EuroSDR

Authoritative Data in a European Context

joint project of
EuroSDR – EuroGeographics – KU Leuven

Joep Crompvoets, Stijn Wouters, Maxim Chantillon,
Dominik Kopczewski, Mick Cory, Carol Agius,
Stephan Grimmelikhuijsen

The present publication is the exclusive property of
European Spatial Data Research

EUROPEAN SPATIAL DATA RESEARCH

PRESIDENT 2018 – 2020:
Paul Kane, Ireland

VICE-PRESIDENT 2017 – 2019:
Fabio Remondino, Italy

SECRETARY – GENERAL 2019 – 2023:
Joep Crompvoets, Belgium

DELEGATES BY MEMBER COUNTRY:
Austria: Michael Franzen, Norbert Pfeifer
Belgium: Eric Bayers
Croatia: Ivan Landek, Željko Bačič
Cyprus: Andreas Sokratous, Georgia Papathoma, Andreas Hadjiraftis, Dimitrios Skarlatos
Denmark: Jesper Weng Haar, Tessa Anderson
Estonia: Tambet Tiits, Artu Ellmann
Finland: Juha Hyyppä, Jurkka Tuokko
France: Bénédicte Bucher, Yannick Boucher
Germany: Paul Becker, Lars Bernard
Ireland: Paul Kane, Audrey Martin
Norway: Jon Arne Trollvik, Ivar Maalen-Johansen
Poland: Krzysztof Bakuła
Slovenia: Dalibor Radovan, Peter Prešeren, Marjan Čeh
Spain: Julián Delgado Hernández
Sweden: Tobias Lindholm, Thomas Lithén, Heather Reese
Switzerland: André Streilein, François Golay
The Netherlands: Jantien Stoter, Martijn Rijsdijk
United Kingdom: Sally Cooper, Claire Ellul

ASSOCIATE MEMBERS AND THEIR REPRESENTATIVES:
Esri: Nick Land
Informatie Vlaanderen: Jo Van Valckenborgh
nFrames: Konrad Wenzel
Terratec: Leif Erik Blankenberg
Vexcel: Michael Gruber
1Spatial: Dan Warner

Joep Crompvoets, Stijn Wouters, Maxim Chantillon, Dominik Kopczewski, Mick Cory, Carol Agius, Stephan Grimmelikhuijsen

"Authoritative Data in a European Context"
joint project of EuroSDR – EuroGeographics – KU Leuven

AUTHORITATIVE DATA IN A EUROPEAN CONTEXT

joint project of
EuroSDR – EuroGeographics – KU Leuven

With 6 figures

Joep Crompvoets [a,b], Stijn Wouters [b], Maxim Chantillon [b],
Dominik Kopczewski [c], Mick Cory [c], Carol Agius [c],
Stephan Grimmelikhuijsen [d]

[a] EuroSDR

c/o KU Leuven Public Governance Institute

[b] KU Leuven Public Governance Institute

Parkstraat 45, B-3000 Leuven, Belgium

[c] EuroGeographics AISBL

Head Office

Rue du Nord 76 / Noordstraat 76, 1000 Brussels, Belgium

[d] Utrecht University School of Governance

Bijlhouwerstraat 6, 3511 ZC Utrecht, The Netherlands

Index of Figures

INTRODUCTION

Societies are increasingly digitalizing more and more aspects of daily life. A basic building block for digitalization is data. This data is being integrated within and across public administrations, but also across borders and across the public, private and not-for-profit sectors. High quality data is a necessary criterion to ensure the quality of both public and private digital services and to drive innovation (Debruyne et al., 2017; European Commission, 2016).

The recognition and organization of data as authoritative should be vital not only for ensuring the data quality, but also to foster trust between public sector organizations, between different sectors and across borders (European Commission, 2017). Especially in the context of geospatial data, the exchange and integration of authoritative data has advanced significantly. Important challenges however still need to be addressed (Cravens & Ardoin, 2016).

Authoritative is a term that one often sees or hears when someone is describing geospatial data. Many public mapping, cadastral and land registration agencies promote their geospatial data as authoritative or as created from authoritative sources. Although authoritative data sounds impressive, it is important to understand what it really means.

In a geospatial context, land surveyors were probably the first to use the term authoritative geospatial data and they have been producing authoritative data for some time. Surveyors define authoritative as data that contains a surveyor's professional stamp and that the data can be used for engineering design, determination of property boundaries and permit applications. In essence, the term carries a certification of positional accuracy (Plunkett, 2014).

For decades, if not centuries, national mapping, land registries and cadastral authorities (NMCAs) have been recognized as the official source of geographic information. They were established by states to collect and distribute geospatial (mapping) and map-related data, often for some defined public purpose, such as defence, taxation or protection of property rights. The data provided by these public authorities were habitually presented as authoritative data.

Today, NMCAs are not the only ones providing geospatial data, information and related services. A growing number of different producers and providers of geospatial data, information and services are entering the market, serving different purposes and needs vis-à-vis the users, who are both private and publicly oriented. These new data, information and service producers/providers come from the public, private and community sectors. With this development in mind, there is a need for setting a clear understanding of what is meant by authoritative. When exploring the meaning of the term authoritative geospatial data, issues related to legislation, trust, and certification emerge. The term might be applied only to data that is legislated or regulated. If it is necessary to differentiate data supplied by government agencies from other sources of data, then it is suggested that the discussion should be about trusted data, and what gives rise to such trust. The validation of this type of data might be part of the certification of authoritativeness. For most practitioners, the term usually somehow refers to data that was produced or is approved by some authority.

Besides the meaning of the term, there is also no proper understanding what the added value of authoritative geospatial data is and which policies lead to its successful use. It is also not fully clear how the term is applied and interpreted across Europe. Under different national conditions 'authoritativeness' can be defined in various ways.

The main objective of this report is twofold: 1) to provide a better and more comprehensive understanding of the definition of authoritative data, its rationale, added value(s), challenges, policies, and the organization of authoritative geospatial data across Europe; and 2) to help NMCAs to better produce and sustain the usage of authoritative geospatial data in the (near) future. Moreover, it might enhance a better communication amongst NMCAs about the generic meaning of the topic.

An online survey was undertaken in the summer of 2018 to get an overview of the meanings, interpretations, policies and usages of authoritative data across Europe. A questionnaire was sent to all members of EuroGeographics, who are the national mapping, land registry and cadastral authorities (NMCAs) of Europe. The first results were presented at the General Assembly of EuroGeographics in Prague (October 2018). During the General Assembly, focus group meetings in the form of roundtable discussions were organised that built on the findings of the survey and delved into the challenges, benefits and opportunities of authoritative data. This report presents the results of the online survey as well as the focus groups meetings.

After this short introduction, the followed methodologies of the online survey and focus group meetings are described in Section 2. In Section 3, the results of the online survey and focus group meetings are presented. Section 4 ends with a discussion of the results, while section 5 provides a conclusion. Whereas the authors opted to include a detailed and complete overview of the results in Section 3, the discussion and conclusion section should allow the reader to gain an understanding of the overall topic, the main conclusions and the discussion points.

1 METHODOLOGY

A two-step methodology was applied:

1. An online survey with the members of EuroGeographics was undertaken to get an overview of the definitions, interpretations, policies and usages of authoritative geospatial data across Europe.
2. Focus groups meetings in the shape of roundtable discussions with the members of EuroGeographics were organised that built on the findings of the survey and delved into more detail regarding the definitions, challenges, benefits and future of authoritative data.

Throughout these two steps, feedback from the academic literature was taken into account.

1.1 Survey

As this research aims to create an overview of the different positions taken by the Members of EuroGeographics, it was decided to conduct an online survey during the 2018 summer. Questions were created on the basis of the insights provided in the academic literature, as well as the specific context in which EuroGeographics and its members find themselves. All Members are known to have a strong knowledge concerning geospatial data and relevant policy making. These competences were taken into account when approaching the concept of

"authoritative data". The survey therefore included both closed and open questions serving a double goal. On one hand, it allowed the researchers to collect data based on existing views presented in the academic literature, whereas the open questions gave the possibility to gather more specific information on the positions taken by the respondents and the organizations they represent.

