GIMA
Geographical Information Management and Applications

Towards open geo-information science; Assessing academic user involvement in portal development and its effect on their usage and perceived satisfaction

GIMA MSc Thesis (March 2018)

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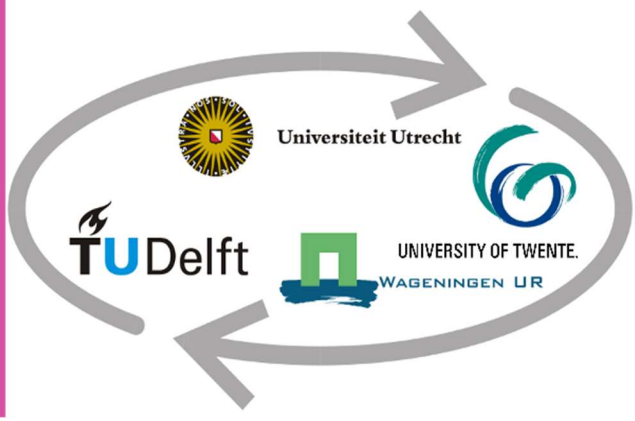

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I wish you, the reader, to have a nice and enjoyable read. If you need any further information, please do not hesitate to contact me. You can contact me through the information offered in the next page.

Summary

Since the beginning of the geographic information (GI) sharing efforts and the creation of the firsts spatial data infrastructures (SDIs), organizational and technological constraints have been identified as the cause of not reaching the expected results regarding use and re-use of GI. Now, with the organizational framework already settled and with the capabilities offered by the web 2.0 and the eruption of web services, stabilising the use criteria and need for the different type of users has become the biggest challenge.

The trend in current SDIs is to involve the user more in GI, looking to better satisfy their needs. This change in perspective from a provider to a user perspective demands a corresponding change in assessment methodologies of the different components, foremost those that enable interaction between user and data, such as the portal, in which the thesis is focused. The new methodology has to consider not only the end-product approach but also the participation approach. The thesis intends to help bridge this gap by designing a quantifiable methodology that considers both approaches, so that the relationship between the two of them can be studied. To this end, indicators for each approach were selected and a survey was carried out among a specific user group, the academic community. Two portals were studied through the survey, Infrastructure for Spatial Information in Europe (INSPIRE) portal and European Data Portal (EDP).

The analysis of the 36 survey responses suggests that the INSPIRE portal is slightly more successful that EDP for both approaches. End-product scoring for the INSPIRE portal was 65 while EDP was rated with 62 out of the maximum 100 possible points. The main differences were caused by indicators related to data. Participation scoring for the portals was low, 12 for INSPIRE and 4 for EDP. Therefore, there is still a lot to achieve to arrive at a user driven SDI.

The methodology developed in the thesis is adaptable to other user groups thanks to the weighting of the final scoring that is based on the importance given by that user group. Further work related to the topic would be to assess other user groups with the same methodology so that differences in needs and satisfaction are studied.

Acronyms List

AGILE: Association for Geographic Information Laboratories in Europe

AI: Average Importance

API: Application Program Interface

CEN: Comité Européen de Normalisation

CSW: Catalogue Service for the Web

EDP: European Data Portal

GI: Geographic Information

GII: Geographic Information Infrastructure

INSPIRE: Infrastructure for Spatial Information in Europe

ISO: International organization for standardization

ISV: Indicator Score Value

NPM: New Public Management

NSDI: National Spatial Data Infrastructure

ODUG: Open Data User Group

OGC: Open Geospatial Consortium

OGD: Open Government Data

PSI: Public Sector Information

PSV: Portal Score Value

RDF: Resource Description Framework

SDI: Spatial Data Infrastructure

UI: User Importance

UISV: User Indicator Score Value

UPSV: User Portal Score Value

W: Weighting Factor

WCS: Web Coverage Service

WFS: Web Feature Service

WMS: Web Map Service

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1. Introduction

Geographic information (GI) emerged in the 80's and has been heavily funded ever since, from both, private and public organizations (Groot & McLaughlin, 2000). During the last decade around 300 million euros were predicted to be invested only in the European SDI (INSPIRE, 2003; Grus et al., 2007), trying to address the needs of specific communities such as forestry or urban planning. Although computers and their technological advances allowed for an improvement in GI techniques, the results produced stayed within the organizations therefore data remained stored in isolated silos, which prevented the re-use and caused the duplication of costs regarding data collection (Crompvoets & Bregt, 2007; Bernard & Craglia, 2005).

Around two decades ago, an effort to integrate the produced geographic information started, initially at a local or national level; here is where the first Spatial Data Infrastructures (SDIs), emerged (Crompvoets & Bregt, 2007). SDIs are formed by policies, institutional arrangements, legal documentation, technology and data that enable sharing and usage of data (Craglia et al., 2003; Nebert, 2004).

Since the creation of the first versions of SDIs, there has been a development, going from a more product-driven approach, where the challenge was to successfully offer pre-existing data (Masser, 2005; Rajabifard et al., 2003), to a more process-oriented approach that enhanced services and added value to the data (Craglia & Novak, 2006). Portals play a key role in SDI development, being the network that provides a one-stop shop environment for GI, allowing the user to access the data (Acerete, Yetano, & Royo, 2016; J. Crompvoets, Bregt, Rajabifard, & Williamson, 2004; Crompvoets & Bregt, 2008).

During the first years of development a threat for the viability of SDIs became clearly visible: the lack of users involvement prevented SDIs from meeting the objectives and expected benefits (Bernard & Craglia, 2005; Budhathoki et al., 2008). Second generation SDIs offered more technically mature geoportals or clearing houses (Crompvoets & Bregt, 2007), but where still unable to produce the expected user satisfaction and re-use results. At this very moment, a product- driven approach is still the dominating approach in SDI development. Some argue that other stakeholders could be more involved, including citizens (Vancauwenberghe & Loenen, 2018; Susha, 2015; Olausson, 2016). A 3rd generation is coming up that is focused in making the user a producer of data in a voluntary way (Budhathoki, Bruce, & Nedovic-Budic, 2008; Bordogna & Carrara, 2017; Spinsanti et al., 2011), this would allow for more complete and updated data, besides further reduction of the cost of data harvesting. Elinor Ostrom classified the information knowledge as public goods of a new kind, as the re-use not only does not empty but enriches it (Ostrom, 2009). But, in order of doing this, enhancing participation is necessary. This means that an approach closer to the user is more needed now than ever.

A key characteristic of a user-oriented SDI is a portal that takes the users' needs into consideration. For this to happen, portals, being the main point for the user to access the data, need to be adapted to a more open, and provide an user-friendly environment that satisfies user needs and enhances participation (Hennig; Belgiu, 2011; Loenen, Crompvoets, & Poplin, 2010).

