be taken into account are the degree to which open data is a requirement, whether full EU coverage is required, the desired level of harmonisation and data quality, the terms for pricing and licensing options, etc. Another element to keep in mind is the INSPIRE implementation, which will finalise in a few years. If all Member States were to fully adopt the INSPIRE guidelines and publish their data, it would ease the development of an EU Gazetteer common service, as the need for further data harmonisation will be limited and individual datasets could be combined more easily.

The possible alternatives are further explored in the next section, presenting and comparing the business cases.

[16] Some of the applications that were analysed used a combination of the presented data source options. Therefore, the total of the individual counts exceeds 26.

6 Business case

The analysis in the previous section revealed that geographical names, administrative units and address data were retained as solid options for the content of an EU Gazetteer common service. Next to this, the other scoping options like licensing and pricing, mentioned in Section 2**Error! Reference source not found.**, have to be explored. This ection presents the alternative implementation actions the European Commission could undertake to establish an EU Gazetteer common service. For each alternative, arguments for and against are explored, including high level costs, risks and benefits. It should be pointed out that, in the absence of detailed costs from data owners, this analysis is indicative until they become directly involved in the evaluation of preferred options.

6.1 Do nothing

In this status quo option, no additional EU action is taken. This alternative is considered to be sub-optimal because it **will not help reducing redundancies** and **duplication of efforts** that public offices, private businesses and citizens are currently undergoing when they need to access and use this data. Furthermore, the **costs associated with data management will remain** and will be **multiplied for each public office that holds data**.

A summary of the key costs, benefits and risks is presented below:

Costs

For the EU, there will be no additional costs. There are however implicit opportunity costs that will remain, if no action will be taken:

- Costs of FTEs needed to overcome the inefficiencies. One example, apparent from the interview that was conducted on the Danish Address Programme, is that public offices dealing with addresses have to spend time to verify each address. For national addresses, this is usually not a significant issue, but verifying international addresses is not always easy, especially in remote areas. This not only affects all European institutions, but also all national public services in every EU Member State.
- Burden for businesses and citizens in having to submit and verify data multiple times for different public services.
- Costs of negotiating with the relevant authorities every time geographical names, administrative unit data or address data are needed for a service.
- Costs of maintaining a separate database in various facilities, including costs associated with setting up the infrastructure, governance, maintenance and improvement of the data quality.

Benefits

This option requires no EU investment. There are already various initiatives working on gazetteers at national and EU level, with various data types. Users will still be able to get access to the data, although existing differences will be maintained.

Risks

The current risks remain. There is a risk that the valuable data will not be used to its full potential or that data input to different services at different times is not consistent. As a result, initiatives that will boost economic growth in the EU will be more limited, due to the fact that existing factors deterring classes of users from taking the most useful data/services will not be addressed. Without an EU supported initiative, the differences in data quality throughout Europe can sustain for a long time.

6.2 Alternative 1 – Further developing existing pan-European data services

This alternative entails EU action to promote the further development and maintenance of existing solutions like the gazetteer service of the European Data Portal, or the GeoLocator Service, which was created as part of the European Location Framework (ELF) project (for further details see the summary of the interviews with the European Data Portal and the ELF project in Annex 1.

- The **European Data Portal gazetteer** (EDP) provides an open gazetteer of geographical names. It has the advantages of being open and providing full EU coverage. Although it favours authoritative data over data originating from Geonames.org, it has the disadvantage that not all data are authoritative. What is more, it currently offers only basic functionality. It would however be possible to 'extract' the gazetteer service from the European Data Portal, further developing it to include other content types such as administrative units, addresses, buildings, cadastral parcels etc. and include enhanced functionality, such as linking with other base registers if addresses are made available, and making it available as a pluggable service.
- The **GeoLocator** (GL) service currently provides access to more content types compared to the EDP, notably: geographical names, administrative units and addresses. However, the GeoLocator is currently in a piloting phase and does not provide full EU coverage with respect to these datatypes. Data providers signed a **data provider agreement**, allowing the data to be used in the context of the ELF project *for evaluation purposes only*. If the GeoLocator were to go into production, the licences would have to be renegotiated. Upon data import, there is a **quality check**, whereby the imported place names are compared with the EGN exonyms database and discrepancies are reported back to the data providers. The ELF project does not apply any data transformation on the provisioned data, other than a transformation of coordinate reference system into ETSR89.

Further developing either of these services is considered to be a preferred alternative because they provide a significant starting point for EU services. Furthermore, both options will result in a harmonised service, making it easier to provide added-value services based on this data. However, neither of the two is (yet) a standalone (callable) service.

Despite this, the **costs will be lower** compared to alternative 2, since no public procurement process will be required and development costs will be lower because it will build upon an existing solution instead of starting from scratch. The fact that both EuroGeographics and the European Data Portal already have well **established relationships with the owners of the data** across Europe is also advantageous because it greatly reduces the risks associated with stakeholder management.

6.2.1 Scope options

Table 11 gives an overview of the current situation. EuroGeographics' GeoLocator and European Data Portal gazetteer are assessed in terms of the different scope options, defined in Section 2. Next, a summary is given of the requirements for an EU Gazetteer common service in terms of these scope options, as well as the necessary next steps needed to pursue this alternative.

Table 11: Summary of requirements and next steps for alternative 1

	Current situation	Requirements for an EU Gazetteer	Next steps
Content type	GL: Partial coverage of: • addresses • admin. units • geographical names EDP: full coverage of • geographical names	Full coverage of: • addresses • admin. units • geographical names	Negotiate access to missing: • addresses • admin. units • geographical names
Data sources	• public, authoritative data providers (GL, EDP) • private data providers (EDP)	• public, authoritative data private data providers if needed	• procure missing authoritative public data • procure private data to fill gaps
Mechanisms for QC	Minimal agreements Minimal quality check	• minimal agreements • feedback loop	Establish a feedback loop with users
Linking with other base registers	Embedded solutions No links on a European level.	Component based (callable) service Linkages across registers of: • companies • population • cadastres	Evaluate potential for component based service Ensure interoperability to link with other systems
Level of harmonisation	Both GL and EDP are harmonised, centralised systems	Harmonised, centralised EU system	Develop a centralised system for the EU Gazetteer common service
Licensing	• EuroBoundaryMap: commercial licence • EuroGlobalMap: open licence • European Data Portal: Data not available; Service is free to use but cannot be reused.	• open data licence • (possible) hybrid licensing	• Determine which data can be made available under an open licence • Set up hybrid licensing system if needed
Pricing mechanism	• EDP: free at point of use • EGG: pricing based on user bands and data coverage	Free at point of use Possible pricing model based on user groups, data types and volumes	Consider trade-off between public sector data and free service. Establish funding model for 'free at point of use' service.

Content type: As EuroGeographics gathered **geographical names** data for the development of the EuroGeoNames project, they already possess a database that covers 17 of the EU countries. For EuroGeoNames, the free use is limited to 100 queries per day. The European Data Portal gazetteer uses a mix of authoritative data sources and GeoNames.org to cover the whole of Europe.

For an EU Gazetteer common service based on **administrative units**, EuroGeographics could use their expertise and contacts used for the EuroBoundaryMap. This map already provides the boundaries of all administrative units in the EU.

It must be noted that EuroGeoNames and EuroBoundaryMap are currently provided as services. Therefore, it is possible that certain contracts will need to be renegotiated to provide the EU Gazetteer common service as open data.

The European Data Portal gazetteer currently does not contain administrative units nor addresses and does not provide the possibility to show boundaries.

The option of an EU Gazetteer common service based on **addresses** could be more beneficial, but also more challenging. Addresses represent the common key for many services and being able to provide an EU Gazetteer common service around them would be beneficial for existing and new users. However, the data is more challenging to obtain and harmonise. Developing an EU Gazetteer common service is technically feasible, as shown by the EURADIN[17] project and the ELF GeoLocator. However, the GeoLocator is currently only based on the address data of 5 countries, who were willing to provide their data for free for the pilot phase. Address data is not open in all countries and negotiations will have to take place if this is a requirement. The relationship between EuroGeographics and the national mapping agencies in the Member States will be beneficial to these conversations, but it has to be taken into account that certain Member States will not be able to cooperate due to legal restrictions. In these cases, negotiations with other, non-authoritative parties should be considered.

***Data sources*:** The EU Gazetteer common service should aim to make use of public sector, authentic sources as much as possible. Compliance with the INSPIRE directive from all Member States would facilitate harmonising datasets, but currently the data quality is variable with multiple countries still not complying, even on the level of geographical names and administrative units. As a result, there is a need to assess the data and transform it into a single format before the data can be used. As it could be difficult to convince national authorities to allow the EU Gazetteer common service to provide the data as free- of-charge, open data[18], definitely in the case of address data, the option could be explored to either provide the EU Gazetteer common service under an hybrid licence, or to strive for an open data licence, using of private sector data providers to fill out the gaps.

***Mechanisms for quality control*:** Minimal requirements on common quality control should be agreed upon with the different data suppliers. Beyond this, a quality feedback loop should be implemented within the EU Gazetteer common service. User feedback will be reviewed and validated by the EU Gazetteer common service staff or by the source data providers, and valid feedback can then be used to improve the data quality of the EU Gazetteer common service. To improve data quality throughout, the feedback should also be shared with the data suppliers.

***Linking with other base registers*:** The centralised model will allow it to be linked to other base registers, like the Business Register Interconnection System (BRIS), cadastral parcel registers, etc.

***Level of harmonisation*:** As both the GeoLocator and the European Data Portal are centralised systems, this alternative will result in a centralised EU Gazetteer common service, with a harmonised, centralised database. Federated master databases will still be the sources for this centralised database solution.

[17] Source : ECP-2007-GEO-317002 EURADIN Final Report
[18] See Table 27: Meeting minutes of the interview with the European Data Portal

***Licensing mechanism*:** The preference is to provide the EU Gazetteer common service under an open data licence. For this alternative, it is envisaged that a compromise will need to be made between using authoritative sources and providing the full EU Gazetteer common service under an open data licence. One option could be a hybrid licensing model, with the aim to provide the data as much as possible under an open licence, but at the same time allowing for the possibility of using data providers who cannot or will not provide (all) their data under an open licence.

***Pricing mechanism*:** The aim should be to provide the EU Gazetteer common service free of charge. National mapping agencies may not all be willing to open up all of their data for free. In this case, a trade-off may exist between using public sector data sources and providing the service for free. A possible solution could be to go for a freemium pricing model, either differentiating on the service or on the quality of the data. In the former, basic data or low data volumes are provided for free and additional services are commercialised. In the latter, basic quality data or a maximum number of data lookups per day are made available free of charge and higher quality data or additional information is provided as a commercial product. Another option could be to make a distinction based on the intended use: NGO, public administrations, scholars, etc. could make use of the EU Gazetteer common service free-of-charge, whereas for commercial reuse, a cost-recovery pricing model could be applied.

6.2.2 Costs

Costs related to such support actions could include among others:

- Coordinating and communicating with national mapping, cadastre and land registry authorities;
- Creating a contributor agreement and a licence framework;
- Putting in place an ETL (Extract, Transform and Load) stream for producing the gazetteer data from various sources;
- Developing mechanisms for quality control;
- Developing the gazetteer API service, map interface, etc.;
- Improving and maintaining data quality;
- Initial operational costs, including hosting, etc.

The body responsible for the management of the EU Gazetteer common service would have to define arrangements with the relevant public sector authorities, which own data on geographical names, administrative units or addresses, to ensure product availability and data quality. The overall costs for this example are expected to be lower than alternative 2.

At the time of writing, EuroGeographics and its members are analysing the costs for operationalising the ELF GeoLocator Service. The outcome of this analysis should be taken into account.

6.2.3 Benefits

This alternative has the advantage of having low costs, because the EU Gazetteer common service will build on the service that is closest to the overall requirement, limiting development costs and reducing implementation time. Access to address data will be improved because users will not have to consult several websites to access the data. The quality of the data will improve because a quality process will be part of the service offering. This alternative will also have the added value of reusing existing solutions, tapping into the knowledge acquired so far. It will also encourage standardisation and with regard to efficiency gains, at minimum, it would no longer be necessary for end users like public administration staff or application developers to negotiate pricing and licensing schema bilaterally with each entity of each country that owns geographical names data, administrative unit data or address data. It will also give EuroGeographics and/or the European Data Portal the opportunity to support the further development of value-added products and services.

6.2.4 Risks

For the GeoLocator option, the success of this business case depends on the willingness of EuroGeographics partners to support the GeoLocator as a standalone product. The GeoLocator service is currently seen as an add-on to existing services, rather than a standalone product. There is also a risk that members may change the business model of the GeoLocator service without consulting the EC. To mitigate this risk, contractual and funding conditions need to be well thought out.

An additional risk associated with EuroGeographics is that it is a membership organisation of public authorities with spatial data interests, receiving funding from several sources including CEF[19], but will probably need additional funding from ISA for a pilot, which might conflict with procurement / competition regulations.

Similarly to the GeoLocator, the success of the business case of the European Data Portal option depends on the willingness of the European Data Portal's responsible service to share and/or further develop the current functionality and provide the gazetteer, which is currently only accessible as part of the Portal services, as a standalone product. There is also the risk that it will be difficult to extend the functionality of the gazetteer, as it might have not been developed with the intent to support other content types.

In both cases, some benefits may not be realised as the fee for using the EU Gazetteer common service may be above the willingness-to-pay (the price elasticity is assumed to be high). Also, DG CNECT may not agree to replace the current arrangement with the new service (using either the GeoLocator service or an enhanced European Data Portal service), as it may be seen as a duplicate investment by the Commission, with insufficient new functionality.

[19] Connecting Europe Facility Programme: https://ec.europa.eu/inea/en/connecting-europe-facility

6.3 Alternative 2 – Prepare a public procurement to outsource to a third party

This example involves contracting a third party for developing, provisioning and maintaining an EU Gazetteer common service via public procurement. In this case, most activities are outsourced to a third-party for a given period, after which the procurement is renewed. This alternative is not the most favourable one. It implies **higher costs than alternative 1** because it encompasses at minimum the full costs of alternative 1 in addition to all costs related to the tendering process. Also, there will be costs in procuring data and margins added to the overall cost. Furthermore, outsourcing the management of the EU Gazetteer common service to a third party implies a **loss of control** over the data and the provisioning of the service as compared to alternative 1, where the organisations have close ties to the EC and the risk of loss of control is minimised.

6.3.1 Scope options

Table 12 gives an overview of the current situation. The current situation consists of a combination of private organisations like Google, HERE and non for profit organisations like OpenStreetMap. They all cover geographical names, administrative units and addresses, but only OpenStreetMap provides free access to the data. The data of these organisations does not always originate from authoritative sources. The different options are assessed in terms of the different scope defined in Section 2. Next, a summary is given of the requirements for an EU Gazetteer common service in terms of these scope options, as well as the necessary next steps needed to pursue this alternative.

Table 12: Summary of requirements and next steps for alternative 2

	Current situation	Requirements for an EU Gazetteer	Next steps for third party
Content type	Partial coverage of • addresses • admin. units • geographical names	Full coverage of: • addresses • admin. units • geographical names	Negotiate access to • admin units • geographical names • addresses
Data sources	• private sector data providers • crowdsourced data	• public authoritative data • private sector data providers • crowdsourcing if needed	• procure authoritative data • procure private sector data to fill gaps
Mechanisms for QC	• minimal agreements on common quality control • feedback loop	• minimal agreements on common quality control • feedback loop	• establish a feedback loop with users • agree minimal requirements on common quality control
Linking with other base registers	On a national level	Component based (callable) service Linkages across registers of: • companies • population • cadastres	• Evaluate potential for component based service • Centralised model should ensure interoperability across registers
Level of harmonisation	Centralised private system	Harmonised, centralised EU system	Develop a centralised system for the EU Gazetteer common service, with a centralised database
Licensing	• Openstreetmap: Open license • Google: restrictions apply to the use	All data available under open data licence	All data should be available under an open data licence as a non-negotiable requirement in the tender contract
Pricing mechanism	• OpenStreetMap: Free • Google: Free at point of use	Free at point of use	Should be free of charge as a non-negotiable requirement of the tender contract, with the option to build commercial services on top of the Gazetteer

Content type: The choice of content type will have little impact on this scenario, although it might be harder to find a third party willing to develop an EU Gazetteer common service on **address data**, because of the inherent difficulties related to gathering authoritative address data and publishing it as open data. Therefore, compromises might have to be made in terms of authoritativeness or other scope options. Another difference will lie in the cost of the EU Gazetteer common service. An EU Gazetteer common service on **administrative units or geographical names** will be less expensive, as the data will be easier to obtain and keep up-to-date.