Besides some introductory questions, such as the name of the respondent, the name of the organization and the country, the following 11 main questions were asked:

1. What is the definition that your organization applies with regards to authoritative geospatial data (sets)?
2. What is your opinion about the tentative definition of authoritative geospatial data (sets) presented at the beginning of the survey?
3. The notion of authoritative can relate to different objects (e.g. a specific category of data, a specific data point, an entire data set) and subjects (e.g. an organization). In your country, does authoritative point to one of the following situations?
4. What are the conditions which define geospatial data (sets) as authoritative?
5. What geospatial data (sets) should always be/remain authoritative?
6. Are there quality management programs within your organization that manage the authoritative geospatial data (sets)?
7. Are authoritative geospatial data (sets) currently used when formulating your national policies?
8. Are there any situations when government entities or organizations (e.g. emergency services) are required (i.e. compulsory) to use authoritative geospatial data (sets)?
9. Is there a formalised approach (e.g. strategy, legal framework, operational framework towards authoritative geospatial data (sets)?
10. Which organization(s) is / are responsible for the validation of authoritative geospatial data (sets)?
11. Is your organization restricted by any of the following issues related to practical management of authoritative geospatial data (sets) in your country?
12. How would your organization like to see authoritative geospatial data (sets) being developed in the next five year?

The questionnaire was sent to the 63 Permanent Correspondents (organizations in 46 countries) of the NMCA members of EuroGeographics.

The data was cleaned and a simple analysis was executed, based on a number of qualitative and quantitative analysis techniques.

1.2   Focus group meetings

A focus group meeting is a good way to gather together people from diverse backgrounds or experiences to discuss a specific topic of interest. In our case, we gathered executives of national mapping, cadastral and land registration agencies in Europe to discuss issues related to authoritative data including definitions, benefits, policies, and future developments. A focus group is a small but diverse group of people whose reactions are studied in guided or open discussions about a specific topic – in our case a guided discussion about authoritative data – to determine the reactions that can be expected from a larger population (Marshall & Rossman, 1999). This qualitative research approach complements with the survey results and

provide more detail. Participants are asked about their perceptions, opinions, beliefs, and attitude towards the topic.

Questions are asked in an interactive group setting where participants are free to talk with other group members. In our case the group setting was based on a roundtable construction in which each person is given equal right to participate. The discussion was led by a moderator who was familiar with the topic. During the discussion, another person either took notes or recorded the vital points he or she was getting from the group. Beforehand, a set of discussion questions were prepared. These questions were mainly derived from the survey results that needed further explanation/understanding. The following questions formed the basis for the roundtable discussions:

1. What is authoritative data for you?
2. How important is it for you that your data is labelled as 'authoritative'?
3. What is the value of your data that is labelled as 'authoritative'?
4. Do you have use cases/examples that clearly illustrate the benefits of authoritative data?
5. Do you have use cases/examples in which no authoritative data was used, but would have been useful?
6. Is there a need for having international-wide approach towards authoritative data?
7. Do you think that there is a future for authoritative data? If yes, then what needs to be done to sustain the usage of authoritative data in the future?

The focus group meetings took place in the afternoon of 8 October 2018 as part of the annual General Assembly of EuroGeographics. An important event in which the executives of most European national mapping, cadastral and land registration agencies participate. Before the focus group meetings, the topic authoritative data was briefly introduced and the preliminary survey results were presented. In total, 94 people participated in one of the 10 arranged roundtable discussions. All the notes of each roundtable were collected and analyzed afterwards.

2 RESULTS

2.1 Survey

2.1.1 Response and organizational characteristics

The online survey was launched on 26 June 2018 and remained open until 25 October 2018. A first reminder was sent in the week of 25 July 2018, and a second one in the week of 9 August 2018. In addition, an oral reminder was given during the General Assembly of EuroGeographics (8 October 2018) followed by a fourth reminder that was sent 12 October 2018. In parallel, several Members were individually reminded. Overall, 37 responses from 31 countries were received. In terms of organizations, the response rate was 37/63 (59%). In terms of countries, the response rate was 31/46 (67%). In comparison with similar studies, these responses rates are very high.

The countries that responded were: Croatia, Cyprus, Czech Republic, Denmark (2), Estonia, Finland, France, Georgia, Germany (2), Hungary, Iceland (2), Ireland, Italy, Latvia (3), Lithuania, Luxembourg, Macedonia (FYROM), Moldova, Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, and United Kingdom (3).

Between brackets the number of responding organizations per country can be found in case that two or three organizations per country responded.

As one of the start-up questions, the respondents were asked if the responsibility of their organization covers (national) mapping, cadastre, geodetic survey, and/or land registration. Most respondents mentioned that their organization is responsible for (national) mapping (82%) (see Figure 1). A majority of respondents also mentioned that the responsibility of their organization covers geodetic survey (74%) and/or cadastre (71%). 44% of respondents mentioned that land registration falls under their organizational responsibility.

ORGANIZATIONAL RESPONSIBILITY

LAND REGISTRATION	44,1
CADASTRE	70,6
GEODETIC SURVEY	73,5
MAPPING	82,4

PERCENTAGE
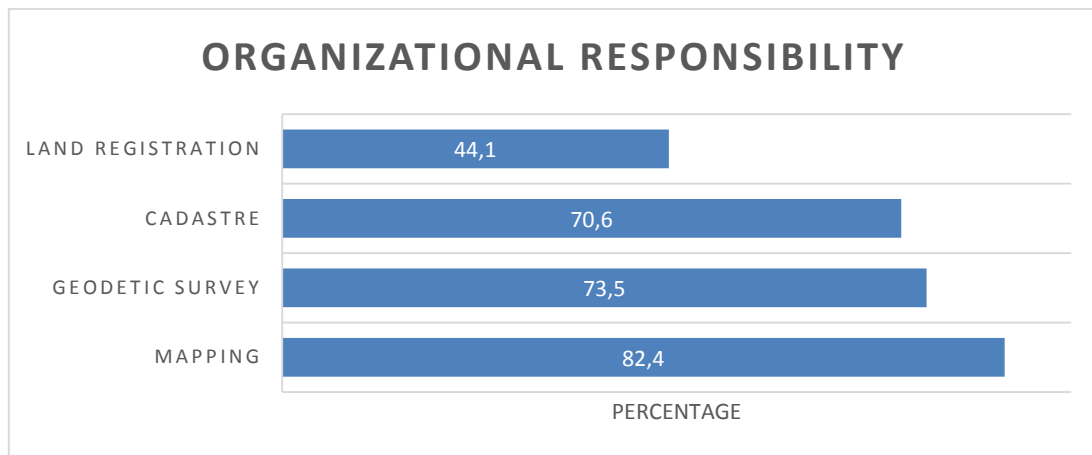
Figure 1: Organizational responsibility (in %)

2.1.2 Definitions

Four survey questions referred to the definition of authoritative data and their coverage.

Respondents were asked the following question: *'What is the definition that your organization applies with regards to authoritative geospatial data (sets)? (Q1)'*

From the 37 respondents, 21 respondents were able to give a definition (60%). From the 20 definitions, 13 definitions made reference to legal/official aspects of authoritative data, 12 definitions made reference to the provision by a public authority, and 3 definitions referred to reference data. 4 definitions were exactly the same as the definition presented at the beginning of the survey. Only 5 respondents mentioned that the given definition was officially approved by their organization.

At the start of the survey, a tentative definition for authoritative data (sets) was presented: *"Data provided by or on behalf of a public body (authority) which has an official mandate to provide it"*. This definition was introduced in the European Location Framework. In this context, the following was question was asked: *'What is your opinion about the tentative definition of authoritative geospatial data (sets) presented at the beginning of the survey? (Q2)'*

From the 35 responses, 30 (strongly) support the tentative definition (86%).

Additional remarks (for strengthening the definition) were given:

- Authoritative data has to originate solely from one authoritative organization;
- All data provided by a public body is not automatically authoritative data;

- Authoritative data is "stamped" by a designated public body, and agreed across the public sector;
- Definition could be completed with other characteristics: veracity, objectivity;
- Definition could be more explicit and exact defining liability, reuse of data;
- Aspect of full right to the data regarding reuse is not touched upon;
- There might be exceptions that data are authoritative even though an organization has no official mandate to provide it. This can be for example the case when new data is created for which no actor has received an official mandate.