Most of the literature and policies so far address the benefits of involving users (Loenen & Grothe, 2014; Craglia and Novak, 2006; Crompvoets & Bregt, 2008; Hennig & Belgiu, 2011), but it is only now that they start focusing on specific groups and mostly on private sector users (Susha, 2015). Although the scientists and academic users were initially pushing for more open and accessible data, as well as being expected a key stakeholder group in supporting the re-use and sharing of GI, this group has been overlooked through the assessment and policy making process (Susha, 2015) Because of their expertise on the geographical domain, they are in the perfect position to identify flaws or trends for future portal development or use.

Trans-national portals constitute the highest organizational SDI level. They are especially important to the academic community as multiple countries are within these types of SDIs and they are key to research related to trans-frontier events, such as atmospheric pollution, immigration or climate change among others.

Two trans-national portals that share GI will be assessed through this thesis; the Infrastructure for Spatial Information in Europe (INSPIRE) and European Data Portal (EDP). The intention is to compare two portals that enable the sharing of GI but under different perspectives. The first one depends on the INSPIRE directive 2007 and while EDP was created after the Public Sector Information (PSI) directive (European Commission Directive 2013/37/EU). This could lead to differences in the development of the portals and comparing them will allow to adapt the best practices.

Quantitative and qualitative assessment will be performed by surveying the European academic community that uses these transnational portals. Two approaches will be applied to the analysis, the end-product satisfaction perception, and the participation in processes. The intention is, besides developing an assessing methodology that focuses more on involvement, to provide statistical evidence of whether there is a direct relationship between perceived end-product satisfaction and participation in development processes or not.

Proving the direct relationship between participation and satisfaction, and participation and use should help justification for the financing of participatory events or initiatives. Additionally, the results will be used to give guidelines to the studied portals for future development, so that it satisfies better the necessities of the academic users. The research is performed through a literature review and a survey to assess the satisfaction of academics and their usage of both portals. For this, a theoretical review is accomplished to identify key performance indicators of satisfaction with the portals and usage.

Until the end of this chapter, the objectives, limitations and approach will be explained. Chapter two will provide a review on SDIs, explaining context, objectives or components, and giving justification for the portal assessment review. Chapter three is where the potential indicators for the assessment are identified and selected. After this, the context framework for the portal assessment is presented in chapter four, clearly explaining how the selected indicators will be used. After that, chapter five will analyse each indicator, for end-product and participation, for both portals, so that the current situation is explained, and qualitative assessment can be given. Chapter six will be focused on presenting the analysis and results of the quantitative assessment and last chapter, seven, will summarize the findings and conclusions, making recommendations for future work.

1.1 Research Objectives

The main objective of the research is to design an academic user-oriented approach for portal development, exemplifying the findings with recommendations for the INSPIRE portal and European Data Portal.

From this overall objective, two more specific objectives can be derived;

1. Assess and report the current portal performance from an academic user perspective
2. Corroborate the hypothesis that ‘the higher the involvement of a user, the higher its usage and its perceived satisfaction’.

Given the objectives mentioned above, the thesis intends to answer the following research question: *Does the involvement of a user in portal development result in higher usage and higher perceived satisfaction of the user?*

1.2 Research Limitations

This research addresses only the academic community related to GI as a specific group of end-users. Therefore, no user that does not belong to the academic community is considered under the scope of this research. The intention is to keep building on the recognition of different specific user group needs while exploring their level of involvement.

Another research limitation is the hierarchical nature of SDIs. This means that INSPIRE is based on the National SDIs of the European countries that are linked to the trans-national INSPIRE portal. Given the workload devoted to the thesis, the research will be limited to the top trans-national portals and any assessment of the base NSDIs is out of scope.

Also, the researches assume that given the time and resources constraints, gathering enough answers for the generalization of the findings to all the academic community is not possible and therefore out of scope.

1.3 Research Approach

Figure 1 shows the workflow that is intended to be followed through the process of the thesis. Three blocks can be distinguished, literature research, creation of the surveys and obtention of the results.

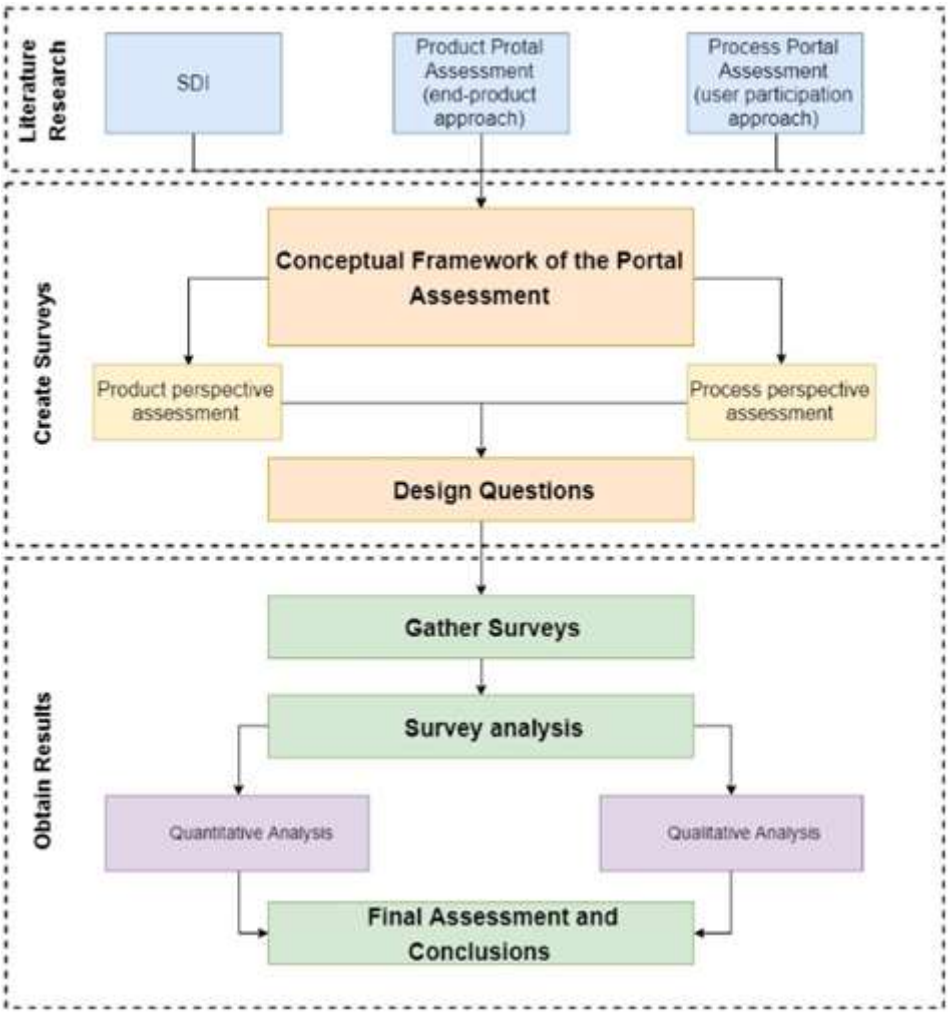

FIGURE 1: RESEARCH APPROACH

Within the first block, the literature research, SDIs and its components will be studied first. The intention of this is to give justification for developing an assessment framework for portals with consideration to the participation in the development processes. Afterwards, indicators for both approaches will be identified, looking to create a final list of indicators for the assessment of the thesis. For this, the assessment process must be studied from both approaches.