***Data sources*:** The third party should aim to make use of public sector, authentic sources as much as possible. It will be difficult to convince national authorities to allow the EU Gazetteer common service to provide the data free-of-charge, as open data,

especially because the negotiating position for the outsourcing party will be weaker than for the European Commission directly. Compliance with the INSPIRE Directive from all Member States would make authoritative data source for geographical names and administrative units more available, but currently the data quality is variable with several countries still not complying. To compensate, it should also be possible to make use of private sector data providers (indicating open data providers like OpenStreetMap) to fill the gaps.

Mechanisms for quality control: As a quality control mechanism for the outsourcing alternative, minimal requirements on common quality control should be agreed upon with the different data suppliers. Next to that, a quality feedback loop should be implemented. User feedback will be reviewed and validated by the third party staff, and valid feedback can then be used to improve data quality.

Linking with other base registers**:** The centralised model of the outsourcing alternative will allow it to be linked to other base registers, like the Business Register Interconnection System (BRIS), cadastral parcel registers, etc.

Level of harmonisation**:** The outsourcing alternative will result in a centralised EU Gazetteer common service, with a harmonised centralised database. Federated master databases will still be the sources for this centralised database solution.

Licensing mechanism**:** The aim is to provide the EU Gazetteer common service under an open data licence. This should be one of the non-negotiable requirements of the tendering contract.

Pricing mechanism**:** The aim should be to provide the EU Gazetteer common service free of charge. This should be one of the non-negotiable requirements of the tendering contract. Nevertheless, the third party could be allowed to build additional commercial services on top of the EU Gazetteer common service.

6.3.2 Costs

The biggest cost in this alternative will be to pay the tenderer the value of the contract. Given the scope of the assignment, this cost should not be taken lightly. Also costs related to the preparing of the tender specifications and running the tender process have to be considered. The chances are that an application will have to be developed. This cost is not included in the other alternatives. Another point to consider is the fact that the contract can be granted to a private company. This often has an impact on the licensing and pricing conditions under which the data can be obtained from the public and private sector data sources.

6.3.3 Benefits

Going for a public tender allows the European Union to set more clear-cut requirements for the EU Gazetteer common service. One of these requirements is that the EU Gazetteer common service should be available free-of-charge under an open licence. This allows for easier access by both public and private organisations, thereby fostering the use of the service and reuse of the data. Just like alternative 1, this alternative will encourage standardisation and with regard to efficiency gains, at minimum, it would no longer be necessary for end users to negotiate pricing and licensing schema on an individual basis with each entity of each country that owns the data.

6.3.4 Risks

A specific risk applicable only to this alternative entails the fact that the contract with the 3rd party is limited in time. As a result, when the contract will come to an end, another third party might take over the service. Transferring the contract to the new 3rd party might be difficult if the appropriate hand over does not take place. It is important to specify this very clearly in the contract. This poses a specific risk in terms of long term

sustainability of the EU Gazetteer common service as well as pricing for the initial service (tenderers will want to make a profit whatever the length of contract).

6.4 Alternative 3 – Federated model: establish common agreements with national authorities

Rather than establishing a single, EU-wide gazetteer, the EU Gazetteer common service can be conceived as a federation of national gazetteers, that adhere to a common set of legal agreements (e.g. common licensing mechanism), a common pricing mechanism, common technical specifications (based on INSPIRE download services, INSPIRE data specifications, INSPIRE as linked data, etc.) and open-source software. This federated model will require the development of a thin layer that would allow users to search for geographical names, administrative unit or address data which will remain stored at the national level. However, a multi-country search could have differences in the way information can be searched, depending on the country and the available metadata. Furthermore, as the Federated model restricts the possible data sources to national authorities, the national authorities have a stronger bargaining position compared to other alternatives. This might have an impact on the pricing model, with some countries making the data available for free while others will charge for it.

This is not considered to be the optimal alternative because it will be **harder to build added value services** on top of it due to the fact that it will be more difficult to access and fully harmonise the data. There will be **no control over the pace** with which public administrations will adhere to common specifications, legal requirements etc. because the Commission will depend on the willingness of the national authorities to collaborate. At the same time, this alternative will require **limited development costs but also a very limited service** which will allow users to search for geographical names, administrative units or address data across national databases that decide to adhere to the federated model.

6.4.1 Scope options

Table 13 gives an overview of the current situation. The current situation consists of a wealth of open datasets provided by Member States covering different content types. However, there is no federated initiative, combining all data from all Member States. These datasets are assessed in terms of the different scope options, defined in Section 2. Next, a summary is given of the requirements for an EU Gazetteer common service in terms of these scope options, as well as the necessary next steps needed to pursue this alternative.

Table 13: Summary of requirements and next steps for alternative 3

	Current situation	Requirements for an EU Gazetteer	Next steps
Content type	Partial coverage of: • admin. units • geographical names • addresses	Full access to: • admin. units • geographical names • addresses	Harmonising admin. units and geographical names is technically and practically feasible (see EuroGeographics and the European Data Portal), for addresses it will need to be evaluated on a country-by-country basis
Data sources	Public sector data providers	All relevant national data providers: mapping agencies, postal authorities…	Procure necessary public data
Mechanisms for QC	Depends on the country.	• minimal data quality requirements • feedback loop	• Establish feedback loop with users • Establish minimum data quality requirements
Linking with other base registers	Datasets are sometimes linked but most exist on their own on a national level	Linkages across base registers of: • companies • population • cadastres	Federated model should ensure interoperability across registers
Level of harmonisation	Decentralised, data is available at the national level	Decentralised with a common portal to access the partially harmonised data	Develop a portal to combine data from different sources and give access to decentralised features Agree on a harmonised data and metadata format to facilitate the integration
Licensing	Large variability: some free for non-commercial use, others also include commercial uses, others are paying	Common licensing mechanism	Establish a licensing mechanism that all countries can agree on, hybrid if necessary
Pricing mechanism	Large variability: Some provide the data for free, other countries sell their data.	Free at point of use	Consider trade-off between public sector data and free service. Consider freemium pricing model, or price setting based on user

Content type: As **geographical names and administrative units** data is already being provided to EuroGeographics to develop the EuroGeoNames and the EuroBoundaryMap respectively, both the technical and practical feasibility of harmonising this data has already been proven.

For **addresses**, this business model will result in data harmonisation up until a certain level. Depending on the willingness of the Member States, this level will be higher or lower, resulting in fulfilling more or less use cases. The European Commission has less influence in this system, as it depends heavily on the willingness of the Member States to cooperate. Given the diversity of address data across countries, it will be necessary to undertake negotiations on harmonisation of this data across EU, which will not be an easy task. Compliance with the INSPIRE Directive from all Member States would increase

the availability of authoritative data sources, but currently the data quality is variable with multiple countries still not complying.

Data sources: The federated model is based on a federation of public authorities (national mapping agencies, postal authorities). Inherently, the EU Gazetteer common service will want to make use of national authoritative data sources. If the Member States were to publish their data in an INSPIRE-compliant format, it would simplify merging different sources into a single EU-wide Gazetteer common service.

***Mechanisms for quality control*:** Timeliness of data is likely to be better for this model than other options because data will be held at source, where it is managed. As a quality control mechanism for the federated model, the Member States will have to agree on minimal data quality requirements, allowing for a collaboration to harmonise data and improve data quality, but not to the extent where the level of data quality will be consistent between Member States. The expectations should be lowered in comparison to the other alternatives, as it is key to the federated model not to exclude any Member States, because of the aim of EU-wide coverage. It will be harder for the European Commission to assure the contributions of the Member States because of the federated approach. Next to the minimal requirements, the inclusion of a quality feedback mechanism should also be considered, allowing users to provide feedback and, after validation, gradually improve the quality of the data.

***Linking with other base registers*:** The federated model will be more difficult to link to other base registers at pan-European level, like the Business Register Interconnection System (BRIS), cadastral parcel registers, etc. because the data will not be completely harmonised. The resulting lack of common identifiers prevents the link from easily being integrated.

***Level of harmonisation*:** In the federated alternative, the data will remain with the public authorities in the different Member States and there will be no fully harmonised central EU database. The centralised team will only be in charge of developing and maintaining the one stop shop portal and will be responsible for the governance and relations with the Member States. Agreements on the level of harmonisation will have to be made between different Member States in order to combine the data from the different data sources.

***Licensing mechanism*:** The preference is to provide the EU Gazetteer common service under an open data licence. As national agencies are the only data source option for a federated model, it is most likely that compromises will have to be made. A possible option could be a hybrid licensing model, with the aim to provide the data as much as possible under an open licence, but at the same time allowing for the possibility of using data providers who cannot or will not provide their data under an open licence.

***Pricing mechanism*:** The aim should be to provide the EU Gazetteer common service free of charge. Not all Member States may be willing to open up all of their data for free. Based on common agreements, a possible solution could be to go for a freemium pricing model, either differentiating on the service or on the quality of the data. In the former, basic data and small volumes are provided for free and bigger volumes and additional services are commercialised. In the latter, basic quality data is made available free of charge and higher quality data or additional information is provided as a commercial product. Another option could be to make a distinction based on the intended use: NGO, public administrations, scholars, etc. could make use of the EU Gazetteer common service free-of-charge, whereas for commercial reuse, a cost-recovery pricing model could be applied.

6.4.2 Costs

For this alternative, the main costs will be linked to coordinating with national authorities:

- To determine and set up contribution agreements and minimal agreements on common quality control.
- To determine and set up service level agreements.
- To determine and set up a common licence framework.

After the set up phase, there will be costs linked to the monitoring of the adherence to these legal agreements, pricing and technical specifications.

Next to that, a one stop shop portal will need to be developed and maintained. The portal will provide further access to the different national gazetteers. The use cases proved that data quality will be a determining factor in the success of the EU Gazetteer common service. Additional initiatives might be needed to improve and harmonise data quality across Europe. To encourage this, EU funding might be necessary.

6.4.3 Benefits

One of the benefits of this alternative is that less investment will be needed compared to alternative 1 and 2, since there is a smaller central system to be setup and maintained. This alternative will to a certain extent also encourage standardisation because of the agreements that will be made.

6.4.4 Risks

Some national mapping agencies may not participate, or may not agree with the common legal framework, pricing rules, etc. At this point, the Commission should strike a balance between including as many countries as possible and having higher quality standards or more consistent licensing. It also has to be considered that some benefits may not be realised as the fee for using the EU Gazetteer common service may be above the willingness-to-pay.

Differences in service levels may exist for a longer period of time because of the federated model, where differences could be maintained.

As this alternative requires a common agreement to be reached simultaneously with all national partners, the risk exists that the preparation phase will take considerably longer compared to the other alternatives.

6.5 Comparison of alternatives

The different alternatives presented in the previous section are compared to highlight the advantages and disadvantages of each alternative. The comparison takes into account different scoping options, like data authoritativeness, mechanism for quality control, linking with other base registers, level of harmonisation, open licensing, pricing mechanisms. The comparison is summarised in Table 14: Summary of comparison of scope options for EU Gazetteer common service alternatives. Note that every item of this table is further detailed in the text below.

Table 14: Summary of comparison of scope options for EU Gazetteer common service alternatives

Scope option	1. Further developing existing pan-European data services	2. Outsource to a third party	3. Federated model
Data authoritativeness	✓✓	✓	✓✓✓
Mechanisms for quality control	✓✓	✓✓	✓✓
Linking with other base registers	✓✓	✓✓	✓
Level of harmonisation	✓✓✓	✓✓	✓
Open licensing	✓✓	✓✓✓	✓
Pricing mechanism – Free of charge	✓✓	✓✓✓	✓

Legend:✓Least preferred option
✓✓✓✓✓ Most preferred option

In addition, **Table 15** summarizes the comparison of costs, benefits and risks of the different alternatives while also taking into account the different content types that are being considered for an EU Gazetteer common service: geographical names (GN), administrative units (AU) and addresses (AD).

Table 15: Summary of comparison of costs, benefits and risks for EU Gazetteer common service alternatives

	1. Further developing existing pan-European data services			2. Outsource to a third party			3. Federated model		
	GN	AD	AU	GN	AD	AU	GN	AD	AU
Costs	✓✓✓✓	✓✓	✓✓✓	✓✓✓	✓	✓✓	✓✓✓✓✓	✓✓✓	✓✓✓✓
Benefits	✓✓✓✓	✓✓✓✓✓	✓✓✓✓	✓✓✓	✓✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓
Risks	✓✓✓	✓✓✓	✓✓✓✓	✓✓	✓✓	✓✓✓	✓	✓	✓✓

Legend:✓ Least preferred option
✓✓✓✓✓ Most preferred option

Data authoritativeness: The original data should ideally come from public sector authentic sources. It is evident that this will be the case when choosing to go for a federated model. In the other cases, it might not be possible to exclusively use authoritative sources. Therefore these options are indicated to be less preferred in terms

of data sources. As it will probably be harder for a third party to negotiate terms and conditions with national authorities, compared to the European Commission or EuroGeographics, this option is deemed to be the least preferred option. Nevertheless, the aim should be to use authoritative sources as much as possible.

Mechanisms for quality control: The data will come from different sources and different countries. This will result in different data quality between the different countries. In each case, minimal agreements on common quality control will be made, allowing for a collaboration to harmonise data and improve data quality. All alternatives should also foresee a quality feedback mechanism for users. The options of the federated model were rated as less optimal, as the European Commission will have less control over the contributions of the Member States because of the federated approach. Building on an existing service (alternative 1) would allow the European Commission to better control, and therefore elevate, the requirements in terms of quality control. If the EU Gazetteer common service were to be outsourced, the same elevated requirements should be well described in the call for tender and contract with the third party. One advantage of the federated model is that only the federated data store needs to be updated if there are any changes to the data. By contrast, in the centralised model both the federated master and the centralised copy will have to be updated. This may not be a simultaneous process but may involve scheduled transfers of data from the federated to the central data store.

Linking with other base registers: The EU Gazetteer common service could link to a number of base registers including: the Business Register Interconnection System (BRIS); the postal address and citizens and residents' address in population registers; registers of cadastral parcels and buildings. Implementing this link will be easier for the extending existing pan-European services and outsourcing alternatives, as they have full control over their centralised database. In the case of a federated model, it will be up to the individual Member States to link their data to the data of other base registers.

Level of harmonisation: The federation of gazetteers will provide the least harmonised alternative. The European Commission will have to make agreements with each Member State regarding harmonisation, but also on data quality, maintenance, etc. Both the alternative extending pan-European services as the outsourcing alternative give rise to a more harmonised, centralised EU Gazetteer common service, which will be easier in terms of maintenance, data quality, regulating oversight, etc. As the existing pan-European services already harmonised the data currently in the system, it will be easier to harmonise additional data in a similar manner.

Licensing: The licensing model strongly depends on the demands of the data providers and, when working with authoritative sources, on the national legislations in the member countries. The preference should be to provide the EU Gazetteer common service under an open licence as this will help minimise access restrictions. As this can be put in the requirements of the outsourcing contract as non-negotiable, this option will be most preferred in terms of licensing. In the federated model, there is no room for open source or private sector data sources apart from those provided by national authorities, which makes it more difficult to negotiate open licensing conditions when compared to the alternative of further developing existing pan-European services. Therefore the federated model is the least favourable of the three.