One response indicated that the definition is vague as it does not say anything about data precision, reliability and responsibility.

In the Discussion Section of this Report, a new definition is suggested which is based on the tentative definition and that into account the remarks made by the respondents.

The next survey question was the following: The notion of authoritative can relate to different objects (e.g. a specific category of data, a specific data point, an entire data set) and subjects (e.g. an organization). *'In your country, does authoritative point to one of the following situations? (Q3)'* The respondents could tick all the relevant options.

From the answers, it appears that authoritative data can relate to a variety of objects and subjects within and across countries. For almost half of the respondents, it is the data or part of the data in the dataset (44%) (see Figure 2). For more than half of the respondents (56%), it relates to the dataset as a whole. For almost 60%, it relates to all data that is collected and/or managed by the authoritative organization. The results clearly indicate that authoritative data cover different objects and subjects and so the coverage is not straightforward.
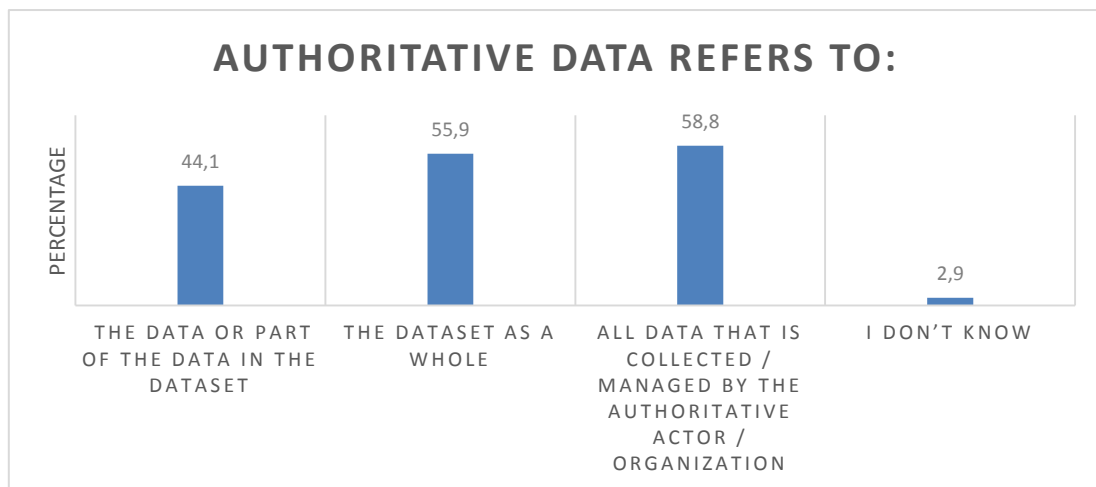
Figure 2: Authoritative data coverage in terms of objects and subjects (in %)

The fourth question referred to *'the conditions which define geospatial data (sets) as authoritative (Q4)'.* Respondents were in the position to tick all the relevant options.

Concerning the conditions which define data as authoritative, almost all respondents indicate input legitimacy as a prominent factor (i.e. 'Supplied by a recognised public authority' (94%) and 'Derived from a trusted source' (71%) (see Figure 3). 'Having a high quality'

(47%), 'Being institutionalized' (44%), and 'Existence of licensing agreements' (38%) are indicated by a significant number of respondents, while all other conditions appear of less importance.
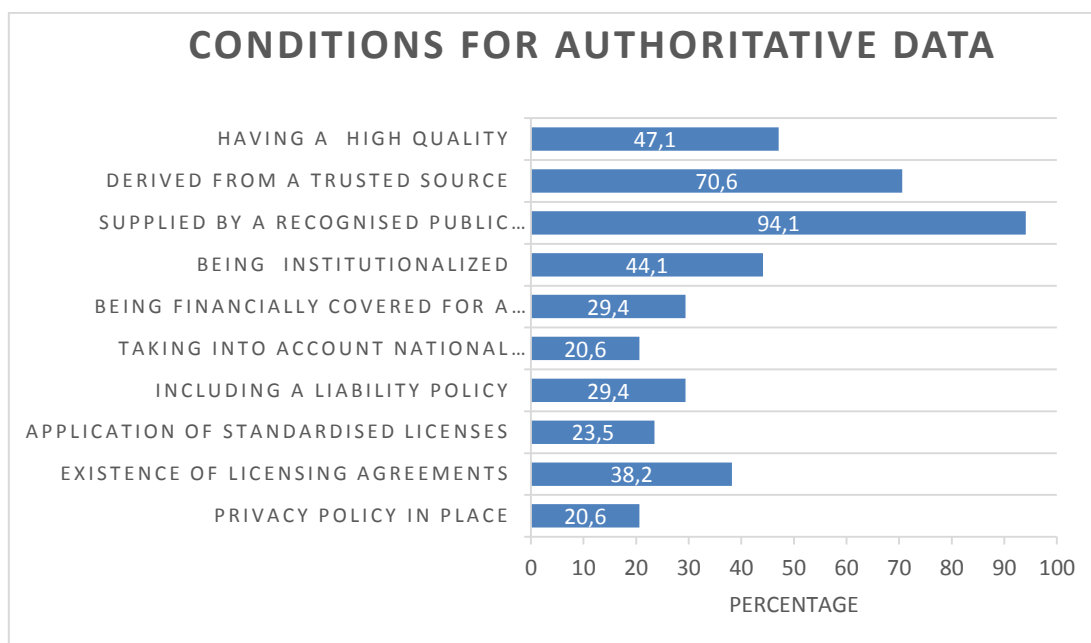
Figure 3: Conditions for authoritative data (in %)

2.1.3 Characterisation of Authoritative datasets

Three survey questions referred to the characterisation of the key authoritative datasets (being type, quality, and usage).

Respondents were asked to answer the following question: *'What geospatial data (sets) should always be/remain authoritative? (Q5)'* Respondents were allowed to tick all the relevant options.

Many members agreed on a wide set of necessary authoritative datasets, with 'Cadastral parcels' (94%), 'Administrative boundaries' (92%), and 'Addresses' (92%) as the most listed datasets (see Figure 4). In addition, it is notable that the percentage for each of the presented datasets is above 50%.

Respondents were allowed to add other geospatial data (sets) that should always/remain authoritative. Examples of other datasets were: land registry data, land cover, land use, geodetic framework, urban plans, and utilities.
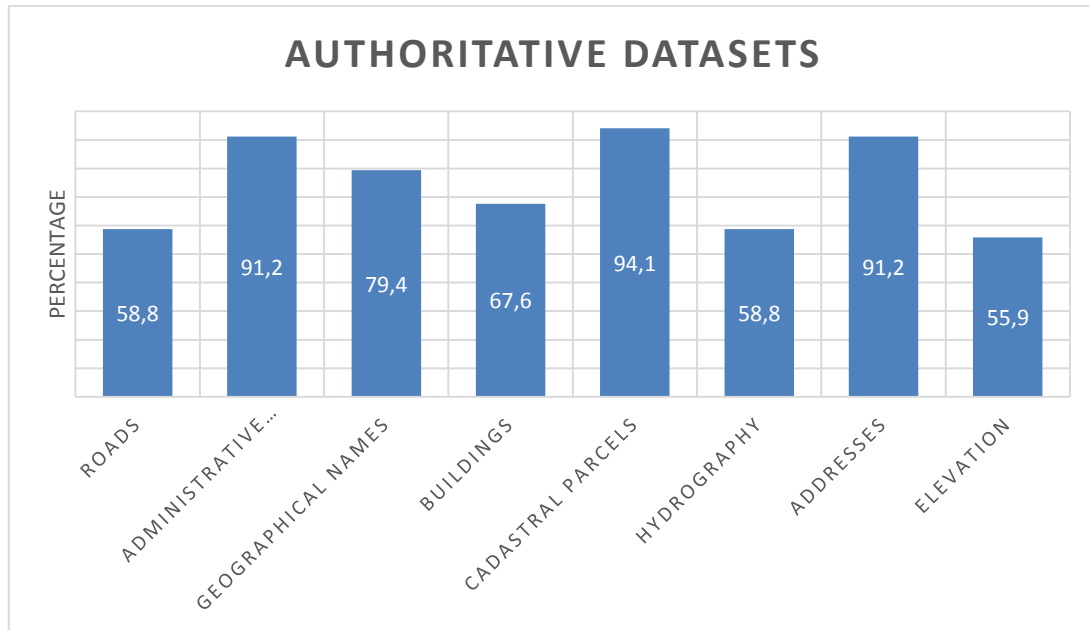
Figure 4: Geospatial data (sets) that should always be/remain authoritative

The next question was: *'Are there quality management programs within your organization that manage the authoritative geospatial data (sets)? (Q6)'*

Most respondents answered this question with 'Yes' (82%). This strongly indicates that quality is a very important aspect in the management of authoritative geospatial data.