The second block outlines the creation of the surveys. For this, first an explanation should be given about concept assessment framework, clearly stating which indicators are to be measured and how. Afterwards, the specific questions will be created.

In the final block the results will be obtained, the intention is to give a quantifiable comparison between portals for both approaches, end-product and participation. Besides this, open questions will be used to allow for a qualitative analysis. Final recommendations and conclusions will be given at the end.

2. Spatial Data Infrastructures

This chapter intends to identify, explain and analyse the components and processes related to SDIs. Through the first section, a definition of SDI will be given, and the basic concepts and components introduced. Afterwards, a deeper description of all the components involved in SDIs is given followed by an explanation of the evolution of SDIs. To end with the overview given in this chapter, the current trends and threats to SDIs will be discussed.

When finishing this chapter, the reader should have a clear notion about; the objectives, components and processes related to SDIs, the importance of the end-user and the portals and the potential of their relationship. Acknowledging the need for constant assessment and improvement of the portals

2.1 SDI Basic Concepts and Definition

"*Geographic data links place, time, and attributes. Some attributes are physical or environmental in nature, while others are social or economic*" (Longley, 2001). It has been argued that this type of information plays a key role in society (Loenen, Zevenbergen & De Jong, 2008). There are plenty of uses for spatial information; resource management, nature conservation, environmental impact assessment, spatial planning, or disaster management, and it has become omnipresent in our everyday lives (Puri 2006; Rajabifard et al. 2006). Longley (2001) even argues that "*almost all human activities and decisions involve a geographic component, and the geographic component is important*" (Longley, 2001).

Linking information to its location gives it extra value, the geographic link makes the object of the study identifiable and reachable but makes it a costly process (Loenen 2006; Grus, Crompvoets, & Bregt, 2007) When thinking about it, GI has been needed for a long time, maps, for example, have been used for centuries related to informational purposes, such as navigational, militaristic, or political needs(Loenen, 2006).

Given the technological advances in the amount of data gathered, the precision it has, the up-to-date it is, and interface through which is accessed, the complexity of GI and the usefulness of the information contained has increased (Loenen, 2006; Grus et al., 2007). Hence, demand of GI and its tools has constantly increased for the last four decades (McDougall 2010) and boomed in the 1980's funded with tens of billions of Euros by both governments and the private sector that proved it as efficient and effective (INSPIRE, 2003; Grus et al., 2007; Rajabifard 2008).

Although computers and their technological advances allowed for an improvement in GI techniques, the GI process only succeeded where the producer and the user within the same, or related, organizations. Therefore, GI remained stored in isolated silos, which prevented re-use and caused duplication of the costs of data collection (Crompvoets & Bregt, 2007; Bernard & Craglia, 2005). Around two decades ago, in the 1990s, an effort to integrate the produced geographic information was started, initially at a local or national level, which led to what is currently known as SDIs or Geographic information infrastructures (GIIs) (Crompvoets & Bregt, 2007; Loenen, 2006). Therefore, SDIs were developed with the objective of allowing the dissemination, use and re-use of GI so that duplication costs are avoided, and efficiency is improved (Loenen, 2006; Grus et al., 2007).

This implies two things. First, that there is a hierarchical nature in SDIs, the ideal SDI would disseminate information from the local level to a global level by communicating with all other SDIs (Loenen, 2006), see figure 2. Second, for the correct dissemination of GI in all these levels, there is a need to stablish a common environment for this dissemination.

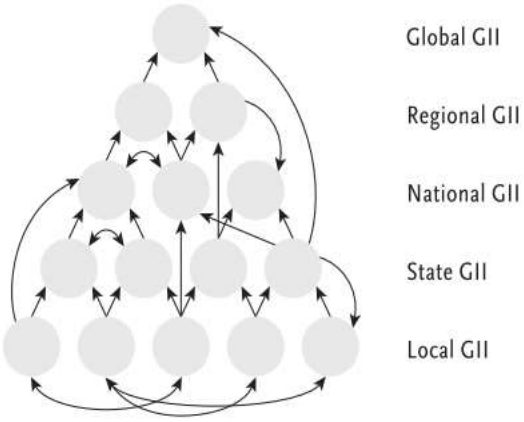

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FIGURE 2: IDEAL NETWORK OF SDI AND GEOGRAPHIC INFORMATION FLOW

This environment can be understood as the infrastructure. Is common that when thinking about this term the first thing that comes to mind is the physical components, like the railways of the train infrastructure, or wires and hardware if we are talking about an electronic infrastructure, but, according to Coleman and McLaughlin (1997) "*Infrastructure is far more than that. It is people, it is laws, it is the education to be able to use systems*" (Coleman and McLaughlin 1997; Loenen, 2006).

Loenen (2006) identifies telecommunications, energy, banking and finances, national security, digital, health, transportation, or water management, among the many types of existing infrastructures. Internet has not only supposed a technological revolution on the pre-existing infrastructures but also has enhanced the creation of new fully digital Infrastructures (Loenen, 2006). Digital Infrastructures are based on the exchange of knowledge through the internet and are characterized as public and quasi-public utilities and facilities (Janssen et al., 2009), understanding by public not having restricted access.

Within digital infrastructures are the OGD (open government data) infrastructures, that look for sharing of knowledge produced within the public sector. They emerged from citizen demand for governmental transparency and access to data produced within the public administrations (Susha, 2015; Olausson 2016) and has led to the creation of several OGD Infrastructures, in which SDIs are included.

One of the most important characteristics is that all infrastructures are dynamic, in the sense that they are constantly evolving and adapting to the new tasks to be supported. There are many examples of this, such as transport, electricity, internet or water, is adapted to address the needs of a growing population (Loenen, 2006). When looking at figure 3, the infrastructure would be the black box that surrounds all the components that enable GI sharing.