Pricing mechanism: The preference should be to provide the EU Gazetteer common service free of charge. This can be set as a non-negotiable requirement in the outsourcing contract, however, this might be utopian for the federated model and the alternative of further developing existing pan-European services. Not all national mapping agencies may be willing to open up all of their data for free. The option of the existing pan-European services is preferred over the federated model, as it would allow alternative free and open data sources, like OpenStreetMap.

Costs: In each case, costs of an EU Gazetteer common service based on address data are deemed to be higher than the geographical names or administrative units alternative,

as address data is more valuable to Member States, more difficult to harmonise in terms of data format and quality and will be a larger dataset to maintain. The costs for the geographical names alternative are deemed to be the lowest, as the data is already most readily available as open data.

Apart from that, the outsourcing alternative is deemed to be less preferred, as it will be more expensive. Everything will have to be paid by the European Commission, including the possible development costs of the software, which has already been developed for the GeoLocator/European Data Portal gazetteer and will be far less complex than the software needed for the federated model.

The federated model is the preferred option in terms of cost, as maintaining the infrastructure and data will remain with the participating Member States. Main costs for the European Commission will be the development and maintenance of the one stop shop portal and costs related to the governance of the federation (e.g. determining, setting up and maintaining contribution agreements and minimal agreements on data quality control).

Benefits: The benefits of an EU Gazetteer common service based on address data are deemed higher than the other alternatives, as address data is more valuable to end-users and developers, as shown by the multitude of use cases requiring address data. Geographical names are linked to point locations, which makes it sometimes difficult to combine different datasets. Administrative units are related to a certain geographical area, making it easier to combine datasets of administrative units or even geographical names. Geographical names covers more than just place names, increasing the number of possible use cases.

The benefits of the federated model are expected to be the lowest, as agreements will need to be made with all Member States, lowering the minimal requirements in order not to exclude any countries. This may result in sub-optimal data quality, which is not reliable enough for certain use cases, thereby limiting the benefits.

The outsourcing option is expected to bring more benefits, provided that the third party complies with the non-negotiable requirements regarding open data and providing a service free of charge.

The preferred option in terms of benefits will be the further development of the GeoLocator or European Data Portal gazetteer because it builds upon existing knowledge and experience, enhancing the sustainability of the service. Reusing an existing service is also in line with the Sharing and Reuse policy of the European Commission.

Risks: In general, acquiring the data from national public authorities may lead to disagreements as they will require a fair price, ultimately leading to non-participation. This risk is even higher for address data, due to its relative high value. A specific risk related to geographical names is the fact that it may lead to duplication of work because existing initiatives are available. This may also hamper the uptake of a geographical names based EU Gazetteer common service.

The federated model is considered to be the least preferred option, because of the risk that too many compromises will have to be made, resulting in a solution that is not fit for purpose. This risk is elevated even further by the lack of alternative data sources. The biggest risks for the outsourcing alternative are the high cost and the risk related to knowledge transfer, which impacts the long term sustainability of the EU Gazetteer common service. Therefore due to the several risks associated with this option, it is considered to be less preferable than alternative 1. The risks for the GeoLocator consist of the possible issues with regard to the funding of EuroGeographics and the potential compromise in terms of open licensing. The latter also holds for the European Data Portal.

7 Conclusions and recommendations

Digital gazetteers provide geographical information on a variety of entities and identify their geographical locations, linking them with their coordinates and type. They represent the basis for a number of services, including looking-up the location of administrative units, streets or getting additional information based on a given set of geographic coordinates. Because of their common usages, they represent common building blocks used in many location-based services in both the public and private sector.

This study analysed the feasibility for further EU action on establishing an EU wide Gazetteer common service. A combination of interview and desk research was performed to define possible scope options, reviewing both demand and supply aspects. As a result, several alternatives were identified and should be further explored by the European Commission.

From a content perspective, geographical names, administrative units and addresses were deemed to be the most suitable candidates for an EU Gazetteer common service.

While there are already a number of organisations that provide gazetteer data and services, such as the European Data Portal, EuroGeographics' GeoLocator and EULIS, nobody offers an authoritative, open EU-wide gazetteer as yet. There is enough anecdotal evidence that indicates substantial benefits derived from the setting up of such a service.

The case of address data is a prominent example in this regard. Address data represent the common key for many services including: postal and parcel delivery, tax purposes, emergency services, utilities, and justice and law enforcement purposes. Furthermore, the development of an EU Gazetteer common service for address data could be further supported by the shift towards open data. However, starting with an EU Gazetteer common service for address data might be challenging, given the differences that exist among the EU Member States from a policy perspective as well as in terms of business models. A full analysis of the situation regarding address data in the different Member States was not part of the scope of this study. It is recommended to perform this analysis if the idea of an address gazetteer will be pursued.

Geographical names and administrative units appear to be less challenging than addresses. The use cases covered by these content types are complementary to the use cases covered by address data. Next to this, it will be easier to combine authoritative data on geographical names or administrative units compared to address data, as this has already been done by EuroGeographics for EuroGeoNames and the EuroBoundaryMap respectively and by European Data Portal for geographical names. As the deadline of the INSPIRE implementation agenda comes closer, more Member States will have to provide INSPIRE-compliant data, simplifying consolidation of the different datasets. Depending on when the EU Gazetteer common service is foreseen to launch, it might be an interesting development to keep in mind.

Because of the existing alternatives, the added value of an EU Gazetteer common service, based solely on authoritative geographical names, could be relatively small. However, combined with administrative units or addresses, this could provide end users and developers with the possibility to link and combine data, based on all content types included. Geographical names could therefore be a good starting point for further actions.

From a service perspective, four main alternatives have been identified and further assessed:

- Alternative 0 – Do nothing
- Alternative 1 – Further developing existing pan-European data services
- Alternative 2 – Prepare a public procurement to outsource to a third party
- Alternative 3 – Federated model: establish common agreements with national authorities

Based on the analysis done in section 6, alternative 1 appears to be the most sustainable option. Further developing existing services will be less costly compared to the outsourcing option (alternative 2), but more costly than the federated model (alternative 3). However, the federated model brings disadvantages related to the quality of EU Gazetteer common service due to the fact that national authorities may not be willing to contribute or compromises will have to be made which negatively impacts the added value an EU Gazetteer common service could bring. It should however be noted that, at the moment of writing, not all Member States comply with the quality, formatting and completeness requirements of INSPIRE, as the implementation phase is still ongoing. This ongoing process should be taken into account. As Member States provide more INSPIRE compliant data the option of the federated model will become more interesting, although INSPIRE does allow for different licensing arrangements.

In summary, the European Commission could sponsor the specification and provision of an EU Gazetteer common service on geographical names, administrative units and/or address data. The service should be made available as a component based callable service that can be reused, as opposed to the embedded solutions that exist today. This service could provide the data as open data free at point of use or could be based on a freemium service. The former approach would support the most uses of the data. The latter approach would enable data and service suppliers to provide and charge for additional services and therefore the market disruption is minimised. Both options would, of course, require the necessary funding. Additional considerations should be made regarding the data quality mechanisms. Implementing a quality feedback loop will facilitate improving the data quality. This should include a validation step, to check the validity of the feedback provided.

8 Next steps

Next steps are highly dependent on the alternative selected by Member States and Commission stakeholders and which content type is selected.

A few of these decision points are:

- Will the EU Gazetteer common service be provided under an open licence or can it be a hybrid model?
- What content types should be covered by the EU Gazetteer common service (in a first phase)?
- Should the EU Gazetteer common service exclusively use authoritative data or can authoritative data be mixed with private sector or crowd sourced data, taking into account the possible impact on the licensing model and data quality?

Regarding the content type, if the decision is made to go for an EU Gazetteer common service based on geographical names or administrative units, the next step will be to develop a pilot project, providing the opportunity to involve data owners and providers of services. The pilot can be limited to a selected number of participating countries; however the long term goal should remain to develop an EU-wide Gazetteer common service.

If the decision is made to develop an EU Gazetteer common service based on address data, it is advisable to perform a deeper analysis on the supply side. This analysis should not be limited to traditional addresses, but it should also look at the opportunities of new ways of identifying addresses that are being created. For example, in Ireland, over 30% of address data was not unique. As of July 2015, a new postcode was introduced. Each address now has an 'Eircode'[20], which uniquely identifies the addressee's locality. Other examples are grid based systems such as What3Words[21], which uniquely identifies each zone of the grid by a unique combination of three words. Finally, additional factors should be assessed, such as heterogeneity of address data formats throughout the EU, data quality, coverage of the addresses (e.g. there might be islands where address are not used).

Before starting the work on an EU Gazetteer common service based on geographical names, the content that is being provided by the existing solutions such as EuroGeoNames or geonames.org should be analysed to substantiate the added value the EU Gazetteer common service based solely on geographical names could bring.

In addition to the content, a decision should be made on how the service should be provided. In the case of further developing the European Data Portal, the team that developed the gazetteer service should be brought together again to discuss the way forward. If the option of further developing the European Data Portal gazetteer is not going to be pursued, it should offer something better and there should be a commitment from DG Connect to use it 'down the line', 'once proven' in the European Data Portal. In the case of further developing the GeoLocator service, the European Commission should start negotiations with EuroGeographics as they will be the service provider for at least the next 2 years. If the alternative selected is to go for the outsourcing of the EU Gazetteer common service, a tender procedure should be launched to select a third party provider. Finally, if the preferred choice is to go for a federated model, it will require the European Commission (and Member States) to put together a team in charge of the governance and monitoring of the service, the development of a one stop shop portal and the negotiations with different Member States. In any case, the developers should aim to provide the EU Gazetteer common service as a callable, component based solution, as opposed to current embedded solutions. Furthermore, the following next step should be taken into consideration regardless of the chosen alternative.

[20] http://www.eircode.ie/benefits/overview
[21] http://what3words.com/

- The business case should be further elaborated to select a concrete business model under which the EU Gazetteer common service could operate. As a best practice the Business Model Canvas can be used as a guideline. As part of this business model, a licensing model will have to be chosen.
- Next, a set of functional requirements should be developed in light of which it is possible to assess the implementation of the chosen solution.

Another suggestion is to develop a model to calculate the expected and actual benefits of the implementation of the EU Gazetteer common service, as the Danish Address Programme did for their open address data.[22] To go beyond the work done already, this model would have to receive inputs from and validation by all participating Member States.

[22] Source: http://danmarksadresser.dk/file/389579/Value_Assessment_Danish_Address_Data_UK_2010-07-07.pdf

References

[CE13] Copenhagen Economics. E-Commerce and delivery. A study of the state of play of EU parcel markets with particular emphasis on e-commerce. http://ec.europa.eu/internal_market/post/doc/studies/20130715_ce_e-commerce-and-delivery-final-report_en.pdf

[EC12] Study on "eGovernment and the Reduction of Administrative Burden" (SMART 2012-0061), European Commission, (2012), http://ec.europa.eu/digital-agenda/en/egovernment-studies

[EC15] Commission Staff working document, accompanying the document "Report from the Commission to the European Parliament and the Council on the application of the Postal Services Directive (Directive 97/67/EC as amended by Directive 2002/39/EC and Directive 2008/6/EC)" http://eur-lex.europa.eu/legal-content/EN/TXT/?&uri=SWD:2015:207:FIN

[EC16] Contributions and preliminary trends of the public consultation on the eGovernment Action Plan 2016-2020, European Commission, (2016), https://ec.europa.eu/digital-agenda/en/news/contributions-and-preliminary-trends-public-consultation-egovernment-action-plan-2016-2020

[EC17] A Digital Single Market Strategy for Europe, European Commission, (2015), https://ec.europa.eu/digital-single-market/en/news/digital-single-market-strategy-europe-com2015-192-final

[EIF] European Commission, ISA Programme, "European Interoperability Framework (EIF) for European public services," 2010. [Online]. Available: http://ec.europa.eu/isa/documents/isa_annex_ii_eif_en.pdf .

[ELF] European Location Framework, "D2.5 ELF Service Specification for GeoLocator," 2014. [Online]. Available: http://www.elfproject.eu/sites/default/files/D2.5%20Service%20specification%20for%20Geolocator.pdf.

[ISO19112] Geographic information -- Spatial referencing by geographic identifiers. http://www.iso.org/iso/catalogue_detail.htm?csnumber=26017

[OGC] Open Geospatial Consortium, "Gazetteer Service Application Profile of the Web Feature Service Best Practice - version 1.0," 2012. [Online]. Available: https://portal.opengeospatial.org/files/?artifact_id=46964 .

[SDI4APPS] PILOT 2: Open Smart Tourist Data. http://sdi4apps.eu/project-information/pilot-applications/pilot-2-open-smart-tourist-data/

[GLOS] INSPIRE glossary [Online] Available http://inspire.ec.europa.eu/glossary

[INSPIRE] Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE) (INSPIRE Directive) http://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32007L0002

List of abbreviations and definitions

BASE REGISTER	A base register, also called an authentic source, is a trusted source of information under the control of an appointed public administration or organisation appointed by government. Base registers contain master data on entities such as persons, companies, vehicles, licences, buildings, locations or roads.
GAZETTEER	Directory of instances of a class or classes of features containing some information regarding position [ISO19112], [GLOS].
GEOGRAPHICAL NAME	Names of areas, regions, localities, cities, suburbs, towns or settlements, or any geographical or topographical feature of public or historical interest. [INSPIRE]
ENDONYM	The indigenous name of a geographical feature in the language spoken at the location of the geographical feature.
EXONYM	The name of a geographical feature in a foreign language.
VERNACULAR NAME	The name of a geographical feature in ordinary, non-official language.
EDGE MATCHING	When side-by-side maps are displayed, they might not line up well with each other. Edge matching adjusts the location of features that extend across one map's boundaries to make them line up when maps are put together.[23]

[23] Source: http://giscommons.org/earth-and-map-preprocessing/

List of boxes

Box 1. Existing applications.....14
Box 2. Existing applications.....15
Box 3. Existing applications.....15
Box 4. Existing applications.....16
Box 5. Existing applications.....16
Box 6. Existing applications.....17
Box 7. Existing applications.....17
Box 8. Existing applications.....18
Box 9. Existing applications.....19
Box 10. Existing applications.....20
Box 11. Existing applications.....20
Box 12. Existing applications.....21
Box 13. Existing applications.....22
Box 14. Existing applications.....22
Box 15. Existing applications.....22
Box 16. Existing applications.....23
Box 17. Existing applications.....23

List of figures

Figure 1: Interconnection of base registers 5

Figure 2: Generic use cases of a gazetteer ..... **Error! Bookmark not defined.**

Figure 3: Status of ELF GeoLocator arrangements of national web services of Geographical Names (in colours), Addresses and Administrative Units.....33

List of tables

Figure 1: Interconnection of base registers 5

Figure 2: Generic use cases of a gazetteer 8

Table 1: Overview of specific use cases 10

Table 2: Business Model Canvas for the Open Address data service, run by the Danish Agency of Data Supply and Efficiency 28

Table 3: Business Model Canvas for Bpost, national Belgian postal operator 30

Figure 3: Status of ELF GeoLocator arrangements of national web services of Geographical Names (in colours), Addresses and Administrative Units. 33

Table 4: Business Model Canvas for EuroGeographics 34

Table 5: Business Model Canvas for the European Data Portal 36

Table 6: Business Model Canvas for EULIS 38

Table 7: Business Model Canvas for HERE 40

Table 8: Business Model Canvas for OpenStreetMap 42

Table 9: Analysis of possible content types for an EU Gazetteer common service 44

Table 10: Analysis of possible data sources for an EU Gazetteer common service 46

Table 11: Summary of requirements and next steps for alternative 1 50

Table 12: Summary of requirements and next steps for alternative 2 55

Table 13: Summary of requirements and next steps for alternative 3 59

Table 14: Summary of comparison of scope options for EU Gazetteer common service alternatives 62

Table 15: Summary of comparison of costs, benefits and risks for EU Gazetteer common service alternatives 62

Table 16: list of interview candidates 75

Table 17: Questionnaire - template 76

Table 18: Meeting minutes of the interview with the ELF project 77

Table 19: Meeting minutes of the interview with the German Federal Agency for Cartography and Geodesy (BKG) 79

Table 20: Meeting minutes of the follow-up interview with the ELF project 81

Table 21: Meeting minutes of the interview with DG GROW 82

Table 22: Meeting minutes of the interview with ESRI 84

Table 23: Meeting minutes of the interview with EuroStat and the Publications Office 86

Table 24: Meeting minutes of the interview with the Danish Address Programme 88

Table 25: Meeting minutes of the follow-up interview with EuroGeographics 91

Table 26: Meeting minutes of the interview with HERE 93

Table 27: Meeting minutes of the interview with the European Data Portal 96

Table 28: Analysis of existing gazetteers 99

Table 29: Analysis of existing applications 107

Table 30: Heterogeneity of datasets on the INSPIRE geoportal 112

Annexes

Annex 1. Stakeholder Interviews

Selection of interview candidates and interview guide

Table 16: list of interview candidates

Country	Organisation – interviewee
DE	**Federal Agency for Cartography and Geodesy (BKG)** **Bundesamt für Kartographie und Geodäsie (BKG)** Andreas Illert Daniela Hogrebe
DK	**Danish Address Programme** Morten Lind
EU	**European Data Portal** Marc Kleemann - con terra Dennis Wilhelm - con terra Daniele Rizzi – DG CNECT Wendy Carrara - Capgemini
EU	**European Location Framework (ELF)** Antii Jakobsson – Finnish Geospatial Research Institute FGI Saulius Urbanas – EuroGeographics Olaf Magnus Østensen – Statens Kartverk, Norway Pekka Latvala – Finnish Geodetic Institute
EU	**EuroStat (NUTS, LAU, COGI)** Hannes Reuter
EU	**Publications Office of the EU** Willem Van Gemert
EU	**DG GROW** Sofia Margariti – DG GROW
INT	**ESRI Gazetteer** Günther Pichler Roberto Lucchi
NL	**HERE** Bram De Bot Caroline Hancock Martijn Van De Runstraat

Table 17 contains a general template for the interview questions. Not all questions were relevant for each interview. Interviewer and interviewee determined together the most relevant points to discuss.