If the answer was ''Yes', then the respondents were able to comment on their response. A number of comments were provided by the respondents:

- Data coming from the private sector are automatically verified and randomly tested. Quality indexes are produced and continuously monitored. Several projects to increase quality are ongoing;

- We run quality checks continuously;

- Validation rules which can be expanded;

- The Centre of Registers validates the data (vertex points of surveyed land parcels) provided by surveyors before entering in the cadastral map;

- Compliance with standards, data updating and validation;

- Each provider has to manage the quality of their data;

- Specific requirements are included in law regulations.

The next question was: *'Are authoritative geospatial data (sets) currently used when formulating your national policies? (Q7)'* A majority of the respondents answered this question with 'Yes' (72%). It is surprising that some respondents did not know how the data was being used (as 14% of the respondents answered the question with 'Don't know') .

The last question related to the characterisation of authoritative datasets was: *'Are there any situations when government entities or organizations (e.g. emergency services) are required*

(i.e. compulsory) to use authoritative geospatial data (sets)? (Q8)' 80% of the respondents point to the obligation to use authoritative data (in general or in some specific circumstances). It is worth noting that 14% responded this question with 'No'. Finally, almost no additional comments were given concerning this question.

2.1.4 Governance

The next set of questions are associated with issues related to the governance of authoritative geospatial data.

The first question refers to the approach of governance: *'Is there a formalised approach (e.g. strategy, legal framework, operational framework) towards authoritative geospatial data (sets)? (Q9)'*

81% of the respondents answered this question with 'Yes'.

If yes, then the respondents could tick all approaches that apply (Figure 5). The results indicate a wide variety of strategic, legal and organizational features among the Members of EuroGeographics. Most respondents ticked National legal framework (65%) followed by National strategy/policy (59%), The approaches referring to organizational features are also significant: Strategy at the level of the organization (44%) and Organizational structure (38%). Approaches referring to the regional and local levels show low percentages.

FORMALIZED APPROACH

	Percentage
NATIONAL STRATEGY/POLICY	58,8
REGIONAL STRATEGIES/POLICIES	14,7
LOCAL STRATEGIES/POLICIES	8,8
STRATEGY AT THE LEVEL OF THE ORGANIZATION	44,1
NATIONAL LEGAL FRAMEWORK	64,7
REGIONAL LEGAL FRAMEWORK	11,8
ORGANIZATIONAL STRUCTURE	38,2
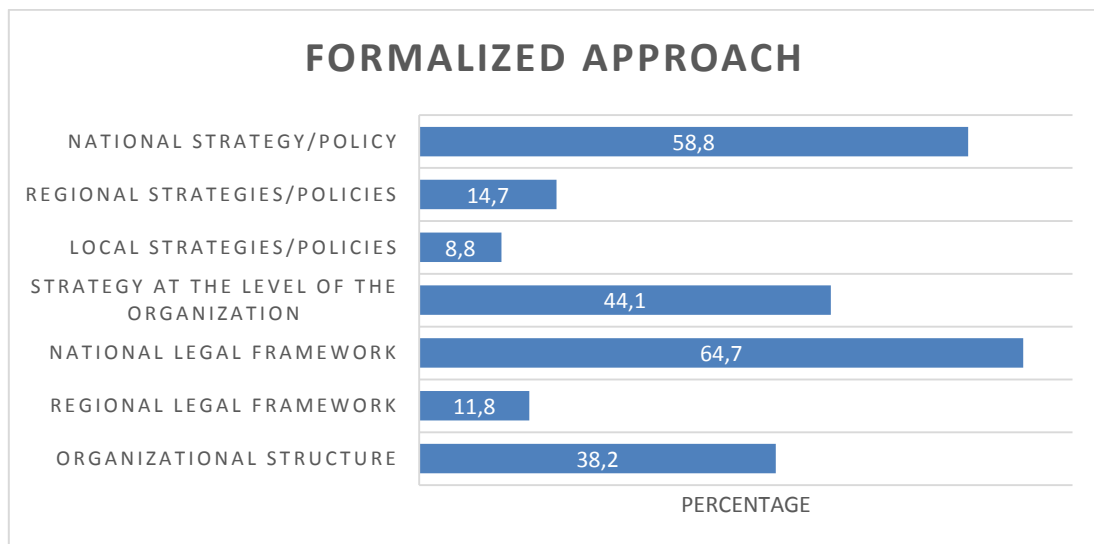
Figure 5: Formalised approaches toward authoritative geospatial data (sets) (in %)

Those respondents that answered the question that there is a formalized approach had the opportunity to answer a sub-question: Please specify what is your organization's role in this approach? The following roles were given in sequence of frequency: producer, authority, registry, supplier, provider, collector, coordinator, project manager, and validator. Many organizations provided more than one role.

A second follow-up question was the following: Please specify whether there is a role for the private sector and/or private sector data (sets) in the approach?

59% of the respondents mentioned that there is a role of the private sector in the approach. Many referred to land surveyors who have a stake in the approach. 41% of the respondents mentioned that there is no role of the private sector in the approach besides being a user.

The final and third sub-question related to the governance approach: Would it be beneficial for your organization if your country develops an approach towards authoritative geospatial data (sets)? All respondents had the opportunity to answer this last sub-question including the ones who answered that there is no formalized approach to authoritative data.

While most countries have adopted strategies and legal frameworks at various levels of government (depending on the institutional structure), and more than half of the respondents have a strategy at the organizational level, the survey indicates that 83% of the respondents emphasize the need for an approach towards authoritative data.

The next governance question was the following: *'Which organization(s) is / are responsible for the validation of authoritative geospatial data (sets)? (Q10)'*

Most respondents answered that it is the authority defined in the law or mentioned the name of their own organization. A few respondents explicitly referred to the organization that provides the data (sets). In most federal countries, the responsibilities are allocated to authorities operating at different levels of administration.

The final governance question was: *'Is your organization restricted by any of the following issues related to practical management of authoritative geospatial data (sets) in your country? (Q11)'*

From the results it was clear that the organizations face a variety of restrictions in the practical management of authoritative data (Figure 6). 56% of respondents point out 'National security', while 47% indicate 'Privacy' and 'Licensing' as a restriction. Other factors (e.g. IPR (41%), Funding (35%), Access (35%), Quality (32%) , Authority (18%)) are much less prominent.

RESTRICTIONS

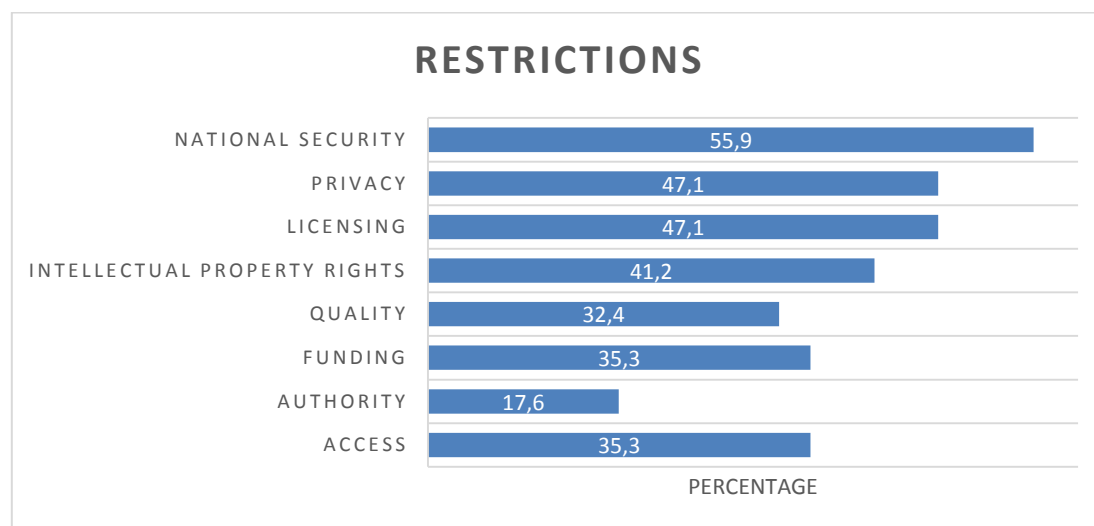|	PERCENTAGE
NATIONAL SECURITY	55,9
PRIVACY	47,1
LICENSING	47,1
INTELLECTUAL PROPERTY RIGHTS	41,2
QUALITY	32,4
FUNDING	35,3
AUTHORITY	17,6
ACCESS	35,3

Figure 6: Restrictions related to practical management of authoritative geospatial data (sets) (in %)

2.1.5   Future developments

The last survey question dealt with the future developments of authoritative geospatial datasets: *'How would your organization like to see authoritative geospatial data (sets) being developed in the next five years? (Q12)'* Respondents had to answer this question both from their country as well as the European perspective.