Figure 3 also represents the basic components related to the process of acquiring GI, people, access network, policy, standards and data (Crompvoets et al., 2004; Giff & Coleman, 2002; Rajabifard et al., 2002). As it can be seen, people are able to access spatial data through and access network that is built on policies and standards that allow for the correct integration of the data to be disseminated (Loenen, 2006). When considering the role of the portal here, it is the point where all the interaction between the people and the data is taking place, therefore allows for the linking of all the different boxes and could be depicted as the lines and arrows of the figure.

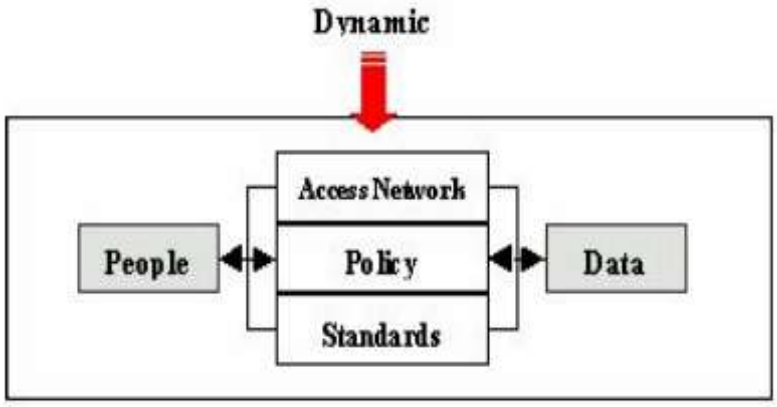

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FIGURE 3: RELATIONSHIP SCHEMA FOR SHARING GEOGRAPHIC INFORMATION

To further understand the needs of the portals to be assessed, it is necessary to further explain the components, which will be done in the following section. First, we should agree on a definition of SDI.

Being SDIs such a complex system with so many parts involved, usually a trade-off happens to summarize information and keep the definition as short and clear as possible. Therefore, differences can be found depending on the perspective of the one giving it (Chan et al., 2001; McLaughlin and Nichols, 1994; Loenen, 2006). The variety of ways in which SDI is defined reflects its multifaceted character (De Man, 2006). Chan (et al., 2001) identified four different perspectives when defining SDIs; identification, technological, organizational, and productional (or process) perspective (Chan et al., 2001).

In the context of the thesis the focus is set on the user participation, so the definition should focus on user participation, a process perspective definition seems therefore the best fit, as it presents the steps necessary to use GI (see figure 4). Anyhow, it seems a good idea to give a longer final definition in a more extended manner that includes the components of the framework, so that this are clear to the reader, therefore, re-phrasing Loenen (2006):

"*SDI is a framework [datasets, institutional framework, policies, standards, financial resources, access network, and human resources] that continuously facilitates the efficient and effective generation, dissemination, and use of needed geographic information within a community or between communities*."

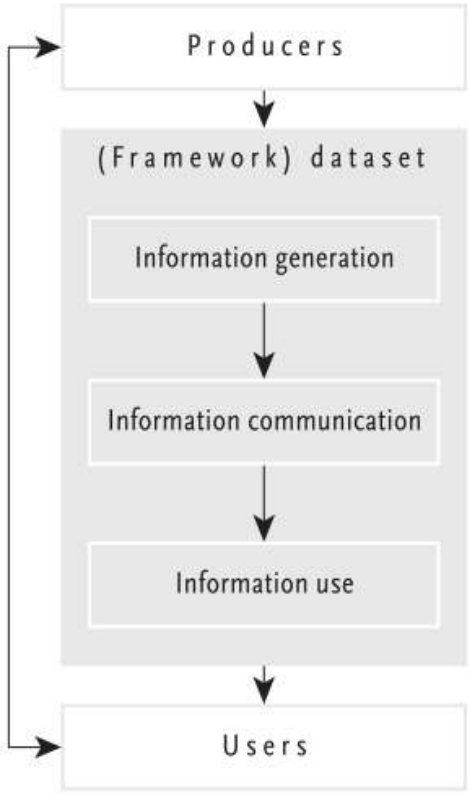

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FIGURE 4: THE GEOGRAPHIC INFORMATION PROCESSES

2.2 SDI components

As a conclusion of the previous section, a longer definition is given that identifies in detail the components within SDIs. The components identified will be further analysed within this section, looking to identify the role they play in achieving the SDI objectives of generation, dissemination, and use of needed geographic information.

2.2.1 Datasets

According to website Webster, they are a collection of related sets of data that composed of separate elements but can be manipulated as a unit by a computer. Is the building block for all GI and disseminating these datasets is the objective of SDIs (Crompvoets et al., 2004; Rajabifard et al., 2002).

Literature differentiates between two type of datasets, framework and thematic. Framework datasets are commonly used as a base dataset upon which other datasets can be placed according to Loenen (2006) they refer to "*the fewest number of features and characteristics required to represent a given information theme*", such as topographic, administrative boundary or land ownership datasets (Loenen,, 2006< Onsrud, 1998b).

These types of datasets are considered static by the process perspective definition of the SDI, as it is assumed that, although there is an ideal to achieve, no change will come once that ideal is reached. Therefore, fixed lists of datasets to be included are being published by the administrations, in the case of the EU, the list of framework datasets is included in the Annexes I, II and III of the INSPIRE Directive (2007/02/EC), shown in figure 5.