Table 17: Questionnaire - template

Interviewee:

Interviewer:

Date:

Context of the study:

The 'feasibility study for an EU Gazetteer common service' is conducted in the context of the European Union Location Framework (EULF) Action of the ISA Programme of the European Commission. The study aims at identifying the scope options and assessing the business case for an EU Gazetteer common service. The purpose of the interview is to analyse the possible need for a common EU Gazetteer common service (demand side analysis) and the characteristics of currently existing gazetteers (supply side analysis).

Demand side analysis: What are the specific needs that an EU Gazetteer common service could address?

1. **Specific use cases**: The *generic* use cases for a gazetteer service are geocoding and reverse geocoding. What are the specific application domains and use cases? The table below depicts a set of possible use cases. Are these use cases valid in your opinion?
2. **Required data quality**: What are the specific needs for these specific use cases in terms of data quality?
3. **Willingness to pay**: Should the use of the EU Gazetteer common service be free-of-charge? What would be the willingness-to-pay for the identified categories of users?
4. **...**

Supply side analysis: What is already existing and where is there need for additional EU action?

- **Data providers**: Which gazetteer data do you offer? How does it compare to existing services like Geonames.org, OpenStreetMap.org Nominatim or Google Maps?
- **Intellectual property**: What are the licensing and pricing conditions for your data?
- **Data quality**: The datasets may be available with different quality levels. Is it feasible to aggregate these datasets and make them uniformly available?
- **Level playing field**: There may already be commercial datasets offering EU-wide Gazetteer data. How can we ensure that interventions from the public sector do not have a distorting effect on the market?
- …

Scope options: Which shape should a common, EU-wide Gazetteer common service take?

- Which specific use cases should an EU Gazetteer common service address?
- What should be the level of centralisation?
    - E.g. a loose 'federation' of gazetteers each responsible for provisioning its own gazetteer data as a service.
    - E.g. an integrated data source of gazetteer data and a single point of access to use this data.
- What should be the content of the EU Gazetteer common service? E.g. geographical names, administrative units, address data, etc.?
- What should be the licensing and pricing options for the EU Gazetteer common service? E.g. an open licence and free-of-charge?
- Should there be any quality control mechanisms applied? Which ones?
- …

Interview with the ELF project on GeoLocator

Table 18: Meeting minutes of the interview with the ELF project

Interviewee(s):
Antii Jakobsson – Finnish Geospatial Research Institute FGI
Saulius Urbanas – EuroGeographics
Olaf Magnus Østensen – Statens Kartverk, Norway
Pekka Latvala – Finnish Geodetic Institute

Interviewer:
Ray Boguslawski – Joint Research Centre
Stijn Goedertier – PwC EU Services

Date: 12 February 2016

1. Context of the study

The 'feasibility study for an EU Gazetteer common service' is conducted in the context of the European Union Location Framework (EULF) Action of the ISA Programme of the European Commission. The study aims at identifying the scope options and making a business case for an EU Gazetteer common service. The purpose of the interview is to analyse the possible demand for an EU Gazetteer common service (demand side analysis) and the characteristics of currently existing gazetteers (supply side analysis). The study is to provide an input to the European Commission to help identify whether and where further action may be needed and desirable.

2. ELF GeoLocator

The GeoLocator service has been set up in the context of the European Location Framework (ELF) project, which runs in the period March 2013 - October 2016.
Antii Jakobsson Presented the GeoLocator using the ELF demo Web application [2]. The GeoLocator service supports the following **use cases**:

- **geocoding**: searching for a place name, administrative unit, or address. The service returns a geometry that can be placed on a map. This comes in three flavours: ordinary geocoding, administrative unit-limited geocoding, fuzzy name search-based geocoding. The search is **multilingual**. The GeoLocator service provides only a **point geometry** of the features in the gazetteer, with the exception of administrative units for which it provides a geometry of the administrative boundary.
- **reverse geocoding**: on the input of a point geometry (i.e. a location on the map), the service returns the nearest administrative unit, place name, or address. This comes in two flavours: ordinary reverse geocoding and administrative unit-limited reverse geocoding.

Pekka Latvala presented the technical features of the **GeoLocator service** also described in ELF Deliverable 2.5 [1]. The GeoLocator service is implemented using open-source software (PostgreSQL/PostGIS, GeoServer, Deegree WFS, MapServer, etc.). Its source code is expected to be made available as open-source software. The GeoLocator service supports various standards and application profiles such as WFS-G AP, INSPIRE/ELF Geographical Names data specifications, Core Location Vocabulary, JSON, KML, etc.

[1] http://elfproject.eu/documentation/specification/geolocator/1.0
[2] http://demo.locationframework.eu/

The GeoLocator service currently contains **data** on INSPIRE/ELF administrative units (Finland), geographical names (DK, PO, UK, NO, SE), and addresses (CZ, DK, PO, ES) spatial data themes. Additional datasets are likely to be added in the coming months. Additionally, the GeoLocator service has data that was part of the EuroGeoNames (EGN) for various countries (AT, BE, CY, CZ, HR, EE, FI, FR, DE, GR, IT, LV, LT, SI, ES, CH, UK) and the exonyms database.

Data providers sign a **data provider agreement**, allowing the data to be used in the context of the EULF project *for evaluation purposes only*. The data providers have to provide the data in a format that conforms to the **ELF/INSPIRE data specifications**. The ELF project does not apply any **data transformation** on the provisioned data, other than a transformation of coordinate reference system into ETSR89. Data providers must provide a dataset as a single file; the combination of regional data (e.g. Belgium) should be done by the data provider. Upon data import, there is a **quality check**, whereby the imported place names are compared with the EGN exonyms database and discrepancies are reported back to the data providers. Data providers should indicate in the metadata of their datasets what the data quality is. The data provisioning process requires manual intervention to propagate data updates.

3. Supply side analysis

After the end of the ELF Project (October 2016), the project participants will keep the GeoLocator Service running for another two years. The ELF Project is currently investigating the options for sustaining the data provisioning and maintenance and further evolution of GeoLocator service. The ELF project is currently assessing the costs of make the service available, together with possible funding models. One option is to guarantee continuity of service under the EuroGeographics membership organisation; EuroGeographics members have already agreed to initially fund the GeoLocator service. This is an important factor in considering the feasibility of further EU action.

The work on the GeoLocator service has the following potential for (re)use:

- **Reuse of the GeoLocator software**: the software of the GeoLocator service could be made available as open-source software. The ELF project expects to make its source code available as open-source software.
- **Reuse of the GeoLocator data:** the aggregated dataset behind the GeoLocator service could be made available for reuse to third parties. This would require different licence agreements with the data providers – although some data providers already make the data available under an open licence. Within the ELF project, there are no plans for attaining this.
- **Use of the GeoLocator Data-as-a-Service (DaaS):** the ELF project currently provides this service and is investigating the necessary steps to sustain it.

4. Demand side analysis

An objective of the ELF project was to make INSPIRE data relevant and used. Various partners in ELF like Europa Technologies (UK) are creating services where data from ELF could be utilised. For example, DG Justice is now considering the use of ELF for looking up property information. As the GeoLocator service is currently made available for evaluation purposes only, there are currently no users of the service who use it for applications other than test purposes.

One of the main benefits of an EU Gazetteer common service like GeoLocator could be an increased consistency in the use of location information between EU services and national public services. Unfortunately, there was no time to discuss in which contexts the GeoLocator service is anticipated to be used in the future, such as:

- Emergency services;
- Law enforcement;
- Transport;
- Environmental licensing;
- Postal services (private sector);
- Property tax / cadastre; or
- Utilities (private sector)

4. Next steps

It was agreed to keep Saulius Urbanas as a key contact point, as he is responsible for ELF Work Package 6: User and 3rd party data content for ELF.

Interview with the German Federal Agency for Cartography and Geodesy (BKG)

Table 19: Meeting minutes of the interview with the German Federal Agency for Cartography and Geodesy (BKG)

Interviewee(s): Andreas Illert - Bundesamt für Kartographie und Geodäsie (BKG) Daniela Hogrebe - Bundesamt für Kartographie und Geodäsie (BKG)
Interviewer: Inge Gielis – PwC EU Services Stijn Goedertier – PwC EU Services
Date: Wednesday, 23 March 2016
1. Context of the study The 'feasibility study for an EU Gazetteer common service' is conducted in the context of the European Union Location Framework (EULF) Action of the ISA Programme of the European Commission. The study aims at identifying the scope options and making a business case for an EU Gazetteer common service. The purpose of the interview is to analyse the possible demand for an EU Gazetteer common service (demand side analysis) and the characteristics of currently existing gazetteers (supply side analysis). The study is to provide an input to the European Commission to help identify whether and where further action may be needed and desirable.
2. Demand side analysis: Use cases: 1. **Geo-referencing of statistical data**: To produce the CENSUS data, the statistical offices[24] in Germany capture information on individual persons and households, who are identified by postal addresses. Aggregation at the administrative unit level would be too coarse-grained. It would be better to have the data aggregated to a geographical grid. To do this, the postal addresses would have to be geocoded. It would be useful if this mapping would be available as open data, but at the moment, this kind of mapping is the property of the German federal states. 2. Data catalogues 3. **INSPIRE Geoportal:** The INSPIRE geoportal could be extended with the ability to show geographical names on a map. 4. **News portal**: All geographical names that are mentioned in a news article or report would be linked to the corresponding geographical location. 5. **Real-estate portal**: This portal would allow customers to look up real estate information, based on a location name in the user's language. 6. **Address database for parcel delivery**: The applicability will depend on the data quality. In Germany, the dataset would be build up from the datasets of the different States, but the data may not be complete, as the official database is derived from the cadastre. About 5% of the buildings are missing, because these buildings may not have any residents, or there is no requirement to register them in the cadastre. By combining the cadastre with the dataset from the postal operator, the completeness of the data could be improved. If there is a need for authoritative data, this would require a complex system. The situation will be different from country to country and harmonisation will be necessary. The relevance of use cases is highly linked to whether the EU Gazetteer common service will be multi-lingual or not.
3. Supply side analysis: WFS Geographische Namen INSPIRE Since the end of December 2015, the German Federal Agency for Cartography and Geodesy (BKG) has provided an open and INSPIRE compliant download service for geographical names. The usage restrictions on the data are included in the legislation "Nutzungsbedingungen: Verordnung zur Festlegung der Nutzungsbestimmungen für die Bereitstellung von Geodaten des Bundes (GeoNutzV) vom 19. März 2013 (Bundesgesetzblatt Jahrgang 2013 Teil I Nr. 14), URL: http://www.geodatenzentrum.de/docpdf/geonutzv.pdf". http://sg.geodatenzentrum.de/wfs_geonames?request=GetCapabilities&service=WFS

[24]https://www.zensus2011.de/SharedDocs/Pressreleases/2012/PR45_2011_Census_survey_to_clarify_discrepancies_starting_now.html?nn=3068828

The gazetteer dataset contains point geometries. However, the dataset behind, which is not freely available, contains more complex geometries, the flow of rivers, ...
Customers of the European dataset can also look up the matching NUTS / LAU codes.

Germany is a federal country. Official surveying and mapping is a task of the federal state.
BKG is federating and harmonising the data (role of data broker). BKG is also doing a lot of coordination activities. Among others, BKG is coordinating its work with the work that happens at EU level.
Most of the BKG data is topographic data (maps), digital data and address data.

BKG already provides some data sets under an open data licence. The usual level of detail of the maps is limited to 1:150.000. More detailed maps would require street names, but these databases are not freely available in Germany.
Some federal data is open by law, but other types of data from the federal states is still a paid service. This is something that will not easily change, as federal states still receive a significant income via this service.

You can compare this strategy with private sector initiatives such as Geonames.org, which has a commercial-use restriction. With the paid version, users get access to more metadata and context. OpenStreetMap is a crowd-sourced dataset which is not 100% error-free, as it is not validated nor standardised.

4. Scope options

EuroGeoNames was working on a gazetteer, which would be partially free-of charge and partially offered as a paid service (complex geometries, links). There was a business plan and business model for this, but it was not approved by EuroGeographics, because some countries did not agree to offer it partially free of charge.

It is important not to compete with the EuroGeoNames project. If the EULF project would result in a second EU Gazetteer common service, it should use the same data pool as the EuroGeoNames gazetteer. This data pool should be a federated system, as it will be impossible to keep the data up to date without national organisations being involved.

5. Data Quality

To add value for the user, an EU Gazetteer common service will need to provide high quality data. The higher the quality, the higher the possibility that customers will be willing to pay for this service.
Quality can be measured in different ways:

- Completeness. For instance, the database of the German postal service will be more complete than the cadastre data, but it will contain more errors than the cadastre data.
- Error rate
- Consistency with standards. This is a measure that can easily be validated using automated tools.
- Accurate geometry. This measure cannot be checked using automated tools, and a manual quality control would be very labour intensive.
- Fitness for use. As there is no general definition, it has to be reviewed case by case.

Follow up interview with the ELF project

Table 20: Meeting minutes of the follow-up interview with the ELF project

Interviewee(s): Saulius Urbanas – EuroGeographics
Interviewer: Ray Boguslawski – Joint Research Centre Inge Gielis – PwC EU Services Stijn Goedertier – PwC EU Services
Date: 19 March 2016
Summary: The conclusion of this interview was that both studies (ELF and EULF) can be conducted in parallel but that continued collaboration is desirable. For the EULF study, the ELF/EuroGeoGraphics GeoLocator is a plausible supply side partner for an EU Gazetteer common service. PwC may also explore other options on the supply side. For the demand side, Saulius mentioned some interesting use cases (emergency services with ITHACA, and risk assessment for the insurance industry with Europa Technologies' Risk Insight and Land planning). PwC is currently scheduling interviews with DG JUSTICE and DG GROW on potential use cases for the EU Gazetteer common service and will inform SU of the outcome of the interviews to avoid double work. The ELF study on the GeoLocator will be concluded by October 2016. The EU Gazetteer common service feasibility study will be concluded by July 2016.
Next steps: • PwC/JRC agreed to send a preliminary version of the report to EuroGeoGraphics by the end of this week (1st of April) • ELF / EuroGeoGraphics agreed to get in touch with PwC/JRC during the 2nd week of April on what information of the ELF project can be shared and when this can be shared.