The responses at the country level were diverse, some respondents had no specific expectations for the developments in the next five years whereas others referred to a number of potential developments. The most frequently mentioned answers referred to developments related to data quality, data quality management control, legislation, governance (in terms of strategy development, structure, coordination, and responsibilities), open data, data accessibility, standardization/harmonization and user-centricity.

The responses towards the potential developments at the European level are less diverse. A similar picture as the one at country level appeared. The answers of those who have clear expectations were however less diversified. Developments related to data harmonization/standardization, governance (in terms of a coordination body or cross-border management), and INSPIRE implementation/usage stood out. A few respondents referred to developments related to data quality, data accessibility, open data, and legislation.

2.2   Focus group meetings

After an introductory session about authoritative data (including the presentation of the preliminary survey results), a number of focus group meetings in the shape of roundtables were organised in Prague at the EuroGeographics General Assembly on 8 October 2018. In total, 10 roundtables were set up whereby 95 participants joined the discussions. Most of the participants were executives of national mapping, cadastral or land registration agencies across Europe.

The participants came from the following countries: Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia & Herzegovina, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Iceland, Ireland, Italy, Kosovo, Latvia, Lithuania, Macedonia (FYROM), Moldova, Netherlands, Norway, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, and United Kingdom.

Before the discussions started the procedure was explained and the discussion questions were introduced. The duration of the focus group meetings was around 1.5 hours.

2.2.1   Question: What is authoritative data for you?

A similar question was asked in the online survey. From the survey it became clear that authoritative data needs somehow to be linked to the provision of data by a (public) authority which is legally binding. In some countries, the term *reference data* is used as an alternative. The discussions in focus groups complement the answers of the survey as the outcomes give a much more comprehensive and detailed picture about the meaning of authoritative data.

From the discussions, numerous characteristics of authoritative data emerged. These include: legally binding, accountability, uniqueness, mandate, mandatory use, liability, official, (public) authority provision, reference data, trusted, standardized, continuity, high quality, quality management system, certified, traceability, maintained, usage, accessibility, and understood. Each of the terms will be briefly introduced and/or explained. It is worth noting

that the terms legally binding, accountability, uniqueness, mandate, mandatory use, liability, and official refer somehow to the legal aspect of authoritative data. Meanwhile high quality, quality management system, certified, traceability and maintained refer to the quality aspect. In addition, it is good to mention that authoritative data cover most of these characteristics but does not necessarily have these all at the time. Moreover, there are strong dependencies among the characteristics. One characteristic could be a vital condition for another.

Legally binding

Many participants strongly stated that authoritative data has to be legally binding. According to several participants, the term authoritative should only be applied to data that is legislated or regulated. It has to be officially recognised by a reference in law. If authoritative data is not embedded in legislation, it can never be labelled as authoritative. Many participants stated that authoritative should mostly be produced and collected by legal obligation. In addition, several participants mentioned that the usage of authoritative data should be legally regulated forcing stakeholders to use it. This legally binding characteristic is a vital condition for authoritative data that to become trusted by society.

Official

Several participants used the term "official", i.e. set by the law. According to them, authoritative data as official data relates somehow to an authority or public body and its activities and responsibilities. "Official" could refer to the data itself or to the organization that produces, provides, and/or maintained.

Accountability

Some participants referred to the need that there is somehow an organization that is legally accountable for the data production, provision, high quality, and/or maintenance of authoritative data. Few participants stated that organizations should be accountable but not necessarily be liable.

Uniqueness

The uniqueness refers to the authoritative data as an object as well as the role performed by the organization which provides the data. According to the respondents, a dataset that stands out from other datasets by its characteristics is 'unique'. Unique is also the provision of authoritative data by giving one organization the sole rights to produce and/or provide for a wide use

Mandate

This characteristic links strongly to the legally binding aspect of authoritative data. It refers to the legal mandate by authority, produced, processed and issued by authority.

Mandatory Use

This characteristic refers to the mandate that other (public) authorities (and other stakeholders) are legally obliged to solely use authoritative data and no other data. As such, authoritative data has been given a higher usage priority.

Liability

The participants did not fully agree if liability is a full characteristic of authoritative data. Most of the participants agreed that authoritative organizations should be accountable for the

data production, provision or maintenance. The participants are less clear about the liability issue. Some participants strongly stated that their organizations are liable for their 'authoritative' actions and products with all the consequences, meanwhile others are not. The implementation of quality management systems enhances the assurance of liability in many organizations. In this context, few participants underlined that authoritative data is not about quality but more about liability.

(Public) Authority provision

Authoritative data refers to data provided by or on behalf a (public) authority body. A few participants added that authoritative data should be also produced, maintained and/or certified by the authority body. It is hereby however not fully clear if authoritative data also has to come from a public entity or not. Some participants stated that authoritative data could be also provided (produced, maintained) by private companies (e.g. by means of outsourcing). Private companies are not in the position to officially certify data as authoritative data. Moreover, many participants agreed that not every dataset provided (produced, maintained) by a public entity should be labelled as authoritative. Some participants asked themselves if the discussion should be about the necessity to differentiate the source of data provision (production, maintenance) by public agencies from other sources of data.

Reference data

In some counties the term reference data is preferred. In these countries, reference data is more than authoritative data and based on the law. It also includes the obligation that it is mandatory for everybody to use this data.

Trust

Although trust did not appear in the online survey, it formed an important topic in the roundtable discussions. Trust is a rather vague topic that is difficult to grasp in its full extent. In order to be widely used in society and to be applied in essential public tasks, it is important that the authoritative data can be trusted. Several characteristics that have already been mentioned are a key condition to reach trust (e.g. characteristics such as legally binding, accountability, official status, authority provision, standardized, high quality, accessibility of authoritative data). It is crucial to provide data that can be trusted by the users in the long term or to build a lasting organizational trust. However, this is a long and complicated process that has to address validation and correction of existing data, implementation of standards and quality control instruments in the collection, production, maintenance and updating processes as well as securing access to the data in future.

Harmonization & standardization

In order to enhance trust and usage, it is important that authoritative datasets are harmonised and the production and maintenance processes/procedures/protocols are specified according to international standards that are defined in relevant regulations.

Continuity

It is important that authoritative data has a long lasting trust. This could be achieved by having building up a tradition in the production, maintenance and/or provision of highly qualitative data that are backed up by legislation. Many datasets of NMCAs have been

successfully institutionalised during the years. This recognition can be a guarantee that the NMCAs are able to produce, maintain and provide authoritative data well.

High Quality

It is assumed to be one of the critical attributes of authoritative data that the quality of authoritative data is higher than the quality of competing data and that correct data enhances the appetite for more quality of data. Data quality is a wide topic and includes issues related to geometric accuracy, precision, updates, and reliability. All these issues have to be taken into account when dealing with the high quality and reliability of authoritative data. Users need reliable data to sue in the business processes. They need to have a guarantee that the data used is good or certified for their activities and/or products. Moreover, users do not want to be liable for their data and prefer to shift the responsibilities to recognized authorities as they are obliged to keep the data updated and accurate. Finally, it is important that the quality of authoritative data is defined in the relevant regulations (e.g. frequency in delivering updated versions).