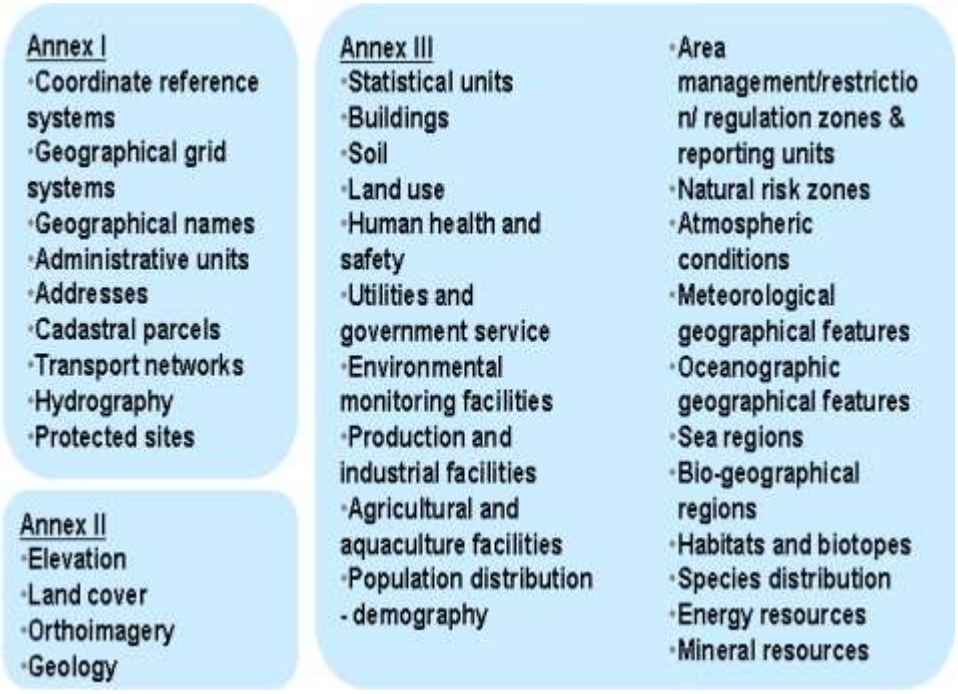


FIGURE 5: ANNEXES I, II AND III OF THE INSPIRE DIRECTIVE

Thematic datasets are created by using the framework datasets as source and adds further value on a theme, this theme can be used again as an input for another thematic dataset and so on. Thus, thematic datasets are dynamic, and will constantly evolve with the needs of the user and build on new themes to generate new knowledge (Chan et al., 2001).

Associated with the data is also the metadata, this is the data about the data (Loenen, 2006; Rajabifard et al., 2002). It gives information about the nature of those data (when or where they were gathered, who collected them, or how to correctly interpret the data) and become of key importance for the user to be able to fully use the data. According to INSPIRE, "Member States shall ensure that metadata are created for the spatial data sets and services corresponding to the themes listed in Annexes I, II and III" (Article 5 of the Directive (2007/02/EC).

2.2.1 Institutional framework

Institutional framework refers to the established organizations dedicated, in this case, to facilitate the functioning of the SDI (McLaughlin and Nichols, 1994; Loenen, 2006). According to McLaughlin and Nichols "*organizational cooperation [is] the critical ingredient that will make or break the best devised plans*" (McLaughlin and Nichols, 1994). The institutional framework is the composed from all organizations, or institutions, that are involved somehow in producing and distributing the data.

Considering the global nature of SDIs, the institutional framework covers from trans-national institutions to local ones. This component is closely dependent on policies, as they stablish the specific objectives and funding of each institution. Without this component the user would not have an access network to retrieve information, nor data providers willing to share their information.

When relating it to the context of the thesis and looking at the European institutional framework, all organizations. from the local data producer of each EU country, to the top-level European policy makers, form the institutional framework. It does not affect the user directly but without an institutional framework SDIs, and its spatial data, would not be available.

2.2.2 Policies

According to website Webster, a policy is a plan of action that looks to influence and determine actions or decisions. Within the SDI context, they are described as a component that defines the limits, objectives and explain how to achieve them (McLaughlin and Nichols, 1994; Loenen, 2006).

When thinking in the hierarchical structure, policies applies from local to global SDIs. Depending on the level of in which the policy is emitted to content will be more or less specific (Loenen, 2009; Loenen & Onsrud, 2004). Local policies can address a single institution and focus on specific issues, e.g. human resources or technology while global policies are much broader and relate more to the political environment, e.g. privacy, access to public information or security issues (Loenen, Kulk, & Ploeger, 2016; Loenen & Grothe, 2014; Welle Donker, 2010). There are two laws that mainly affect European SDIs when looking at the trans-national level:

Infrastructure for Spatial Information in Europe Directive (INSPIRE Directive); Is a framework directive to promote a European SDI. It consists of different pieces of legislation regarding spatial data. The contents are not only about the directive itself, but also about how the member states should transpose the directive to their own legislation, issuing rules and presenting technical guidelines for the correct development of the SDI tools (such as data, metadata, or identified datasets) sharing and reporting guidelines, or web services. (INSPIRE Directive 2007/2/EC; Loenen & Grothe, 2014).

Re- use of Public Sector Information Directive (PSI Directive); Enhances the re-use of all information produced within the public organization. Again, it is a directive and should be transposed to the national legislation of the member states. It was first emitted in 2003 and amended in 2013 and 2019.

The European Commission uses the term Public Sector Information to refer to "*all the information that public bodies in the European Union produce, collect or pay for*" (European Commission, 2011, p. 1). Thus, PSI is not specifically related to spatial information and it is a common policy framework for both portals to be studied.

According to Welle Donker (2010) PSI directive is built around the key pillars of the internal market: free flow of data, transparency and fair competition. It is important to note that not all of the public sector information is OGD, as national security issues might prevent open access of the data (Welle Donker, 2010).

The PSI directive and its world-wide analogous policies have enhanced a new public management (NPM) approach that enhances a higher degree of involving citizens in service delivery and seeing them as customers (Kubicek, 2016; Olausson, 2016). This directive has had a great impact in the evolution of SDIs (see sections 2.3 and 2.4).

2.2.3 Standards

A standard is an agreement among a community concerning the management of certain topic (Loenen, 2006). Standards have a great impact in our society, for example, they have been reported to contribute to 13% of the growth in labour productivity in the UK over the period 1948-2002 (DTI, 2005). We follow standards on an everyday basis, whenever we drive a car on the right side of the road, stop in front of a red traffic light, measure any distance, or weight something, among many others (Loenen, 2006; Bregt, 201X).

According to A.K. Bregt, 201X there are four types of standards; Ad hoc standards (designed for groups of few people for a specific reason), Proprietary standards (within an organization with intention to protect an investments and market share), De facto standards (widely accepted and used but lacks formal approval) and de jure standards (standards recognized by an official standardization organization, they can even be mandatory by law (Bregt, 201X).

When talking of an SDI, de jure standards are the only one considered, as without formal standardization trans-national interconnectivity would not be reachable. There are three main international organizations in the formulation of standards related to SDIs, Comité Européen de Normalisation (CEN), International organization for standardization (ISO), and Open Geospatial Consortium, Inc (OGC). Standards are applied to different aspects of the spatial data and web-services that allow for the transformation of the data into GI.

2.2.4 Financial Resources

As previously mentioned, a characteristic of geographic information its costly collection and processing (Loenen, 2009) and "*Without funding, no coordination and without funding, few initiatives in the general interest are likely to start*"(Loenen, 2006). Most of the time that the data is offered for free or at a marginal cost, there is a public funding behind, but there also exists blended funding techniques, in which SDIs finance themselves by offering more developed payed services (Welle Donker, 2010).

The investment requirements for INSPIRE at European, national, regional and local levels are estimated to be from €202 to €273 million each year (INSPIRE, 2003; Grus et al., 2007). With this amount of economical, personal and political investment, the pressure for SDIs to clearly report benefits is enormous.