Interview with DG GROW on postal services

Table 21: Meeting minutes of the interview with DG GROW

Interviewee: Sofia Margariti – DG GROW
Interviewer: Ray Boguslawski – Joint Research Centre Inge Gielis – PwC EU Services Stijn Goedertier – PwC EU Services
Date: 05 April 2016
Feasibility study for an EU Gazetteer common service PwC is conducting a study in the context of the European Union Location Framework (EULF), an action of the European Commission's Interoperability Solutions for European Public Administrations (ISA) Programme. The study aims at making a business case for an EU-wide, Gazetteer common service. The study will be an input to the European Commission to help identify whether and where further action may be needed and desirable.
Would it be interesting to create an EU address Gazetteer in the context of strengthening the postal service market? Sofia Margariti stated that DG GROW would probably welcome an EU initiative on the creation of an EU Gazetteer common service on address data. Such an address database could contribute to making (cross-border) postal services market more competitive. Article 11a of the third Postal Services Directive 2008/6/EC states that "Member States shall ensure that transparent, non-discriminatory access conditions are available to elements of postal infrastructure or services provided within the scope of the universal service, such as postcode system, address database, […]". Setting up an EU Gazetteer common service with address data from the public sector (so not the privatised postal operators) may contribute to this. In this way, an EU Gazetteer common service on address data may also support the objectives of the Digital Single Market Strategy on cross-border parcel delivery. Sofia Margariti stated that DG GROW would probably see the obvious advantages for all users (retailers, consumers, postal providers) in the cross border parcel delivery context in particular. However, she pointed out the need to consider that to date the provision of address data is a business for a number of service providers, so it is necessary to address this adverse effect in any proposal that is put forward.
Address Standardisation initiatives (incl. INSPIRE data specifications on addresses) Sofia Margariti pointed out that in reality, not all address databases are structured in the same way. Until recently, Ireland had no postal code system. Certain islands in Greece do not have addresses. There are not postal codes nor street categorisation. In the context of the INSPIRE Directive, the Commission has created – in collaboration with the Member States – the ISNPIRE Data Specifications on Addresses. http://inspire.ec.europa.eu/index.cfm/pageid/2 The INSPIRE Directive requires, for example, that by 23 November 2017 relevant datasets corresponding to the Annex I spatial data themes have to conform to the implementing rules on interoperability of spatial datasets and services. This makes that important *public sector* datasets containing information on among others addresses will become available in harmonised data formats. This by itself may not be sufficient. There may be need for additional EU action to create an EU-wide EU Gazetteer common service on address data harmonising data quality, conditions for use (licences), pricing, etc.
How would an EU Gazetteer common service on addresses be used in the context of postal services? There seem to be at least two valid use cases: • **Address verification**: Postal services do not always know the address structure in the delivery-country. Expeditors (e.g. online retailers) but also postal operators could use the address data in the EU Gazetteer common service to verify the address data of consignments, which would reduce mistakes in delivery. Without verification, the correctness of the delivery address is usually only known at the moment the parcel is being delivered, the time and costs related to any error at this point are much higher than

when the address would be cross checked by the sending postal service.The failure of delivery usually implies additional costs for the sending postal service, but of course, this all depends on the contract between the postal services. High-quality address data could therefore reduce the costs of (cross-border) postal services. Postal services work with various logistic partners for cross-border parcel delivery. Basedon the parcel, the postal service like Royal mail could use different channels and uses different providers in different countries.

- **Optimising the delivery route**: Knowing the exact geolocation if the point of delivery linked to an address allows postal service operators to optimise delivery routes. This is particularly useful in the case of large apartment buildings or companies with mail rooms, where the delivery time can greatly vary depending on the actual location of the point of delivery. Depending on the arrangements, the delivery point can be a mailbox, a corporate mailroom, a post office box, a kiosk, a parcel depot, etc. To overcome the problem of losing to much time locating the exact delivery point, many postal operators. In the traditional chain of delivery, the delivery point is either a home or a business premises. In this case, it would be useful to know the exact location.

Further information on cross-border parcel delivery and market organisation can be found via the following link:
http://ec.europa.eu/growth/sectors/postal-services/studies/index_en.htm

Availability

The National Regulatory Authorities are responsible for regulating the postal market in their country. They will be able to tell you if an address database is available and if it is available free of charge.

The Universal Postal Union (UPU) has already built and address database, but it is not freely accessible for everyone. Only the national postal providers in the UN member countries have access.
http://www.upu.int/en/resources/postcodes/universal-postcoder-database.html
If such an address data base would be available free of charge, this would have an added value to the cross border parcel delivery.

Interview with ESRI on the ESRI World Geocoding Service

Table 22: Meeting minutes of the interview with ESRI

Interviewee(s): Guenther Pichler – ESRI Roberto Lucchi – ESRI
Interviewer: Ray Boguslawski – Joint Research Centre Inge Gielis – PwC EU Services Stijn Goedertier – PwC EU Services
Date: 05 April 2016
Short introduction to the ESRI Geocoding Service
The ESRI Geocoding Service consists of 2 elements: • The service and the client application, which are available to the users • The content The coupling between the two takes place in coupling instances in ESRI. The ESRI Geocoding Service is a tool to geolocate objects. These objects can be physical addresses, points of interests, … It can be a point (like in the case of an address) or a polygon (like the outline of a country, the area of a building, …) They try to provide as many client experiences as there are different personas that they are aware of: Geocoding zip codes, latitude-longitude, … On ideas.esri.com, it is possible to find ideas for use cases from ESRI users. Users can use this site to express their needs and ESRI uses this site as their main input for further developing the platform. • Geosearch • Reverse geocoding • Batch geocoding • … ESRI is a technology provider. They offer a set of APIs and tools to their users to give them the opportunity to build their own system. There are plenty of use cases ESRI are barely aware of, because it is implemented to work directly with the information the user has at hand. On https://developers.arcgis.com/rest/geocode/api-reference/geocode-coverage.htm, it is possible to see the quality of the geocoding service on a country level. Per country, there is a tabular view of the sources that are being used to build the service. ESRI has a journal (ARCnews) where they tell the stories of different users in different countries. The data sources are a mix of authoritative sources and private data initiatives like HERE and geonames. The sources differ from country to country. There is also ESRI's community maps programme, where they provide users with a standardised form to fill in. All sources are aggregated to get the best quality possible. The quality of service depends on the use case. Improvements in accuracy can always be of service. ESRI charges users of its World Geocoding Service on a pay-per-use basis. The first 1M hits are free-of-charge.
Which measures should be taken to ensure a level playing field and avoid market disturbance? The EU Gazetteer common service would give ESRI the opportunity to get access to new datasets. Even if the service would not be (entirely) free, it would be the first time ESRI would get access to the data. The open data initiative is helping to gain access to data sources, but not all data sources are open yet. ESRI would not object to the EU funding the EU Gazetteer common service to help them aggregating the data, as long as ESRI could also get access to the data. The biggest cost for ESRI is in the gathering of data, so a high quality EU Gazetteer common service would be an advantage for ESRI as well. The EU Gazetteer common service may become a big competitor for ESRI's other data suppliers like HERE. It might be interesting to get in touch with HERE to learn their opinion. The EU Gazetteer common service should refrain from any exclusivity arrangements. ESRI is a commercial company, and tries to offer the best assets for their users. The more competition, the better. If other providers would compete on quality and price, it is only in the benefit of the consumers. The quality mentioned above goes hand in hand with the use cases. Certain use cases can only be

enabled after a certain level of accuracy is reached. These are still some pain points for ESRI: there are some nice use cases out there, but with the data they can provide at the moment, the issue is not fully addressed.

ESRI community maps: the copyrights stay with data owner, but the tiled maps are property everyone: http://doc.arcgis.com/en/living-atlas/contribute/contribute-to-the-living-atlas.htm

See also:

http://opendata.arcgis.com/

http://esri.com/opendata

Interview with EuroStat and Publications Office on NUTS/LAU and ATU

Table 23: Meeting minutes of the interview with EuroStat and the Publications Office

Interviewee(s):
Hannes Reuter – EuroStat
Willem Van Gemert – Publications Office

Interviewer:
Ray Boguslawski – Joint Research Centre
Inge Gielis – PwC EU Services
Stijn Goedertier – PwC EU Services
Francesco Pignatelli – Joint Research Centre

Date: 12 April 2016

Feasibility study for an EU Gazetteer common service
PwC is conducting a study in the context of the European Union Location Framework (EULF), an action of the European Commission's Interoperability Solutions for European Public Administrations (ISA) Programme. The study aims at making a business case for an EU-wide, Gazetteer common service. The study will be an input to the European Commission to help identify whether and where further action may be needed and desirable

Geographic Information System of the Commission (GISCO)

Hannes Reuter explained that within Eurostat, GISCO is responsible for meeting the European Commission's geographical information needs. GISCO manages a **database** of geographical information, and provides related services to the Commission.

Commission inter-service group on Geographical Information (COGI)
Hannes Reuter explained that GISCO also coordinates Commission-wide geographical information activities, in the context of the Commission inter-service group on Geographical Information (COGI). The COGI group helps to coordinate spatial data on a corporate (European Commission) level.

NUTS boundaries
Hannes Reuter explained that GISCO, in cooperation with the National Statistical Institutes (NSI) and National Mapping and Cadastral Authorities (NMCA), produces the NUTS boundaries dataset, which can be downloaded free of charge, subject to requirements such as commercial-use restrictions and giving attribution:
http://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/administrative-units-statistical-units/nuts
The source dataset for the NUTS boundaries is currently the EuroBoundariesMap of EuroGeographics, for which EuroStat has a specific licence agreement. It may be a possibility to base the NUTS boundaries dataset on the EuroGlobalMap data product of EuroGeographics, which is available under an open data licence (but only available in an (older) ESRI Personal Geodatabase format). The latter however, does not contain the local administrative units, but is limited to the NUTS terrestrial units.
The NUTS are statistical terrestrial units, not administrative units. For example, in Scotland NUTS regions crosscut different regional administrative units. A NUTS region will not cross-cut an administrative unit at the lowest level.

Administrative Territory Units (ATU) Named Authority Lists (NALs)
Willem Van Gemert gave an overview of the work of the Publications Office on the Administrative Territory Units (ATU) Named Authority Lists (NALs). The NALs consist of core reference data for the Publications Office initially to be used in all its production systems, the scope of the NALs is now extended for use by all EC services.
The correspondence between NUTS and NAL ATU can be made via the (boundaries) of the Local Administrative Units (LAU codes).
The Publications Office is less interested in providing the boundary geometries, but considers that a collaboration with EuroStat GISCO could be fruitful in this area.

Persistent Identifiers for the NALs
The Publications Office operates a corporate Persistent URI redirection service on the data.europa.eu domain. The Publications Office will investigate together with EuroStat whether it is feasible / desirable to have persistent URIs for the NUTS codes created via the Persistent URI redirection service.

Gazetteer of the European Data Portal

The European Data Portal also has a gazetteer, containing city names and administrative units. The gazetteer has been created by Conterra, a member of the European data portal consortium. The data of the gazetteer is a combination of data from national mapping authorities and Geonames.org (see this issue for an overview of the data sources: https://ies-svn.jrc.ec.europa.eu/issues/2385). The software of this gazetteer service is based on Safe FME and Conterrra smart.finder software. (see https://gitlab.com/european-data-portal/Gazetteer).

Use case for an EU Gazetteer common service: statistical analysis

Hannes Reuter explained that although the NUTS codes will remain the most important reference data for statistical analysis, the statistical offices in Europe would benefit from high-resolution geocoding services, which would also include addresses data, street names, etc. For EuroStat and other EC entities, such a gazetteer would need to be available in house. Using an ELF service would not be possible without sufficient service level guarantees (including availability and long-term persistence) needed for statistical work. Statistical users in the Member States would also have similar requirements.

Hannes Reuter also explained that EuroStat is following up on several research and innovation grant projects over the period 2014-2017 involving address databases and statistical analysis. He confirmed that there is high demand for such data. For example, in the domain of business statistics, statisticians would love to have the possibility to geocode trans-boundary business statistics, but currently still have insufficient access to EU-wide address data.

Use case for an EU Gazetteer common service: Europa websites (like eJustice Portal)

Another use case could be the use of the EU Gazetteer common service by other commission services, such as the eJustice portal. The EU Information providers Guide (IPG) does not allow the use of third-party tools (e.g. Google Maps) on Europa.eu websites. DG COMM is providing the ESRI World Geocoding Service to DG GROW / DG JUSTICE. The Yahoo! Geocoding service was previously used, but Yahoo! stopped providing this service

INSPIRE data specification on address

Hannes Reuter raised a doubt that the INSPIRE data specifications on addresses may not always be accurate enough for all use cases. There are many special types of addressing, for example in Berlin it is common to refer to a "front-side dwelling" and "back-side dwelling".

Although the INSPIRE data specifications conceive an address as a compound structure that can consist of several locators, of various locator designator types, which may be extended, (see: http://inspire.ec.europa.eu/codelist/LocatorDesignatorTypeValue). Further effort may be required to cover all "special cases" of commonly used addresses.

Interview with Danish Address Programme

Table 24: Meeting minutes of the interview with the Danish Address Programme

Interviewee(s):
Morten Lind

Interviewer:
Ray Boguslawski – Joint Research Centre
Inge Gielis – PwC EU Services
Leda Bargiotti – PwC EU Service

Date: 29 April 2016

Feasibility study for an EU Gazetteer common service
PwC is conducting a study in the context of the European Union Location Framework (EULF), an action of the European Commission's Interoperability Solutions for European Public Administrations (ISA) Programme. The study aims at making a business case for an EU-wide, Gazetteer common service. The study will be an input to the European Commission to help identify whether and where further action may be needed and desirable.

Danish Address Programme

Current status of the Danish Address Programme
The objectives of the Danish Address Programme can be summarised as follows:

- Improving the underlying infrastructure by developing new address services and creating new registers for i.e. addresses and street names. The new register will contain location information on all entries. All road names and addresses will be geocoded.
- Improving data quality by going into the field and assigning addresses to properties that had no address up until now. This is an ongoing process.
- Improving the reuse of official addresses and trying to eliminate the need for individual organisations to keep their own address database and to update it manually.

Currently, the Danish Address Programme is only midway, but it has had already significant impact. For instance, with regard to reuse, everyone can access the service without any need for licensing and registration. On top of that, organisations can already see changes within 12 seconds after they were recorded in the register.

In 2013, the Danish Ministry for Housing, Urban and Rural Affairs made an analysis of the Danish authorities' use of foreign addresses. The analysis was based on a set of in depth interviews with different public parties in Denmark, i.e. the Ministry of Foreign Affairs, the Ministry of Defence, tax authorities, local authorities and the Ministry of Health. The analysis provided three possible solution scenarios A, B and C, where the project members suggested model C "Common address service (foreign)" to be the preferred option. This would most likely result in a single point of contact for all Danish bodies, allowing them to access address data from all over the world and relieving them from the burden of having to contact all countries themselves. A challenge identified entailed the fact that it would not always be possible to validate the complete address, but only e.g. the postcode, the city or the street name. Morten suggested the idea of a gradual approach, first connecting to the address registers of the other Nordic countries (because they have already good addresses, mostly free of charge and no licensing issues exist), and afterwards expanding to the other European countries. The Danish Basis Data Board approved the proposed model C in principle, but there were no resources available to start a pilot or implementation, due to other priorities at national level.