Quality management system

It is important that the validation of high quality of authoritative data is assured as authorities are often liable for their data produced, provided or maintained. This could be achieved by establishing a quality management system specifically developed for securing validation processes of certain authoritative datasets. These validations must be part of the certification of authoritativeness and should be made as transparent as possible.

Certified

Authoritativeness is a kind of status. Therefore, this authoritativeness needs to be defined and validated. When data are produced by third parties, the data needs to be validated on the basis of a set of standardized criteria. As a recognition that all the criteria are achieved, the dataset can be certified as authoritative.

Traceability

According to several participants, an important condition for data to be labelled as authoritative is that the data generation has to be fully traceable with clear documentation of the process of how the data has been created and/or maintained. It is an important quality specification.

Maintenance

Several participants strongly stated that the data needs not only to be produced by a (public) authority but also needs to be maintained in order to fully receive the label of authoritative data. It is therefore crucial to communicate how the authoritative date are maintained and how it will be updated in the future.

Usage

Many participants referred to the usage of authoritative data. Different, sometimes conflicting, aspects of usage were mentioned such as size (used by everyone, all public authorities, a selected group of public authorities), purpose (for public policy, non-commercial or enhancement of public values), obligation to use or not to use, and degree of usability (is it easy to use or not necessary to use).

In order to provide trusted data, participants mentioned that authoritative data also needs to be accessible to users. When the authoritative data is accessible, the usage of the data could be significantly increased and become more trusted. Accessibility could be enhanced by providing authoritative data via geoportals or other relevant platforms. Important to underline is the fact that the participants gave very conflicting responses on whether or not the data needs to be open and/or free.

Understood

Finally, it is important that all the stakeholders understand the meaning and value of using authoritative data. Education, training, capacity building and communication are vital means to enhance the meaning as well as the value of authoritative data use. It will contribute to the creation of stronger authoritative data and more effective usage.

2.2.2   Question: How important is it for you that your data is labelled as 'authoritative'?

One roundtable described "authoritativeness of data" as a label meaning that an organization is granted a legal mandate to collect and maintain certain information which serves a concrete purpose or a task within the public administration. This relates to several responsibilities of public authorities, including: securing legal rights and ownership of lands, proper and actual addressing, zoning and planning, administrative divisions, public infrastructure and other aspects that have to be taken into consideration in the decision-making processes within the public administration. In other words, authoritative decisions can be (only) made based on authoritative data.

According to most participants, it is very important that some of their data is labelled as authoritative. NMCAs might lose part of the 'market' if their data is not labelled as authoritative. In general, it can be assumed that the user will likely give higher credits for authoritative data, compared with other data; e.g. the use of authoritative data would potentially lead to the avoidance of conflicts by citizens as they are/feel more (legally) secured. In order to be labelled authoritative data, agreed rules and/or protocols need to followed and independent entities need to check if these rules and/or protocols are respected. It is very likely that governments will invest more in updates and other kind of support related to authoritative data than to data that are not labelled as authoritative. This all means that data labelled as authoritative will likely be more used by public authorities and other stakeholders and that their demand will be higher when the data are not labelled authoritative. In this context, investments in the improved accessibility of data is a must to facilitate the usage of the authoritative data.

2.2.3   Question: What is the value of your data that is labelled as 'authoritative'?

None of the roundtables gave a straightforward answer to this question. Most participants consider the value of their data that is labelled as authoritative as (very) high. The value of authoritative data seems somehow be translated in terms of trust, data quality, guaranteed data usage, guaranteed public service usage, enhanced interoperability at technical, semantic, organizational and legal levels. One roundtable considers the highest value of authoritative data that these datasets are trusted by default, and so the best what is available. An important condition to keep the value of authoritative data at high level is that these datasets are rather easily accessible, in particular for other public authorities.

2.2.4   Question: Do you have use cases/examples that clearly illustrate the benefits of authoritative data?

The participants provided a number of examples illustrating the benefits of authoritative data. An overview of the provided examples can be found hereunder:

Example from Germany

ALKIS® (Amtliches Liegenschaftskataster-Informationssystem) is the Official Real Estate Cadastre Information System in Germany. The nationwide implementation of ALKIS® is nearing completion. Although in Germany the official surveying and mapping is assigned to the Laender, and consequently the responsibility for the implementation is up to each of the 16 Laender, the coordinating role of the Working Committee of the Surveying Authorities of the Laender ensures uniformity.

With ALKIS®, the data of the Real Estate Cadastre are managed in one single system for the first time. So far there were two separate process solutions: on the one hand the Automated Real Estate Register managing the semantic data, and on the other hand the Automated Real Estate Map managing the graphic data. With ALKIS®, a new cadastre standard is implemented. This has a number of advantages: Uniform object-structured data model, integrated management of graphic and semantic data, international standards are considered, standardized exchange interface, standardized description language, management of metadata and data quality.

ALKIS® is one of the greatest changes in the history of the official surveying and mapping in Germany. It is the base for many other geospatial data and has a great importance especially for the tax administration, for the official area statistics, for the standard ground values and in future for the object-structured land register database. It provides a huge potential as a standardized database for many thematic applications. For this reason a new step of data processing in the official German surveying and mapping will be reached. Finally, it has to be underlined that this authoritative system makes an important contribution to the geospatial data infrastructure of the Laender and of the federal government in the context of INSPIRE. And it is especially INSPIRE that brings a substantial boost to e-government, to interoperability and to online services.

Example from the Czech Republic

Since July 2012 the Czech Republic authoritative location data are generated by the Base Registry called RUIAN, which stands for Territorial Identification, Addresses and Real Estates. RUIAN is a reference source of location data according to the Czech Law, which defined 'reference data' as trustful data. The other Base registries, and through them also other subject oriented information systems and applications, use the RUIAN location information in their policies and any related decision making, planning, evaluation etc. Users of the data are for example the building authorities, the emergency and healthcare services, the police etc. Also the organization of the elections is based on the data: In the preparatory phase, to communicate and deal with the voters transparently and efficiently and also as a basis for elaborating, presenting and analysing election results in further stages.

Furthermore, as the RUIAN data are published in the open data regime for further re-use, their usage is extremely broad. The private sector uses the web map services of the Cadastre and the RUIAN open data in their applications – urban development, energy providers, telecommunications, agriculture, forestry, air pollution policy, property management or travel routs planning, insurance companies, postal services, accommodation services etc.

Finally, in addition to the RUIAN data, CUZK and its Land Survey Office provide a broad range of topographic data via their geoportal. These are authoritative in the sense that the CUZK and the Land Survey Office are the official provider of the data. In contrast to RUIAN data, these topographic data are however not reference data for the public and private sector.

Example from Switzerland

Currently, the Swiss Authorities, with a specific role for Federal Office for Topography, i.e. Swisstopo as well as the Swiss Cadastre and the Cantonal Geospatial Offices, are working on the development of Swiss geospatial official dataset. A particular example is the official dataset of addresses. The dataset aims to contain the address attributes as well as the building coordinates of all buildings known to the Swiss administration. Currently, there are several lists and the administration aims to develop one official list to be published as open data via a specific licence. In this way not only the public administration can benefit from such an official dataset, but also the private sector. The basic logic behind this work is the reasoning that good baseline data can help authorities as well as other stakeholders in developing better policies, with particular attention for their e-government developments. In particular, such a common official dataset ensures that the data is complete, official and up-to-date. The Swiss state aims to have an official and coordinated dataset of all its addresses, buildings and streets by the end of 2020.

Examples from Turkey

The administrative units in Turkey are used as a reference for sharing/distributing the taxpayers funds amongst regional governments. Also authoritative sea level data is used by private industry for building new constructions (harbours) in Turkey. A final example deals with low flight barriers. Those were not available in Turkey and it caused several fatal accidents. The prevention is organized now since the authoritative data became available to the public.

Example from Belarus

TomTom and HERE captured navigational data in Belarus. The processes were not well organized, narrow commercially oriented, and covered only the biggest cities. Now, due to the use of relevant authoritative data, there is full coverage with high quality. The NMCA received more feedback on the quality of its data from a wider group of users.