2.2.5 Access Network

In the case of SDIs, the access network is related to the internet and without it we would not even imagine a concept such as SDI. Another name for access network is clearinghouse, used by Crompvoets, (2006) to define the "*Internet networks that facilitate access to spatial data and services […] for searching, viewing, transferring, ordering, advertising and/or disseminating spatial data*". Described as one- stop for all spatial data sourced from governmental agencies and/or industrial bodies (Crompvoets et al., 2004).Grus et al., (2007) report that worldwide around €120 million is spent each year just on clearinghouse management (Crompvoets, 2006; Grus et al., 2007).

Within the clearinghouses context, portals play a key role, being the doorway that allows the user to access the clearinghouse and use GI (Annoni et al., 2004) so if the portal is not user friendly and understandable by the user, is very likely that he will never get to use the different services, no matter how developed they are (Crompvoets et al., 2004;Crompvoets & Bregt, 2007).

When thinking about the access network, it should be remarked that within the clearinghouses different services can be offered too. These services allow for the querying, visualization and processing of GI without leaving the portal. Most important services within the access network are Web Feature Services (WFS) that allows the user to query update create and delete features; the Warehouse management system (WMS), which delivers maps images; Web Coverage Services (WCS) allow for viewing of coverages of the surface and Catalogue web services (CSW) that allow to discover the data (Masó et al., 2012; Welle Donker, 2010).

2.2.6 Human Resources

On the one hand, this component determines to what extent the full potential of the SDI will be achieved, as through people will be involved in all processes related to SDI development (e.g. building the clearinghouse, collecting data, processing data, policy makers, education etc.) (Crompvoets et al., 2004; Loenen, 2006). This would be the human resources within the institutional framework. On the other hand, this component is also the one that measures to what extent the needs of society are being sufficiently addressed, as the users also belong to this component.

According to Loenen (2006) the human resources involved in an SDI can be distinguished according to their roles:

- Providers: Owners of networks, makers of applications and providers of content;
- Regulators: Those in charge of the policies regarding data;
- Users: those using the data.

Veljković et. al. (2014) uses a collaboration perspective to describe the human resources involved:

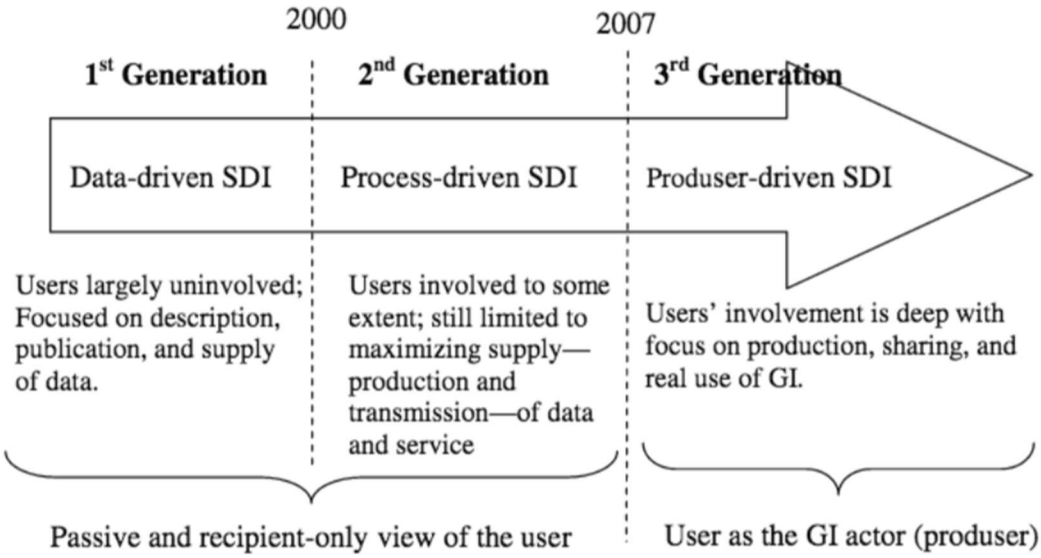
- internal collaboration: government to government collaboration
- intra collaboration: government to businesses collaboration
- external collaboration: between government and citizens

Given that the thesis scope is framed on the user, the two first bullets of both classifications are considered out of scope and will not be researched through the thesis. Thus, the focus will be done on the external collaboration end-users.

2.3 SDI Evolution

Till now, SDIs have been introduced and its components studied, but it is necessary to talk about how SDIs have evolved trough time in order to better understand the current state of play of what will be assessed afterwards (Bernard & Craglia, 2005; Budhathoki et. al , 2008); Hennig & Belgiu, 2011; Pons, & Zabala, 2012)

As it is understandable, all the SDI components have evolved through the last decades (Crompvoets et al., 2004; Budhathoki et. al 2008) but there were two critical factors for the SDI evolution: technological boom regarding ICT and the NPM that changes the approach to the user (Loenen & Grothe, 2014; Olausson, 2016). Figure 6 shows the three different generations of SDIs and their approaches, explained below:



EXTRACTED FROM HENNIG & BELGIU, 2011

FIGURE 6: SDIS GENERATIONS AND THEIR CHARACTERISTICS.

2.3.1 1st Generation: producer driven

They were the first attempt to coordinate spatial data and started at a national level, mostly in the 90s'. (Budhathoki et. al., 2008; Pons, & Zabala, 2012; Hennig & Belgiu, 2011). At this phase, there was not yet an independent budget to finance SDI, their funding came as part of national geographical funding (Budhathoki et. al., 2008; Hennig & Belgiu, 2011). There are still few SDIs and those that exist are driven by national mapping institutions that hoped to create a linkage of national spatial data into a common database (Budhathoki et. al., 2008; Loenen, 2006).

Therefore, the focus here is to address the government needs, looking to integrate the pre-existing data in the SDI so that it could be shared within the public administration and to stablish data management standards for spatial data Thus, only producers were involved in the development and the external end-user is not considered (Hennig & Belgiu, 2011). SDI definitions coming up from these initiatives usually fall under the identificational definition described by Chan et al. (2001).

At the time, the technological capacities of SDIs still had a lot of limitations to offer processed information (Crompvoets et al., 2004; Grus et at., 2007). The choice of what data to include in the SDI was done depending on how easy it was for the organization to integrate that data, not on the usefulness of it (Hennig & Belgiu, 2011). The interface was unfriendly and hard to understand, therefore, only experts could use it (Budhathoki et. al., 2008).

2.3.2 2nd Generation: user driven

Emerging in the 2000, the objective of this generation was to change the focus from a data-driven approach to a process-driven approach, allowing for the user to access processed information (Bernard & Craglia, 2005; Hennig & Belgiu, 2011). There is already proof of the value of SDIs so the number of national initiatives started to increase and some SDIs are starting to get financed with an specific budget, denoting an increase of awareness of SDI importance by the administration (Budhathoki et. al., 2008; Loenen 2006; Hennig & Belgiu, 2011).