Benefits and costs
The report on Denmark's Open Address Data Set, written by Juliet McMurren et.al. estimates the direct financial benefits at 62 million at a cost of only 2 million. Could you elaborate on this?

The focus of this study dealt with one specific business case: opening up address data, which individuals and organisation had to pay for until 2005. The report's objective was to estimate the costs and benefits of making address data free of charge (2002). The costs were fairly limited, as the quality of address data was already pretty good, and the sale of the address data was fairly low. The local administrations got a onetime compensation.

The current address programme started in 2012. For this project, the annual benefits are estimated at about 25-35 million euro, with a one-time investment of 14 million euro plus annual maintenance costs of 5 million euro.

The reason for the relatively high level of investment is that it, in order to improve the quality of the address data, it is necessary for the local authorities to go in the field. Next to that, there is also a cost on the government's side. When you assign a dataset to be a reference dataset, you must ensure that the dataset is of high quality. To achieve this, more involvement is needed from both the government as well as the local authorities.

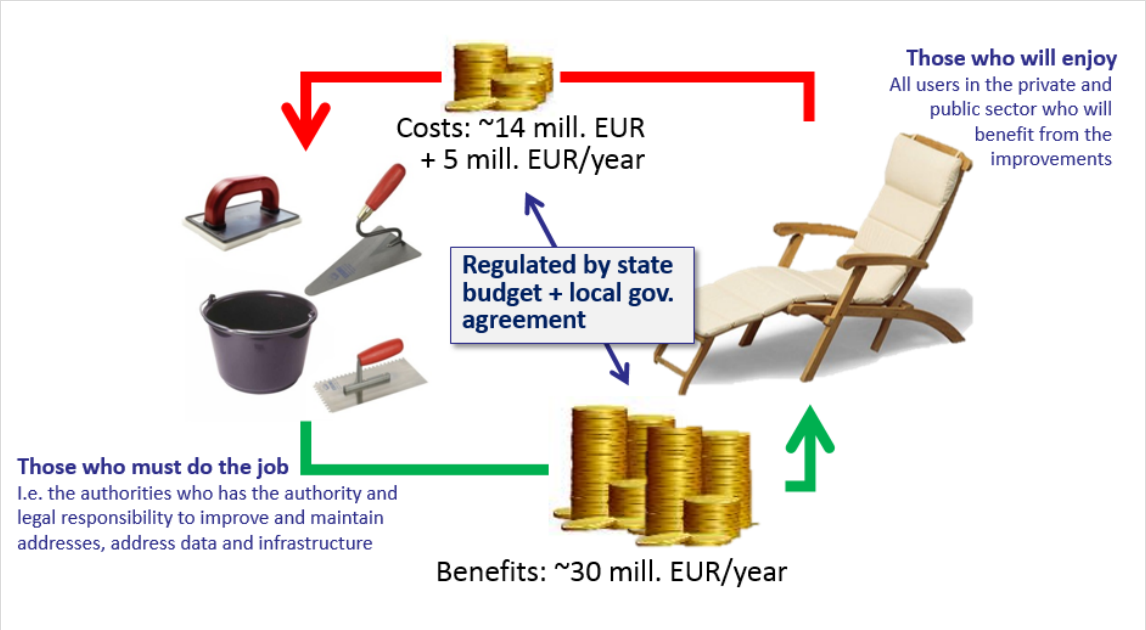

Fig. 1: Address Programme Business case (Presentation at INSPIRE conference 2013, Firenze)

Challenges

What are the main challenges you encountered in setting up the address service?

The main challenge for the address programme is to ensure the long term funding. We rely on the government to receive proper funding from the state budget in the years ahead. This could be a weak point.

EU Gazetteer common service

We are exploring the scope an EU Gazetteer common service might cover. You probably had a similar discussion when defining the scope of the basic data programme. How did you decide on the scope?

The Danish Basic Data programme covers all the most important "fundamental" public data sets on business entities, citizens, properties, addresses, cadastral and topographic mapping etc.

When determining the scope of what later was called the Basic Address Programme, it was decided to focus on addresses and street names. Many other datasets are relevant, e.g. administrative units, place names, property data, buildings, transport network, hydrography etc., but basically addresses and road names play a special role – with a very strong business case – because they represent the common key for several services, like business registries, and can be scaled up to geographical locations, statistical units, etc.

It is a limitation that the present Danish Address Programme did not manage to include services that target addresses in other countries. A lot of public agencies had to deal with addresses out of Denmark: Danish or foreign citizens receiving Danish social benefits, people owning properties in other countries, business entities located outside Denmark, people seeking asylum, people working abroad, people who travel abroad and register themselves with the Ministry of Foreign Affairs to receive information when something happens in Denmark or even abroad. In many administrations, there are people whose only job is to contact public bodies in other countries to validate the addresses of a person, business or property.

A common address service should be managed by a government body which provides a service and which has the contacts with the other countries. There are a number of commercial services as well. They investigated some of these and concluded that the quality of the service varies from service to service. In some countries, you can only access address data through commercial service, in other countries, the best possible solution was to access address data through the national address body.

Also other use cases are important such as: emergency services, place names, ensuring that an address abroad is a real property and exists.

It would be a good idea to develop an EU service focussing on address data. Governments will definitely benefit from this, but other parties, including commercial services could also be interested in this.

Addresses are interesting, because they are the common key. When you are talking about business registers, information on properties, location information in the population register, statistical services. Addresses are the common data – like a location reference.

The need for address data differs between public and private sector.
In the public sector the typical use case is to be able to validate a certain address (is it correct, does it exist?), whereas the private sector typically is interested in which addresses exist, where they are located, and how they can connect to them.

How do you think we can guarantee quality?
In Denmark, all addresses are recorded by local authorities. They have the legal authority to assign road names and addresses – typically in relation to planning, zoning and building permit. Unfortunately, this is not the same in every EU country, but in those cases, it will be possible to validate at least a postal code. More and more public agencies deal with addresses in other countries.

In your opinion, what data sources should the EU Gazetteer common service use?

In Denmark, it became clear that a cooperation between public and private sector providers will be necessary if you want a global coverage. It will be difficult to cover the whole world with individual contacts with national mapping services only, but if one has access to the original source, then it is not necessary to use the private sector sources which themselves often rely on those original sources. Morten envisages the possibility of having a flexible model, allowing to work with whoever has something to offer.

In your opinion, what are the main benefits of an EU Gazetteer common service on addresses?

In the Danish case, 4 key benefits emerged

- You do not have to deal with errors, which was a very cumbersome task.
- You are able to connect to a central service who provides good quality basic data, meaning you do not have to maintain it yourself (less cost) or do not have to connect to all countries individually.
- You do not have to buy in extra data, because the public or accessible data was often not good enough.
- You have many opportunities and possibilities, as you can rely 100% on the data, which allows you to combine it with other data.

Follow up interview with EuroGeographics

Table 25: Meeting minutes of the follow-up interview with EuroGeographics

Interviewee(s): Saulius Urbanas
Interviewer: Ray Boguslawski – Joint Research Centre Inge Gielis – PwC EU Services Leda Bargiotti – PwC EU Services
Date: 17 May 2016
Feasibility study for an EU Gazetteer common service PwC is conducting a study in the context of the European Union Location Framework (EULF), an action of the European Commission's Interoperability Solutions for European Public Administrations (ISA) Programme. The study aims at making a business case for an EU-wide, Gazetteer common service. The study will be an input to the European Commission to help identify whether and where further action may be needed and desirable.
GeoLocator **Status update on the GeoLocator** So far, the GeoLocator has not been recognised as a standalone product, rather it is an application for services. But this position could be reconsidered in the future. At the end of the ELF Project (October 2016), a transition plan is foreseen to hand over the application to EuroGeographics. Furthermore, it has not been decided yet whether the GeoLocator will be a public service free of charge or a product for which a specific licensing scheme will apply. The choice will depend on the agreements with the data providers. For the next two years there is a data provider agreement for non-commercial services. Licensing beyond this timeframe, will be decided after 2018. In case the EU Gazetteer common service would make use of the GeoLocator's functionalities, it would be a strong signal that the data will be used by the EU Institutions. As a consequence, it is the personal opinion of Saulius that this would make it a strong case for making the information available free of charge. In fact, although there are several data providers that have already or are planning to make the data available for free, there are others, such as IGN (France) and Ordnance Survey (UK) that in the past have expressed the need to get a return on investment. Although, their position may be different now and should be verified, especially in the light of the latest developments on open data. However, at this point in time, market analysis suggests that there is no great interest in paying for the data. It should be pointed out that, even if the data providers require a return on investment, this does not mean that the service should be made available with the payment of fees. For example, EuroGeographics decided to make available for free data for which it had to pay for (example of Bulgaria) and cover for the cost via membership fees. The context in which the GeoLocator service could be used in the future is not clear yet. The GeoLocator service provides access to: • Geographical names (DK, PO, UK, UN, SE) • Addresses (CZ, DK, PO, ES) • Administrative units (FI) • Data part of the EuroGeoNames Project. Users will be able to download the data independently of the GeoLocator. Therefore the licensing conditions of the data and of the GeoLocator may well differ. The GeoLocator is an application that uses national services, combining data of various databases in one central virtual database.

Currently the search capacity is being expanded in order to include multilingual searches. The ELF toponymical expert communicates with national toponymical experts to collect exonyms and variants. This additional information is only available through the GeoLocator application.

Right now the GeoLocator is an application that is running via the ELF platform, but it could also be embedded in other platforms, such as the geoportals. It shows content of services available, based on the INSPIRE themes. The application could be made available in the public domain.

The financial options on how to fund the platform still need to be considered.

With regard to address data, access conditions vary from country to country in Europe. Furthermore, depending on the country, different authorities are the authoritative source of this data. It is important to let the user choose what data they want to access independently from whether it is freely accessible or available against the payment of a fee.

Conclusions

The analysis carried out so far shows that the strongest case for an EU Gazetteer common service is about address data and that the most straight forward use case is about statistical units.
Address data is complex, probably more than geonames.
Key parameters to be taken into account for the business cases are:

- Scope
- Availability of data
- Licensing conditions
- How the service might be accessed

A period should be foreseen where the potential take up/user demand of the EU Gazetteer common service is assessed.

Promotion and information on the usage of the service is also important.
Licensing arrangements should be simple and to the extent possible open.
Given that access to address data in Europe varies from country to country, an option could be to let the user choose among the alternatives available, depending on what is valued the most (e.g. quality vs costs).

Fees are clearly a barrier to access, but it is not a matter that can be overcome easily. Plus, in some cases, typically when data are recognised as being the authoritative source, users might be willing to pay for it.

In some countries there might be more than one data provider of address data. It is important to identify the authoritative source.
It is not possible to generalise what authority (mapping, postal etc.) would be more willing to provide data as it depends on the country.

If it is not possible to cover the whole of Europe, at first a gradual approach may be considered.

Actions: Saulius to share information on availability of services (based on an excel table that was used in the discussion).
ELF will have a follow up discussion on access rights and the licensing framework in August, in which case they can share findings due in September.

With regard to awareness raising activities, ELF is organising an Innovation Awards competition for application developers producing use case examples utilising ELF data and tools. Furthermore ELF is also organising an awareness tour.

Interview with HERE

Table 26: Meeting minutes of the interview with HERE

Interviewee:
Bram De Bot - HERE
Caroline Hancock - HERE
Martijn Van De Runstraat - HERE

Interviewer:
Leda Bargiotti - PwC EU Services
Inge Gielis - PwC EU Services
Ray Boguslawski - Joint Research Centre

Date: 18 May 2016

Context of the study:
The 'feasibility study for an EU Gazetteer common service' is conducted in the context of the European Union Location Framework (EULF) Action of the ISA Programme of the European Commission. The study aims at identifying the scope options and assessing the business case for an EU Gazetteer common service. The purpose of the interview is to analyse the characteristics of currently existing gazetteers (supply side analysis) and the possible need for an EU Gazetteer common service (demand side analysis).

HERE

1. Specific use cases:
   HERE offers location products and services via three business units:
   - Consumer;
   - Automotive;
   - Enterprise.

   They have many types of customers and use cases. For instance, in the Enterprise and Automotive space, there is no limit on how customers use their data. Some just want to find a location, other customers might be using it for geo-marketing, looking up information on income of the surrounding area, how long it takes to get to the location from the highway, availability to logistics, … . HERE's main income comes from the automotive industry, where they provide navigation maps and devices for cars. In this respect, addressing and finding a location are key aspects to get started. Their gazetteer service is only part of the story. Other examples of their customers are: delivery services, looking for where to go to deliver a package, or plan their delivery routes; portals that embed their extended search to allow users to look up addresses, points of interest (restaurants, monuments, hospitals, etc.).

   HERE delivers content and services, based on the demand coming from their customers. HERE's customers use their data, but also HERE uses their customers products and services. For example, ESRI uses HERE's data in their software products, and HERE uses ESRI software in their products and services.

   Location data (addresses, street names, postal coding) is only part of the service. A gazetteer is focusing on the search function in a spatial sense. But location data is often used to do something else. For example HERE provides search options, algorithms, etc. to determine what people want find or locate. If everyone would open up their data, this would be an opportunity, but also a risk. On the one hand, HERE wants to be at the forefront if the data becomes available and make use of it, but on the other hand, making sure that data are of high quality and can be used for various purposes is also part of HERE's business.

   INSPIRE is very theoretical, it mainly provides rules, formats and structures. Looking at TN-ITS[25], HERE is one of the first to look into the data exchange process. INSPIRE is very useful to provide structure, but the real value is in the data. This is currently missing on the INSPIRE side. Setting up an EU Gazetteer common service would totally change this. An EU Gazetteer common service would be delivering upon what was built before. It is taking the theory into practice. Developing and maintaining an EU Gazetteer common service is a big investment. It

[25] Transport Network ITS Spatial Data Deployment Platform

means investing in infrastructure, the data service, looking for customers, …

2. Data quality and data sources:
   What data sources does HERE use in Europe?
   HERE uses different data sources. There are differences within Europe with regard to quality and availability: some data sources are structured, free of charge and of very high quality, in other countries, the data is not even available or is of poor quality. In Italy, for example, the data is very scattered and HERE had to go to each municipality individually to negotiate and collect the data. It is complex to get hold of the right contacts, understand who holds what and negotiate a deal because the legal restrictions are quite complex. For example HERE needs to use data for a service that is openly available, but also re-sells the data to its customers which is not always possible to control. HERE might need perpetual rights to the data, for example to update navigation systems. In countries like the UK, the quality of address data is very high but the data is highly protected, which makes it very difficult to use. Denmark opened up its address data. This created more economic activity, and the investment will pay itself back in taxes. Of course, the mapping office itself does not fully benefit from this. HERE taps in to that data, it is very easy to access and very fresh.
   An EU Gazetteer common service would be an opportunity to have access to good high quality data, but everybody else can access it as well, meaning that potentially it can be in competition with HERE.

   Every time HERE obtains a new dataset, the data quality needs to be assessed and the data needs to be aligned. Sometimes HERE has fallouts when data is linked to the map. Bram's team tries to mould the data so it can be used in HERE's services. INSPIRE is already helping a lot in this, but there is not always a general spatial infrastructure.

Supply side analysis:
Intellectual property: The legal constructions in different countries are complex. HERE needs to be able to use the data in a service that is openly available, but they also sell it as a service and resell the data. They need perpetual rights to the data, which is not always easy.
Level playing field: *There may already be commercial datasets offering EU-wide gazetteer data. How can we ensure that interventions from the public sector do not have a distorting effect on the market?*
HERE is a commercial company, so HERE needs to be better than the rest. If HERE can solve certain issues, it means HERE is managing things better than others. If certain things open up, it will benefit all companies alike.