2.2.5   Question: Do you have use cases/examples in which no authoritative data was used, but would have been useful?

The participants provided some limited of examples in which no authoritative data was used, but would have useful. The examples that were given were the following:

- Building private houses. The NMCA identified risk of flooding, but the municipal level provided permission to build the houses based on generic geospatial data. Result of court case: NMCA was right;

- Environmental data for disaster management needs authoritative data;

- The agency responsible for classification of forest allowed a private company to do the forest mapping. The geometric accuracy was OK, but the accuracy was not sufficiently adequate for the required forest classification with the result that the published data were not trustworthy;

- There are many errors in commercial navigational data, and better quality could be achieved by utilizing authoritative data also;

- Integration of state registers would not be achieved without authoritative data;

- Due to an insufficiently developed legal framework and non-response of the respective authority to the market needs, an address register was created "by the market" (post office) with the result that half of the population remained without addresses in the official address register.

2.2.6 Question: Is there a need for having an international-wide approach towards authoritative data?

In general the participants agreed that there is a need for having an international-wide approach towards authoritative data. However, whether authoritative data matters strongly depends on the user/use case. A good example might be the need to deliver authoritative data in the context of monitoring/comparing the performance of the UN Sustainable Development Goals. Identifying other relevant international user/use case would be a first step towards the necessary international approach. Existing pan-European authoritative datasets prove that national authorities are already not operating alone and that their data is relevant in the broader context. These pan-European datasets also show that the user can rely on NMCAs as an authoritative source for standardized, trusted, and high quality information.

A structured/systematic international-wide approach does not properly exist yet. The European Union INSPIRE Directive (2007) and its subsequent implementation could however be considered as a good start. The participants mentioned that if the INSPIRE standards are applied to all relevant datasets then it should contribute to the integration of organizations and datasets with the result that stakeholders can use information of higher value.

Besides the identification of good international use cases, it is also important to identify the expectations of the users as one of the first steps in the international-wide approach development. In addition, a commonly shared definition for authoritative data at this stage is a must as this would be the foundation for a better understanding of the roles of all the stakeholders involved as well as the associated impacts for the different stakeholders.

It was underlined by the respondents that all the strategy developers and data providers involved need to have a common understanding of the approach. Also, a strong strategy plan with a clear roadmap need to be set up. Moreover, mutual agreements on the content of the authoritative data would be needed for the production of these international-wide datasets. In turn, these international agreements towards authoritative data could help positioning the national definitions of authoritative data in most European countries.

Participants also recommended that the focus of the approach should be on the authoritative data and not the organizations involved as the authoritative data should survive associated re-organizations and reforms.

A final recommendation given by the participants is that it would be good to have a reference in international policy or position when developing the internationally-wide approach – for example the INSPIRE Directive though with a lot of shortcomings it had to be institutionalised into National Spatial Data Infrastructures.

2.2.7   Question: Do you think that there is a future for authoritative data? If yes, then what needs to be done to sustain the usage of authoritative data in the future?

The participants strongly stated that there is definitely a future for authoritative data, but only for a limited number of datasets (at least for addresses, cadastral and administrative boundaries).

If NMCAs would have no future, then they do not have a purpose. Authoritative geospatial data are core business and a unique selling point of NMCAs. There will always be a need for public authorities to provide and use authoritative data as they are the only ones required to be used in numerous key public policy and delivery processes. It is likely that authoritative data will become even more important when more public processes will be more automated in which there will be less opportunity to intervene in the processes. This means that data in these automated processed will strongly depend on standardized, high qualitative and legally binding datasets – so authoritative data. The participants also indicated that the use of authoritative data provides an excellent means to better detect (public) fraud.

The participants also indicated that there might be a need to distinguish two types of authoritative data; a core set of datasets that always have to remain authoritative (e.g., for military or national security reasons) vs. a set of associated datasets. This set of core datasets can only be provided by public institutions. To a certain extent, topographic data can be collected by companies or citizens, however the authoritativeness of topographic data can be important when associated with (administrative) boundaries.

Some of the key responsibilities of modern welfare states include military, social welfare, justice, or spatial planning tasks. These tasks strongly demand authoritative data and moreover, citizens assume that these public tasks are simply executed by default, but they will however not be executed (correctly) if there is no authoritative data.

Authoritative data have a cost for data acquisition, collection, storage, maintenance and distribution, and cannot simply compete with data provided by private companies. A question that does arise is the conflict that arises when public authorities are required to sell their data to third parties. The participants underlined that there is no such conflict as it is just a discussion of funding policy. In this context, it is also important to underline that non-public authorities are able to provide authoritative data, see PSMA in Australia[1]. It is as such not the sole tasks of public authorities.

In response to the second part of the question, participants gave a set of recommendations to sustain the usage of authoritative data in the future.

The first recommendations refer to the legally oriented recommendations:

- Authoritative data needs to be registered in laws and regulations in order to ensure that this data is available into the future and is not manipulated. If someone would like to change it then they need to legally challenge and/or question it.

- Ensure the legally binding aspect of authoritative data. A citizen can decide if he/she uses data from the state, or another source, but if a judge needs to make a verdict he will always refer to authoritative data, because the law states it.

---

[1] Although PSMA Australia Limited is a company, it has to be underlined that it is owned by all the governments of Australia.

- Validate crowdsourced data by an expert in order to be certified as an authoritative source.

Several recommendations also refer to trust as an important future element.

- Open authoritative data in order to enhance public transparency and allow users to give feedback;

- Focus on the public values of authoritative data serving the general public interest;

- Do not focus only on the possible profits;

- Be persistent in order to guarantee that the data will be kept available and provides continuity.

It is also strongly recommended to make the existing authoritative data as used as widely as possible to ensure it meets future needs. This could be achieved by opening the data and by improving its accessibility, for example via popular platforms and/or one-stop shops.

Other given recommendations are listed hereunder:

- Invest in the high quality of authoritative data (in terms of accuracy, frequent updates);

- Have a strong data quality management control system in place in order to ensure the data integrity;

- Invest in marketing in order to enhance the visibility of the strengths of authoritative data;

- Be independent from commercial entities that have a chance to disappear. If such entity does not longer exist then all the associated data are lost;

- Learn from other pubic authorities on the definitions via meetings, workshops;

- Support international activities such as those that take place in light of EU, UNGGIM;

- Explore the opportunities and threats of new technologies such as blockchain.

3   DISCUSSION

Based on the results in this report, this discussion section addresses the definition of authoritative data. In the survey, a tentative definition of authoritative data was provided: "Data provided by or on behalf of a public body (authority) which has an official mandate to provide it." From the survey, 86% strongly supported the tentative definition, while there were no significant remarks raised against this definition. Important however, was that various respondents underlined, both in the survey and the focus groups that criteria could help to make the definition more comprehensive. This is also in line with how most countries or public administrations approach the topic of authoritative data: There is not a single (strict) definition that is applicable but a broader set of criteria that describe when data can be labelled as authoritative. Also, there should be a clear focus on data quality.

Nevertheless, it seems important to the researchers that there is a common but broad definition available which can be used by the Members of EuroGeographics as well as EuroGeographics itself in relation to external partners at the national and, especially,

European and international level. Such a definition will make it easier for the organization and its members to define common positions on this topic and to make it comprehensible for outsiders what is meant by the concept.

Based on the results and remarks made in the survey and the focus group meetings, as well as the above described arguments, the researchers are pleased to propose and suggest the following working definition. This definition can be used by EuroGeographics and its members to work towards a common definition, criteria and governance approach.

> *Authoritative data is data provided by or on behalf of a public body (authority) which has an official mandate to provide it, that is based on a set of known criteria to ensure (inter alia) high data quality, and that is required to be used or aimed towards extensive use and reuse within the public sector and society as a whole.*

Concerning the criteria referred to by the respondents, we propose the following to be reflected upon by EuroGeographics and its members: the legal aspect of authoritative data, the role of public authorities in the provision of data, the role of private sector organisations, the meaning of a 'trusted' source of data, the meaning of 'high quality', the role of licensing agreements and the re-use of data, the degree of institutionalization of authoritative data, and the financial agreements on authoritative data. Another, crucial criteria to reflect upon is the broader definition of 'data': Sometimes data will refer to a group of data sets, while it can also refer to data in a data set. This, of course, has important implications for authoritative data. Also the other elements described in 3.2.1 Question: What is authoritative data for you? should be part of a discussion, as those elements were also of importance to all respondents. In addition, it is necessary to mention that authoritative data can cover most of those criteria but does not necessarily meet all of those criteria at all times. Moreover, there are strong dependencies among the characteristics. One characteristic could be a vital condition for another characteristic, which in turn could be one for another one. This is something future research could address in more detail.