Backed by the technological advances regarding the SDI clearinghouses and the web-services and linking within it, processed information could be offered (Budhathoki et. al., 2008; Bernard & Craglia, 2005; Hennig & Belgiu, 2011). The hierarchical structure of SDIs started to emerge with

the linking capacities, and, although there are still no transnational SDIs, now local SDIs were integrated within national ones (Budhathoki et. al., 2008; Grus et al., 2007).

The focus was to create interoperable data and resources, the implementation of web-service and their standards starts in this phase (Budhathoki et. al., 2008; Rajabifard et al. 2006). This implies that for the development, not only providers, but also those in charge integrating the data, were involved. The user domain is constrained to several stakeholders besides the administration (Budhathoki et. al., 2008; Hennig & Belgiu, 2011).

End-user is considered for the development of a friendlier and clearer interface (Budhathoki et. al., 2008) but their needs are not actively addressed. Thus, the success of the interface is only partial, as datasets offered are not very valuated, and experts are almost the only ones able to access it (Rajabifard et al. 2006; Hennig & Belgiu, 2011). Technological and organizational perspective (Chan et al., 2001) would be the best definition approach for this generation of SDIs.

2.3.3 3rd Generation: produser driven

Less than a decade afterwards, around 2007, the scene of SDIs has changed a lot. There has been a constant growth of the number of SDIs, thanks partly to the new means of finance (specific budgets, private initiatives, crowd sourcing) (Hennig & Belgiu, 2011). Here, trans-national SDIs are starting to emerge.

The technical barriers related to linking and processing data in the world wide web environment are mostly addressed, therefore the focus was to stablish usability criteria, bringing not only experts into the user domain, as only this will bring SDIs to their full potential (Hennig & Belgiu, 2011; Olausson 2016). Also, with the develop of apps and services with the role between the user and the producer starts to get blurry, as the user potentially considered able of providing geographic data gathered within the use of apps, the so called produser (Budhathoki et. al., 2008).

For the development, user feedback and means to communicate with the end-user, became a crucial issue (Susha, 2015; Olausson 2016). For this change, PSI directive and the new public management approach meant a major turning point on how the user is considered within the organizations. These are user- centric SDIs looking to establish social networks that allow to build a sense of community and so encourage social interaction (Hennig & Belgiu, 2011).When open data and citizen participation are tackled a new generation of open SDIs will emerge.

2.4 Current SDI trends: open SDI

As concluded in the last section, initially the governmental intention of creating SDIs for their own internal use but, due to the growing technological capacities and the governmental need for transparency (PSI directive), the public management approach shifted from an internal consumption to an external one, that did not only consider the user of the public administration but all citizens as potential users (Welle Donker, 2010; Susha 2015; Olausson, 2016).

This shift means a great opportunity for the sector as the economic potential of PSI re-use is estimated at least €40 billion for the EU27 (Vickery 2011, Broomby et al. 2000) and $900 billion per year worldwide (Manyika et al. 2013). However according to Grothe and Loenen (2014), PSI re-use has not yet reached its assumed potential and still has margin of development.

But, with a great opportunity comes a great responsibility and, with the growing diffusion SDIs and the multi-million investment made, concern about return of investment in the public sector started to raise and the number of researches for evaluating the ongoing initiatives increased (Craglia & Campagna 2010; Hennig & Belgiu, 2011). The problem is that when addressing such a broad group of users, challenging or nearly impossible to stablish their needs as a whole and has to be tackled specifically per user group, which are also hard to identify Craglia & Campagna (2010).

Not understanding who the user is, has become one of the biggest threats for SDI (Susha 2015). If user needs are not addressed, the infrastructure is less likely to be used. This is a common characteristic of the public sector information, not only in spatial data; every citizen is a potential user, and because of it, identifying all user groups to stablish the user needs becomes almost impossible (Susha, 2015; Olausson 2016). This leads to inconsistencies when assessing cost estimation and creates difficulties at the time of obtaining political favourability to these projects (Craglia & Campagna, 2010).

The concept of open SDIs introduced in 2017 by Vancauwenberghe and Van Loenen (2018) while looking on the changing role of nongovernmental actors when developing the SDIs. Open SDIs focus in offering free GI (unless legitimate privacy, security, or privilege limitations are found), be the framework that facilitates free e-services every citizen or business to access the offered GI, taking into account specific needs and requirements of different stakeholder groups and finally that all stakeholders can contribute to the development of the infrastructure (provide data and components) (Vancauwenberghe, Glenn & van Loenen, Bastiaan, 2018).

The intention was to further involve the external user with the SDIs development and access. Besides the improvement in the potential of use-and re-use, this approach should allow for an improvement of the costs-analysis and justification for the projects benefits as the private benefits are more clearly related to the initial investment.

To address this threat, the current requirement is for SDIs to switch from a product-based approach in which the end-product is the main way to satisfy the user, to a process approach, in which, participating in the development of the end-product they need, the users will be more satisfied (Susha, 2015; Olausson 2016; Hennig & Belgiu, 2011).

By fostering involvement, SDIs intend to build user communities that participate in the decisions affecting the SDI so that they can express the specific needs of their user group. This will not only help to address the short-term satisfaction but also with the identification of the different user groups for long term work (cf. Olausson 2016).

As a conclusion for this chapter, new assessment methodologies are needed for all components that integrate SDIs to help bridge the gap between end-product and participation approaches to satisfaction. The thesis will start by focusing on a key component that enables communication between user and provider, the access network. In the case of GI this is the portal, or clearinghouse, through which the user accesses GI. Constant assessment of the SDI portal is needed because of the dynamic nature of the SDIs. To avoid the threat of not engaging the user, it is necessary to develop new ways of assessing portals that considers the participation of the user in portal development processes, so that the specific needs of a user groups are considered. In the following section indicators used for portal performance assessment will be identified considering the new requirement of tracking user involvement and participation.

3. Portal Assessment Review

Portals are a key component of SDIs as they allow GI to be known, attainable and usable, the three characteristics needed to use GI (Backx, 2003). Determining the indicators for portal performance is challenging from an academic-user perspective, as not many user groups, and their needs, have been identified yet (Susha, 2015). Therefore, identification of indicators will be done by analysing how portal performance is usually measured.

When thinking about portal assessment two different perspectives can be used to assess the portals: (1) an end-product and (2) a process, or participation, approach. The end-product approach is more relatable to a provider's perspective and first and 2nd generation SDIs, while, by including the process approach the user participation and involvement can be assessed, allowing for a better adaptation 3rd generation SDI and open SDI.