Scope options:
Where would HERE see the most added value?
The EU Gazetteer common service should focus on where there is economic value in the EU. A gazetteer service that encompasses everything is very difficult. It will be easier to focus on one topic that would create ample development for EU countries. Other things that need to be taken into account are the knowledge that needs to be bought in, the service that needs to be developed, infrastructure, marketing, …

If one wants data to work, it has to be used. This is what is happening in Denmark. Denmark is now very open, people are more and more using it, there is more feedback and the mapping agency can see that the data is being used. This is very inspiring for people. If other people are interested and value what people do, this will motivate the people working in the mapping agencies to continue what they are doing.

Challenges
A gazetteer service is not only about the data, but also about the search facilities and how fresh and live the data is. People type in the strangest things, spelling typos or the names of a restaurant or a park for which they do not know the address. Looking for spatial information is very broad. There is also a need to find a structuring system for addresses in Europe, which is a huge task**.**

How would HERE like to be part of the development of an EU Gazetteer common service?
HERE would like to be able to make use of it. But even before that, HERE would like to be involved in testing it and potentially influencing where needed, even small changes could result in an added-value service that the EU Gazetteer common service could offer, e.g. aspects such

as licensing rights could be aligned to facilitate use. HERE has a lot of knowledge on this topic. HERE could provide insights or help steer the work. The more data becomes available, the more people will make use of it and the customer base will also grow.

Immediate next steps

JRC to share draft EU Gazetteer common service Feasibility study with HERE for information and for any comments or suggestions they may wish to make.

Interview on the European Data Portal

Table 27: Meeting minutes of the interview with the European Data Portal

Interviewee:
Daniele Rizzi, (DG CNECT),
Wendy Carrara (Capgemini),
Marc Kleemann (conterra.de),
Thore Fechner (conterra.de)
Interviewer:
Leda Bargiotti
Date:19/09/2016
Context of the study:
The 'feasibility study for an EU Gazetteer common service' is conducted in the context of the European Union Location Framework (EULF) Action of the ISA Programme of the European Commission. The study aims at identifying the scope options and assessing the business case for an EU Gazetteer common service. The purpose of the interview is to analyse the characteristics of currently existing gazetteers (supply side analysis) and the possible need for a common EU Gazetteer common service (demand side analysis).
European Data Portal
The European Data Portal harvests the metadata of public sector information available on public data portals across European countries. Information regarding the provision of data, the benefits of re-using data and several use cases are also included on the website. One of the features offered by the European Data Portal is the ability to search and geo-locate the datasets and visualise them on a map. To put in place such a service, the European Data Portal relies on its own gazetteer. The main characteristics of that gazetteer are summarised below:

- **Content type:** Geographical names and administrative units.
- **Source of data:** To gather data, Member States were contacted and the JRC INSPIRE geoportal was sourced together with national INSPIRE geoportals. The same was done for Open Data geoportals and the result was complemented with information collected via search engines. When combining the data, authoritative data is always preferred over non-authoritative data, because authoritative data is assumed to be more accurate.
- **Scope of search capabilities:** The search capabilities mainly cover the populated places of Geographical Names (INSPIRE Annex 1) – however the data quality varies widely so it is complemented with additional data from Geonames.org, e.g. populated places, administrative units and exonyms. Exonyms are usually not provided by the Member States, but from a user's perspective they are important and useful. Exonyms allow users to find the place they are looking for using the geographical name of that place in their own language. The option for street names and addresses is not included yet, but could be in the future.
- **Data refreshing:** Data is refreshed with FME (Feature Manipulation Engine) on a regular basis. Currently this is every three months as the source data does not change often.
- **Transferability of search function:** The search function should be easily transferable. It builds on con terra's smart.finder technology that is built on top of Apache Solr, extending the core Solr with a couple of specific functions that improve overall handling. However, the index itself could be served via any Apache Solr Instance, and the Solr is queried via its RESTful API.

Demand side analysis: What are the specific needs that the gazetteer serving the European Data Portal should address?
- **Specific use cases:** The specific use cases mentioned were geocoding, reverse geocoding, disambiguation (including exonyms), locating and filtering of data. This data filtering allows users to look for all datasets for city X, but also for all datasets on a particular topic in a specific region or city.
- **Data quality:** All Member States are expected to comply with INSPIRE. The datasets published and claiming to be INSPIRE compliant do not always meet the extensive INSPIRE specifications. Currently, the data quality is variable, with some countries (Germany, UK) complying perfectly, while other datasets lack even basic descriptions. There is a lot of leeway for the Member States as they only need to publish what is present. Therefore, it is hard to find datasets for the same content type for all the Member States. As a solution, the EDP supplemented them with data from Geonames.org. A common use case, could stimulate the adoption of INSPIRE in the Member States, given that everyone sees value in it.
- **Content type:** The content type needed depends on the use case. To run its service, the European Data Portal needs geographical names and administrative units. Currently both types are in one dataset, but it would be useful to have 2 separate datasets for easier

manipulation of the data. In addition, more INSPIRE-compliant, authoritative data is needed, to guarantee quality. This would also increase the amount of polygon information (2-dimensional, such as the boundaries of a city) available. Finally, many exonyms pulled from Geonames.org were provided by the user community, which is great as a first draft but raises questions regarding reliability and quality.

- **Polygons:** Source data is provided both as points and as polygons, however for a consistent user experience, all data is currently presented as point information. Given that polygons are not available all the time and only point information is available, for instance for a city, the geographical bound of the city is inferred/extended to be able to do any meaningful spatial operations. An EU-wide gazetteer service could solve this issue by guaranteeing authoritative polygon information. Next to that, it is not always straightforward which point should be chosen to e.g. represent a city. It could be the centre of gravity, the location of the town hall, the centre of a bounding box, … This implies that different sources can link the same city to different geographical points, making it difficult to determine whether they represent the same city or not.
- **Demand for a gazetteer service:** Currently the European Data Portal has its own gazetteer. Overall, the service provided meets the business requirements, however there are a number of aspects that could be improved including:
    a. Licensing: bilateral negotiations had to be carried out with each Member States' authority. This is time consuming and in some cases it was not possible to use the information because of licence restrictions. An EU Gazetteer common service could take care of the licensing negotiations.
    b. Consistent representation of EU borders and geographical names. Current services like Google Maps provide different representations of certain countries depending on where the map is viewed (for instance FYOM in Greece, Macedonia if the map is accessed from another country). An EU Gazetteer common service could provide a harmonised view.
    c. Authoritativeness: currently the gazetteer is made out of a mix of authoritative and non-authoritative data. An EU Gazetteer common service could guarantee a higher degree of authoritativeness. Thirdly, it would guarantee that all data is authoritative and absolve the need to use crowdsourced and/or commercial data.
- **Willingness to pay:** An EU Gazetteer common service should be viewed as a public service. The data becomes public property. Even though there are costs related to maintenance and sustainability, using the gazetteer should be free of charge. If not, users will find their way to free alternatives like Geonames.org and OpenStreetMap, given that the quality of these services may be good enough for the purpose.
- **Use of data:** The European Data Portal monitors the use of the portal and publishes statistics about traffic to the site, downloads and metadata quality, indicating i.e. that WMS is the preferred redistribution format. Next to that, a plethora of use cases can be found on the website. This can be useful when determining demand for Gazetteer services and when refining use cases.

Supply side analysis: What is already existing and is there a need for additional EU action?

- **Data providers**: To collect all relevant data, the European Data Portal started from the JRC INSPIRE geoportal and the annual INSPIRE reports where statements can be found about which datasets are published. They also consulted the national INSPIRE geoportals which sometimes have different/more complete datasets compared to the EU INSPIRE geoportal. On top of this standard desk research was performed together with consultations with national cadastre agencies (not all of them due to language barriers).
- **Intellectual property**: Licensing was one of the issues encountered during the development of the gazetteer. For each institution or country, new negotiations had to be made and the developers had to deal with new requirements. Effectively, 2 Member States had published data but not under an open data licence, and thus the data could not have been made available on the European Data Portal. The entire process also took a lot of time. Acquiring licensing information is challenging. Even if data is available, conflicting licence information is published, at the service, catalogue or website level. Licences are often only available in the native tongue, and documentation about the offered data is sparse, meaning each dataset has to be analysed individually.
- **Data quality**: One of the quality checks carried out entails identifying duplicates, i.e. if a feature is identical in Geonames.org and authoritative data. To do this, a combination of spatial and textual filtering is used to identify whether a feature is identical and merge it from Geonames.org to the authoritative data if something is missing. From a scientific point of view the data could be validated better. Thus, it would be interesting to analyse, evaluate and

potentially improve the quality processes that merges the data. One key difficulty is comparing point information with polygons. For example if Geonames.org provides a point information for "Barcelona" and there is also an authoritative source for "Barcelona", but it is a polygon, it is not easy to decide which one to use because although they refer to the same element ("Barcelona"), they can represent different aspects of "Barcelona".

Scope options: Which shape should a common, EU-wide Gazetteer common service take?

- **Level of centralisation**: Ideally, if all Member States implemented INSPIRE, a federated/decentralised approach could suffice, as each country would have its own regional gazetteer, which can all seamlessly be put together. A thin EU wide layer could be interesting to provide a single point of access and to take care of exonyms, licensing etc. Currently however, this is not the case. The best case scenario would be a federated model that can rely on INSPIRE-compliant SDI across all Member States.
- **Quality Control**: Quality control should be done at the national level, through compliance with the INSPIRE requirements.

Overall, an EU Gazetteer common service could provide an added value to current solutions. It would provide a validated gazetteer, both in terms of accuracy of the content, but also from a political perspective, related to border location etc. It will show how the 28 Member States see the world, including the borders of countries, naming of geographical places. If the gazetteer will be available as open data, it will not be a competitor to the EDP, but rather an additional source that can be used. From a technical point of view, it could also be interesting to develop an API for the EU Gazetteer common service, facilitating its reuse.

Annex 2. Analysis of existing gazetteers

Table 28 summarizes the analysis of existing gazetteers, discovered during the desk research. For each gazetteer, it lists the country covered by the dataset, the name of the gazetteer and the organisation providing and maintaining it, the INSPIRE data theme of the dataset, the languages in which the service and the data is available, if the gazetteer is based on authoritative data, what licences apply to the data and service, if the data is INSPIRE conformant, in which data formats the data can be downloaded, and the website of the gazetteer. The gazetteers are subdivided into 3 subcategories depending on the coverage of the dataset: National, European or Global.

Table 28: Analysis of existing gazetteers

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
National										
CZ	INSPIRE - Geographical Names (GN)	Land Survey Office	Geographical names	CZ, EN	Yes	Commercial use not allowed.	Not identified	Yes	XML scheme	http://geoportal.cuzk.cz/(S(f4xcfe3f5ebjyq0lpcwq3ibu))/Default.aspx?mode=TextMeta&text=geonames_uvod&side=geonames&menu=26
CZ	Register of territorial identification addresses and real estate (Ruian)	Geoportal ČÚZK	Addresses, Administrative units, Cadastral parcels, Buildings	CZ, EN	Yes	No restrictions	No restrictions	Yes	GML 3.2.1 format.	http://geoportal.cuzk.cz/(S(4pdxucmzlfpqeisjsvrmqjcz))/Default.aspx?lng=EN&mode=TextMeta&side=dsady_RUIAN&metadataID=CZ-CUZK-RUIAN_CR&menu=331
DE	Geographical Names 1:250,000 - GN250	Bundesamt für Kartographie und Geodäsie	Geographical names	DE, EN	Yes	No licence	No licence	Yes	ArcInfo - SHAPE CSV-Datei	http://www.geodatenzentrum.de/geodaten/gdz_rahmen.gdz_div?gdz_spr=eng&gdz_akt_zeile=5&gdz_anz_zeile=1&gdz_unt_zeile=20&gdz_user_id=0

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
DK	Danmakrs Adresseregister	Danish Geodata Agency	Addresses	DK	Yes	Attribution	Open Source (MIT/X11)	Yes	CSV GeoJSON JSON	http://dawa.aws.dk/om#opensource
DK	Danmarks Stednavne	Department of Nordic research	Geographical names	DK	no	Open licence	Open licence	Yes	PDF, CSV	http://danmarksstednavne.navneforskning.ku.dk/
DK	INSPIRE_GN NamedPlace	Styrelsen for Dataforsyning og Effektivisering	Geographical names	DK	Mixed	No restrictions on the data	No guarantee on data availability	Yes	Multiple: GML, TXT, …	http://download.kortforsyningen.dk/content/geodataprodukter?field_korttype_tid_1=3585
EE	Estonian Land Board Geoportal	Estonian Land Board	Geographical names Addresses Cadastral parcels	EE, EN	Yes	Open data	No licence	Yes	TAB, SHP, DXF, DGN	http://xgis.maaamet.ee/knravalik/
EE	Estonian place names database	Institute of Estonian Language	Geographical names Street names	Multiple	No	Open licence	Open licence	Yes	PDF HTML	http://www.eki.ee/knab/knab.htm
ES	SIGNA – Sistema de información geográfico nacional de España	Ministry of development	Geographical names	ES languages, EN, POL	No	Not found	Only technical support	Yes	SGV, GML	http://www.ign.es/signa/

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
FI	National Land Survey of Finland	National Land Survey of Finland	Street names Placenames	FI, EN	Yes	Open data license CC 4.0	No service	Yes	Esri shape, MapInfo MIF, and MAAGIS/XL.	http://www.maanmittauslaitos.fi/en/opendata/list-of-the-digital-data-products-to-be-opened INSPIRE Administrative Units Schema: http://xml.nls.fi/Kuntajako/Asiakasdokumentaatio/Skeemakuvaus/NLSF_AU_schema_documentation.html Geographical names: http://www.maanmittauslaitos.fi/en/digituotteet/geographic-names Road names: http://www.maanmittauslaitos.fi/en/digituotteet/road-names
FR	GEOFLA® Communes	Institut National de l'Information Geographique et Forestière	Administrative units	FR	Yes	Open Licence	No service	Not identified	SHP	https://www.data.gouv.fr/fr/datasets/geofla-communes/
FR	BAN - Base Adresse Nationale	Etalab du Secrétariat Général à la Modernisation de l'Action Publique (SGMAP).	Addresses	FR	Mixed	Licence gratuite de repartage (Usage Propre) Licence ODbL	GPL v2 (OpenStreetMap)	No	CSV	https://www.data.gouv.fr/en/datasets/ban-base-adresse-nationale/

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
GR	Gazetteer of Municipalities and Communities (2001)	Hellenic Statistical Authority	Administrative units	GR	Yes	Creative Commons Attribution	No service	Yes	ODS XLS	http://geodata.gov.gr/en/dataset/lexiko-demon-kai-koinoteton-2001
HR	Gazetteer of Geographical Names	State GeoDetic Administration SDI Sector Department of NSDI	Geographical names	CRO, EN, DE, FR, ES, IT, NL, HU, Slv, Slo , Cze	Not identified	Full dataset cannot be accessed	Restrictions apply (It is prohibited to change, copying and distribution of data on any type of media)	Yes	PDF, XML?	http://cgn.dgu.hr/home/
IE	Placenames Database of Ireland	Fiontar & The Placenames Branch (Department of Arts, Heritage and the Gaeltacht).	Placenames	IR, EN	Yes	Open Licence	Open licence	Yes	PDF, XML	http://www.logainm.ie/en/
IE	Eircode	Capita Business Support Services Ireland.	Postcodes	IE	Yes	Commercial	Commercial	No	Not available	https://www.eircode.ie/home
LV	Geographical Names Database	Latvian Geospatial Information Agency	Geographical names	LV	Not identified	Not available	Open licence	Yes	PDF	http://map.lgia.gov.lv/index.php?lang=2&cPath=3&txt_id=24