Those two elements, i.e. a more general definition and a list of specific criteria, could lead to a clear framework for authoritative data – one of the requirements for the respondents regarding this topic.

Extra recommendations by the respondents could be collected through the survey and the focus groups. Those recommendations allow for a broader discussion on the topic of authoritative data. They refer to the legal aspect of authoritative data as well as to the importance of trust as a key element for the future development of this type of data:

- Authoritative data needs to be registered in laws and regulations in order to ensure that this data is available in the future and is not manipulated. If someone would like to change it then they need to legally challenge and/or question it;

- Ensure the legally binding aspect of authoritative data. A citizen can decide if he/she uses data from the state, or another source, but if a judge needs to make a verdict he will always refer to authoritative data, because the law states it;

- Validate alternative sourced data by an expert in order to be certified as an authoritative source;

- Open authoritative data in order to enhance public transparency and allow users to give feedback;

- Focus on the public values of authoritative data serving the general public interest;

- Do not only focus on the possible profits, but on public value;

- Be persistent in order to guarantee that the data will be kept available on a continuous basis.

It was also strongly recommended by the respondents to maximize the use of existing authoritative data to ensure their future needs. This could be achieved by opening up the data and by improving its accessibility, for example via popular platforms and/or one-stop shops. Finally, two other useful recommendations are (1) the advice to develop a strong data quality management control system to ensure the data integrity and (2) to invest in marketing in order to enhance the visibility of the strengths of authoritative data. It was noted that there were no recommendations on the use of blockchain or distributed ledger technologies and the potential role of NMCA's in their governance.

These recommendations are highly relevant and point to an ongoing tension between providing authoritative data from the perspective that the organization providing the data is the authority and is therefore the one and only organization that can provide this type of data, versus the need for building up trust in the data that is provided by the organization. Today, acting as an authority is no longer a sufficient condition to be recognised as an authority. Indeed, nowadays the authority of organizations relies on trust. Some of the recommendations clearly point in this direction, whereby quality and a legal embedding is of high importance.

4   CONCLUSION

Data are the bedrock of public and private service provision. Digitalization exposes the need for a common approach towards data, through a higher demand for data within and across both the public and private sector (and the so-called third sector including academia and not-for-profit organizations), but also through the development of innovative services. A common approach within countries, but also across borders, is necessary to ensure high data quality, to invigorate trust between stakeholders, to reduce inefficiencies, to stimulate innovation and to allow for a user-centric service provision. Authoritative data are a means to define and organize data, but also to coordinate the roles of all the involved stakeholders. However, the term itself is defined and operationalized in various ways, depending on institutional, legal and cultural characteristics of countries and public administrations.

To understand the phenomenon, this study applied a two-step methodology, making use of (1) an online survey, and (2) focus group meetings based on roundtable discussions, both with the members of EuroGeographics. Both steps were followed by a triangulation with the academic literature surrounding the subject.

The results of this report underline the need for a systematic and harmonized approach towards authoritative data. The survey revealed three main conclusions:

1. There are a variety of definitions and approaches applied by the different member organizations of EuroGeographics, as well as different opinions on which data should be considered as authoritative.

2. Most of the EuroGeographics Member organizations underlined that their country has a formalised approach towards authoritative data, as well as an obligation to use authoritative data.

3. The survey results indicated that there is consensus concerning the central role of public organizations in the organization and use of authoritative data.

Through the focus groups, the results of the survey were corroborated and several additional elements could be added on the topic of authoritative data. The main conclusions of the focus groups are the following.

1. From a methodological point of view it is important to underline that the key conclusions of the survey, as described above, were indeed confirmed.

2. Related to the first conclusion, it is necessary to underline that several additional conditions and characteristics of authoritative data were added to the (existing) organizational conditions for authoritative data mentioned in the survey: Legally binding, accountability, uniqueness, having a mandate, mandatory use (within the public sector), liability, official, (public) authority provision, reference data, trust, harmonization and standardization, continuity, high quality, the need for adequate quality management system, certification, traceability, maintenance, use and understanding.

3. The NMCAs underlined that data that is validated as authoritative data is considered to be of very high quality. This does, in turn necessitates adequate resources for ensuring data quality and up-to-dateness

4. It was also underlined that the obligation to use authoritative data depends on the situation at hand. More effort should be put in making authoritative data available and recognizable by other public organizations as well as private actors.

5. The participating NMCAs underlined that there is a need for organizations within the public sector to take up a central role in the governance of authoritative data.

Based on these results, from both the survey and the focus groups, the research team has taken the liberty to formulate the following four recommendations in relation to authoritative data in a European context:

1. Inter-organizational, cross-sector and cross-border exchange of authoritative data necessitates the need for transparency about the characteristics of the authoritative data that is shared and accepted as authoritative by other stakeholders. A commonly agreed meta-level description methodology, to be developed by the European NMCAs grouped under EuroGeographics could be a step in this direction.

2. A harmonization of definitions and criteria is necessary at both country and European level. At the latter level, this could take the form of a broad framework concerning the dimensions, definitions and barriers to exchange and use of authoritative data, mirroring the network-approach of the European Interoperability Framework or the more hierarchical approach of the INSPIRE directive. Additionally, a governance approach of authoritative data between all stakeholders and their representatives should be organized at the European level. Given the broad membership of EuroGeographics and the diversity in legal, organizational, semantic and technical approaches, we advise for the development of such a governance approach which makes use of a combination of network and hierarchical instruments. However, given that it was underlined by several NMCAs that also private sector organisations can play a role in the further development of authoritative data, we strongly encourage reflections on the potential use of market instruments as well.

3. Within this context, it is necessary that the role of public organizations is re-evaluated. Datasets have to be classified according to their importance (either authoritative or not) and governance schemes have to be developed accordingly. First, for core authoritative datasets, authoritative public organizations will be in charge of the governance, whilst other public sector organizations and the private sector will only play a supporting role (for example in a decentralized data gathering setting), depending on the country. Second, other data could be governed by other public organizations or the private sector. Here, authoritative public organizations could take up a role of control, certification and a leading role concerning the governance of data, including harmonization, standardization and interoperability in general. Third, for other data, authoritative public organizations have a role to work towards harmonization and standardization, but based on network instruments (i.e. '(more or less) stable patterns of cooperative interaction between mutually dependent actors around specific issues of policy' – examples are the development of an advisory body or information exchange through voluntary negotiation and norms), whereas the former two categories also include hierarchical instruments (i.e. instruments which are based on authority and power 'as fundamental processes and resources' – examples are regulations and laws achieved via a process of authority and/or power).

4. As a final, and more general recommendation, we think that further research on the specific use of authoritative data(sets) in a policy context would be helpful to deepen the understanding of the topic. This would not only be useful from an academic point of view, but even more so from a practical point of view. Indeed, by researching specific cases that make use of authoritative data(sets), the added value of the 'authoritative' element can be demonstrated in practice thereby stimulating other administrations to work on this topic.

References

Bouckaert, G., Peters, B. G., & Verhoest, K. (2010). The Coordination of Public Sector Organizations – Shifting Patters of Public Management. Basingstoke: Palgrave Macmillan.

Cravens, A. E., & N. M. Ardoin. (2016). Negotiating credibility and legitimacy in the shadow of an authoritative data source. Ecology and Society, 21(4).

Debruyne, C. et al. (2017) Ireland's Authoritative Geospatial Linked Data. In: C., d'Amato et al. (Eds.), The Semantic Web – ISWC 2017 (pp. 66-74). Cham: Springer.

European Commission (2016). EU eGovernment Action Plan 2016-2020 – Accelerating the digital transformation of government.

European Commission (2017). Annex to the communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions European Interoperability framework - Implementation strategy.

Marshall, C. & G. B. Rossman (1999). Designing Qualitative Research. 3rd Ed. London: Sage Publications, p. 115.

Plunkett, G. (2014). What does the term "Authoritative Data" Really mean? Environmental Systems Research Institute Canada.