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
PL	National Register of Geographical Names	Central Documentation Centre of Geodesy and Cartography	Geographical names	PL	Yes	No Licence	Yes	No	XLS, GML, SHP	http://www.codgik.gov.pl/index.php/darmowe-dane/prng.html
PL	Polish INSPIRE geoportal	Polish Head Office of Geodesy and Cartography	Addresses, Administrative units, Geographical names	PL, EN	Yes	No data available	Access to services search and browsing is universal and free.	Yes	Not available	http://geoportal.gov.pl/en/uslugi/usluga-pobierania-wfs
UK	National public transport gazetteer	Department of Transport	Placenames	EN	Yes	Open Government Licence	Open Government Licence	No	XML scheme	https://www.gov.uk/government/publications/national-public-transport-gazetteer
UK	National Street Gazetteer	GeoPlace LLP	Street names	EN	YES	Restrictions apply	Restrictions apply	Yes	INSPIRE compliant format	https://www.geoplace.co.uk/streets/managing/what-is-the-nsg
UK	National Address Gazetteer infrastructure	GeoPlace LLP	Addresses	EN	Yes, takes information both from local authorities and Ordnance Surve	Businesses can also access the data from Ordnance Survey through a range of licences and web services	The AddressBase range of products are made available free at the point of use by Ordnance Survey for the entire public sector, under the Public Sector Mapping Agreement and	No	Not downloadable	https://www.geoplace.co.uk/addresses?nwid=19#sthash.GbwKBYhM.dpuf

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
					y		the One Scotland Mapping Agreement			
European										
EU	EuroBoundaryMap	EuroGeographics	Administrative units Statistical units	EU languages	Yes	Commercial licence	No service	Yes	ESRI ArcGIS Geodatabase; ESRI Shapefiles	http://www.eurogeographics.org/products-and-services/euroboundarymap
EU	European Land Register Information Service (EULIS)	EULIS	Cadastral parcels	National languages	Yes	Mixed	Open/Commercial licence	Yes	Not identified	http://www.eulis.org
EU	Nomenclature of territorial units for statistics (NUTS) + NUTS Boundaries	Eurostat	Statistical units	Multiple	Yes	Open licence	No service	Yes	PDF	http://ec.europa.eu/eurostat/web/nuts/overview
Global/International										
INT	Countries of the World (COW)	Americas Open Geocode Database	Countries Placenames	EN, ES, FR	Mixed	No licence	Yes	No	CSV	http://opengeocode.org/download/cow.php

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
INT	GeoNames	GeoNames	Geographical names	Multiple	Mixed	Creative commons attribution license	Open licence	Yes	txt	http://www.geonames.org/ Countries gazetteer: http://www.geonames.org/ Postal codes per countries: http://www.geonames.org/postal-codes/ Cities gazetteer : http://www.geonames.org/maps/wikipedia.html
INT	Google Maps	Google	Addresses Geographical names Administrative units Buildings	Multiple	Mixed	Data is not available	Restrictions apply	No	Not available	https://maps.google.com
INT	Getty Thesaurus of Geographic Names	Getty	Geographical names	Multiple	Mixed	Open Data Commons Attribution License Commercial Licence	Restrictions apply	No	AAT, TGN, ULAN available in JSON, RDF, N3/Turtle, and N-Triples AAT, TGN, ULAN available in XML	http://www.getty.edu/research/tools/vocabularies/tgn/

Country	Name	Organisation	Theme	Languages	Authoritative?	Dataset/database Licence	Service licence	INSPIRE conformant	Data format	Website
INT	OpenStreetMap nominatim	OpenStreetMap	Geographical names Addresses Administrative units	Multiple	Mixed	Open Database License	GPL v2	No	SQL?	https://nominatim.openstreetmap.org/
INT	EuroRegionalMap	EuroGeographics	Administrative units Geographical names	National languages	Mixed	Commercial licence	Commercial licence	Yes	ESRI File Geodatabase ArcGis 10.1 ESRI ARC shapefile (on demand)	http://www.eurogeographics.org/products-and-services/euroregionalmap
INT	EuroGlobalMap	EuroGeographics	Administrative units Geographical names	National languages	Mixed	Open Data	Open Data	Yes	ESRI Personal Geodatabase and File Geodatabase ArcGis ESRI shapefile	http://www.eurogeographics.org/products-and-services/euroglobalmap

Annex 3. Analysis of existing applications

Desk research was performed in order to identify existing applications (partially) covering the specific use cases mentioned in section 0 . As a result, 26 applications were further analysed in terms of target audience, generic gazetteer use cases implemented, coverage of the dataset, underlying services and data sources used (like gazetteers, raw data, visualisation, …) and licensing conditions. The results are summarised in Table 29 below.

Table 29: Analysis of existing applications

Name of the application	Target audience	Disambiguate	Geocode	Locate	Reverse geocode	Link	Look up	Specific use case	Homepage	Country of origin	Coverage	Underlying services or data sources used by the application	Free for reuse?	Free as a service?
Google News	End user					✓		Organising news items based on their location aspects	http://news.google.com/	US	Global	Google	No	No
The Edinburgh Geoparser Demo	Both	✓	✓	✓				Retrieve archived documents by location	https://www.ltg.ed.ac.uk/software/geoparser/	UK	Global	Geonames; The Edina Unlock Service (OS, Natural Earth, Unlock, DEEP, Pleiades+) Google Maps	Free	Free
European Data Portal	Both	✓	✓	✓	✓	✓		Link datasets of data portals to a geographical location	https://www.europeandataportal.eu/en	EU	European	National registers/Geonames.org OpenStreetMap	Not identified	Free
INSPIRE geoportal	Both	✓	✓	✓	✓	✓		Link datasets of data portals to a	http://inspire-geoportal.ec.euro	EU	Europea	Geonames.org CleanTOPO2	Not identifie	Free

								geographical location	pa.eu/discovery/		n	GTOPO30 EuroGeoGraphics GlobCover 2009 GLOBCorine 2009 Natural Earth ESRI	d	
Eurostat Statistical Applications	End users	✓	✓	✓		✓		Analyse the location dimension of Statistical data	http://ec.europa.eu/eurostat	LUX	Europea n	Statistical authorities in the Member States	Free	Free
Local Crime Map	Both		✓	✓		✓	✓	Law Enforcement: Analysis of Crime	http://visualised.io/crime/index.html	UK	UK	Google Maps	Open Government Licence	Open Government Licence
Verkehrsinfo	End users			✓		✓		Road maintenance	http://www.verkehrsinfo.de/	DE	National	Google Maps	Not identifie d	Free
Google Maps - Traffic	End users	✓	✓	✓	✓	✓	✓	Road maintenance	http://maps.google.com	USA	Global	Google Maps	Not identifie d	Free
ArcGIS Sign Inventory	End users	✓	✓	✓	✓	✓	✓	Location of traffic signs and infrastructure	http://solutions.arcgis.com/local-government/help/sign-inventory/	USA	Global	HERE/OpenStreetMa p	Paid	Paid
Geocoding webtool on europa.eu	Both	✓	✓					Locate companies and brances of a business register on a map	https://webgate.ec.europa.eu/fpfis/wikis/display/webtools/Geocoding	EU/USA	Global	Esri World Geocoding Service	Free	Free

Rome2rio	End users	✓	✓	✓		✓		Cross-border multi modal travel planner	https://www.rome2rio.com/about	Australia	Global	Google Maps	Not identified	Free
Optimap	End users	✓	✓	✓		✓		Geocode postal addresses for postal services	http://gebweb.net/optimap/	USA	Global	Google Maps	Not identified	Free
Google Maps	End users	✓	✓	✓	✓	✓	✓	Geocode postal addresses for postal services	http://maps.google.com	USA	Global	Google Maps	Not identified	Free
OpenStreetMap	Both	✓	✓	✓	✓		✓	Geocode postal addresses for postal services	www.openstreetmap.org	UK	Global	OpenStreetMap	Free	Free
Open Smart Tourist Data	Reuse	✓	✓	✓	✓	✓	✓	Locate tourist and cultural heritage places	http://sdi4apps.eu/project-information/pilot-applications/pilot-2-open-smart-tourist-data/	CZ	Local	OpenStreetMap local data resources	Free	Free
GeoLocator	Reuse	✓	✓	✓	✓		✓	Validation of foreign addresses by public administrations	http://elfproject.eu/documentation/specification/geolocator/1.0	FI	International	EuroGeoNames, EGN exonym database	Not identified	Not identified
Google Maps	End users	✓	✓	✓	✓	✓	✓	Validation of foreign addresses by public administrations	http://maps.google.com	USA	Global	Google Maps	Not identified	Free

ITHACA	End users			✓		✓		Provide situational awareness of emergencies and crises	http://www.ithacaweb.org	Italy	Regional	Not identified	Not identified	Not identified
Google Maps for Work - Government - Emergency Management	End users	✓	✓	✓	?	✓	?	Provide situational awareness of emergencies and crises	https://www.google.com/work/mapsearth/government/index.html	USA	Global	Google Maps	Paid	Paid
Google for work - Utilities	End users	✓	✓	✓	?	✓	?	Use of geodata by utilities companies	https://www.google.be/intx/en/work/mapsearth/utilities/	USA	Global	Google Maps	Paid	Not identified
EULIS	Both	✓	✓	✓	?	✓	?	Property taxes	www.eulis.org	NL	National	National Land registries Google Maps	Not identified	Free
Permit Application Tracker	End users	✓	✓	✓	✓	✓	✓	Attribute environmental permits	http://deq.nc.gov/permits-regulations/permit-guidance/permit-application-tracker	USA	National	Google Maps	Not identified	Free
FEMA Flood Map Service Centre	End users	✓	✓	✓	✓	✓	✓	Calculate insurance risks	https://msc.fema.gov/portal	USA	Regional	ESRI	Free	Free
WATERINFO.be	End users	✓	✓	✓		✓		Calculate insurance risks	http://www.waterinfo.be/default.aspx?path=NL/loket	BE	National	ArcGIS ESRI	Free	Free

									ten/geoloket					
What's in Your Backyard	End users	✓	✓	✓		✓		Calculate insurance risks	http://apps.environment-agency.gov.uk/wiyby/default.aspx	UK	National	Royal mail Ordnance Survey	Content is free for reuse. Business and commercial use restricted	Free
Google Maps for Work - Government	End users	✓	✓	✓	?	✓	?	Urban Planning	https://www.google.com/work/mapsearth/government/index.html	USA	Global	Google Maps	Paid	Paid

Annex 4. Datasets on the INSPIRE geoportal

Table 30 provides examples of differences with regard to source, content, scale, format and use of datasets/services across Europe.

Table 30: Heterogeneity of datasets on the INSPIRE geoportal

	Title of the dataset/service	INSPIRE theme	Source	Scale	Use
AT	Land Information System Austria	Land cover	Umweltbundesamt GmbH	1:10000	Commercial use not allowed
BE	CRAB Adressenlijst	Addresses	Agentschap voor Geografische Informatie Vlaanderen	1:1000	Use allowed for commercial and non-commercial use.
BG	Административна единица - държавна граница	Administrative units	Военно-географска служба	1:50 000	Open licence
CZ	INSPIRE datová sada pro téma Zeměpisná jména (GN)	Geographical names	Český úřad zeměměřický a katastrální	1:10 000	Subject to a charge
DE	Verwaltungsgebiete 1:250 000 - Stand 01.01.	Administrative units	Dienstleistungszentrum des Bundes für Geoinformation und Geodäsie	1:250 000	Commercial and non-commercial use allowed
DK	DAGI_REF	Administrative units	Styrelsen for Dataforsyning og Effektivisering, Energi-, Forsynings- og Klimaministeriet	1:10 000	Commercial and non-commercial use allowed
EE	Eesti aadressiandmete süsteemi	Addresses	Maa-amet	unknown	Commercial and non-

	Title of the dataset/service	INSPIRE theme	Source	Scale	Use
	infosüsteem				commercial use allowed
EL	ΟΙΚΙΣΜΟΙ	Geographical names	Οργανισμός Κτηματολογίου και Χαρτογραφήσεων Ελλάδας,	1:50 000	Commercial and non-commercial use allowed with attribution
ES	División Administrativa. Límites catastrales de los municipios de Navarra a 1-1-2016	Administrative units	Gobierno de Navarra. Departamento de Hacienda y Política Financiera. Servicio de la Riqueza Territorial.	1:5.000	Commercial and non-commercial use allowed with attribution
FI	Cadastral index map Fastighetsregisterkarta	Cadastral parcels	Maanmittauslaitos	1:5 000	Subject to a charge
FR	POINT ADRESSE	Addresses	Institut national de l'information géographique et forestière (IGN-F)	1:10 000	Commercial and non-commercial use allowed
HR	Registar geografskih imena	Geographical names	Državna geodetska uprava	1:1 000	Commercial use not allowed
HU	Hungarian Gazetteer	Geographical names	Institute of Geodesy, Cartography and Remote Sensing	1: 40 000	Subject to a charge
IE	DAHG - UNESCO World Heritage Sites	Protected sites	DAHG - Department of Arts, Heritage and the Gaeltacht,	1:5000	Commercial and non-commercial use allowed with attribution

	Title of the dataset/service	INSPIRE theme	Source	Scale	Use
IT	Database topografico Comune di Cantù	Buildings, Addresses and Administrative units	Regione Lombardia	1:2 000	Commercial use not allowed. Non-commercial use allowed with attribution and share alike
LT	Adresai - INSPIRE duomenų rinkinys	Addresses	VĮ "GIS-Centras"	1:10 000	Commercial use not allowed
LU	Cadastral Parcels - Layer Cadastral parcels	Cadastral parcels	Administration du Cadastre et de la Topographie	1:2 500	Commercial and non-commercial use allowed
LV	Ēkas un būves (INSPIRE dati)	Buildings	Valsts zemes dienests	1:2 000	Commercial use not allowed
MT	Parcels of Registered Land	Cadastral parcels	Land Registry Department	1: 10 000	Commercial and non-commercial use allowed
NL	Adressen (INSPIRE geharmoniseerd)	Addresses	Kadaster	1:1000	Commercial and non-commercial use allowed
PL	PRNG – nazwy miejscowości	Geographical names	Centralny Ośrodek Dokumentacji Geodezyjnej i Kartograficznej (CODGiK)	1:10 000	Commercial and non-commercial use allowed

	Title of the dataset/service	INSPIRE theme	Source	Scale	Use
PT	Cadastro Geométrico da Propriedade Rústica	Cadastral parcels	Direção-Geral do Território	1:2000	Subject to a charge
RO	Limitele administrative judeţene scara	Administrative units	Agenţia Naţională de Cadastru şi Publicitate Imobiliară	1:5000	Subject to a charge
SE	Byggnader, enligt INSPIRE, hela Sverige	Buildings	Riksantikvarieämbetet	1: 10000	Commercial and non-commercial use allowed
SI	Register prostorskih enot	Addresses and Administrative units	Geodetska uprava Republike Slovenije	1:5000	Commercial and non-commercial use allowed with attribution
SK	Road network of Slovakia	Roads	Slovak Road Administration / Road Databank	1:1100000	Commercial and non-commercial use allowed
UK	Agricultural Land Classification detailed Post 1988 survey ALCL04589	Land use	Natural England	1:10 000	Commercial and non-commercial use allowed

Europe Direct is a service to help you find answers to your questions about the European Union.

Freephone number (*)**:**

00 800 6 7 8 9 10 11

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

More information on the European Union is available on the internet (http://europa.eu).

HOW TO OBTAIN EU PUBLICATIONS

Free publications:

- one copy:
  via EU Bookshop (http://bookshop.europa.eu);
- more than one copy or posters/maps:
  from the European Union's representations (http://ec.europa.eu/represent_en.htm);
  from the delegations in non-EU countries (http://eeas.europa.eu/delegations/index_en.htm);
  by contacting the Europe Direct service (http://europa.eu/europedirect/index_en.htm) or
  calling 00 800 6 7 8 9 10 11 (freephone number from anywhere in the EU) (*).

  (*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

Priced publications:

- via EU Bookshop (http://bookshop.europa.eu).

XX-NA-xxxxx-EN-C

JRC Mission

As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle.

EU Science Hub
ec.europa.eu/jrc

@EU_ScienceHub

EU Science Hub - Joint Research Centre

Joint Research Centre

EU Science Hub

Publications Office

doi:xx.xxxx/xxxx

ISBN xxx-xx-xx-xxxxx-x