3.1 End-product approach to portal assessment

The end-product approach assesses how much the user is satisfied with the final product, such as the dataset's availability, metadata conformity, linked services or access network. A clear example of this type of assessment would be the one performed by Crompvoets and Bregt in 2008. For this assessment, they used 15 SDIs characteristics, listed below, that, according to Crompvoets and Bregt, 2008 they "*represent the key variables for determining the suitability of the clearinghouse to facilitate the spatial data/service discovery, accessibility, use and dissemination*":

1) Number of data suppliers;
2) Monthly number of visitors;
3) Number of web references;
4) Languages used;
5) Frequency of web updates;
6) Level of (meta)data accessibility;
7) Number of datasets;
8) Most recently produced dataset;
9) Decentralized network architecture;
10) Availability of view services;
11) Number of mechanisms (alternatives) for searching;
12) Use of maps for searching;
13) Registration-only access;
14) Funding continuity;
15) Metadata-standard applied

The characteristics and description for each component can be found at Crompvoets et al. (2004) but it is done mostly from a provider perspective, therefore each of them must be critically analysed to see if they are relatable to the thesis objectives. They can be classified in four different groups depending on which component they are relating to.

3.1.1 Indicators related to human resources

Indicators associated with the people involved are those that depend on how much people is related to the portal. It considers the providers and developers of the data, managers of the portals, and the end-user (Crompvoets et al. 2004).

1) Number of data suppliers; This characteristic indicates the variety and quantity of providers and developers involved. As SDI portals are nothing but means for disseminating, this is an important element for the assessment (Crompvoets et al. 2004). Considering the user

perspective and relating it more to the thesis approach, this indicator can help give a hunch about the completeness of the data, as the more variety of providers the more perspectives and better covering of the area.

2) Monthly number of visitors; is a quantitative indicator for the use of the portal by end-users. It relates to the monthly number of the portal homepage visitors, but it is not relatable to the success in disseminating GI, as it does not identify the behaviour of the user and it could be the case that the user leaves the portal without achieving any obtention of GI (Crompvoets et al. 2004). This indicator seems clearly more useful for the portal manager of GI provider than to the user itself and does not seem very suitable for the thesis intention.

3) Number of web references; Tries to assess the portal popularity by means of measuring the linking from other websites, such as search engines or other web pages, to the homepage of such portal (Crompvoets et al. 2004). According to the author, correct linking can mean dramatic changes in the traffic of the homepage web site (Crompvoets et al. 2004). This can be useful from the provider perspective, as the more linking, the more capacity of reaching potential users, but the user, foremost the expert user as the one we are dealing with, has no benefits on a better linking, assuming they already reached the portal.

4) Languages used; This characteristic indicates the number language used at the 'search' page of the portal (Crompvoets et al. 2004). It indicates the ease for searching and the diversity of the users that can access for data (Crompvoets et al. 2004). Useful for the thesis approach given the trans-national nature of scientific research performed by the academic user community and the portals analyzed.

5) Frequency of web updates; this characteristic is related to the people in charge of the management of the portal (Crompvoets et al. 2004). It is measured by the author in days between the last update and the date of measurement (Crompvoets et al. 2004). Another way to measure it could be the mean in days between web updates at the time of the research. Updated information is important for users to obtain temporal accuracy in their use of GI, especially for scientific research, that can have stationary or even daily needs of measurement, therefore, this indicator should be included in the thesis.

3.1.2 Indicators related to data

Data related indicators are those related to the assessment of the data disseminated through the portal. Data should be interoperable in order to be used and re-used and this means compatibility in terms of: format, reference system, projection, resolution and quality (Crompvoets et al. 2004). There are three indicators related to data:

6) Level of (meta)data accessibility; According to the author "describes the presentation of the data content" and there are four different possible levels: prototype (final metadata security checks have to be arranged), non-standardized metadata (offered by non-standardized means such as jpeg, e-mail or bitmap format), standardized metadata (offered by standardized means such as the OGC web feature server) and data (+standardized metadata, indicates direct access to data through the clearinghouse without contacting the producer). This indicator in clearly useful for the user, foremost in a scientific environment, as standards are needed for the correct validation of performed researches.

7) Number of datasets; Is a way assess the portal through the quantification of the number of metadata records, were each describes one dataset (Crompvoets et al, 2004). Is useful from the user perspective as it gives an indication of the diversity of the available data.

8) Most recently produced dataset; This indicator assesses the up-to-date nature of the content and relates to the management of the data. Measured by the duration between the last update (in months) and the time of the measurement (Crompvoets et al, 2004). For the user, it allows

for an understanding of the accuracy of the temporal aspect of the data, but, given that the survey will be long, and that this indicator was low rated in importance the survey made by Crompvoets and Bregt in 2008, it will not be included in the survey.

3.1.3 Indicators Related to the access network

The third group of indicators is associated to the access network, these are the indicators that relate to the accessing, querying and viewing data through the portal (Crompvoets et al, 2004).

9) Decentralized network architecture; Measures to what point (meta)databases and services are distributed multiple servers running autonomously, installed by different suppliers and interconnected through a network (Crompvoets et al, 2004). The assumption is that for trans-national portals, as the ones that will be assessed in the thesis, decentralized network is mandatory given that every NSDI is considered in the trans-national level a data provider and have their own server, therefore there is no clear justification to address this specific indicator in the case of the thesis.

10) Availability of view services; This indicator assesses the standardized view services for documented data, a typical tool of second-generation SDI (Crompvoets et al. 2004). This viewing capacities includes general-purpose maps to display location and interactive and customizable mapping tools. It should be supported by simple queries and a context so that it is understandable and valuable by the user (Crompvoets et al. 2004).

11) Number of alternatives for searching: this indicator assesses the different tools for the user to search for information. Searching tools would be predefined search items (hypertext links), location (spatial search), index maps (defined boundaries), free keyword search, search place name (gazetteer) and by time of production of the dataset (Crompvoets et al 2004).

12) Use of maps for searching; In the 2008 study Crompvoets and Bregt (2008) only used digital maps search as an indicator but in Compvoets et al. (2004) this indicator is described as one within the several means for discovering spatial data through the portal. Within their approach, the assessment of this searching alternative is done specifically y differenciating between use of map search for locating an area of interest or by clicking in an area with pre-defined borders.

A major critic within this group is that there are several currently several types of services related to data standards such as; Web Feature Services (WFS) that allows the user to query, download, update create and delete features; the Warehouse management system (WMS), which delivers maps images; Web Coverage Services (WCS) allow for viewing of coverages of the surface, not related to objects; or Catalogue Web Services (CSW) that gives a common environment for publishing and searching for metadata related to the GI and services (Masó et al., 2012; Welle Donker, 2010).

The access though an Application Program Interface (API) should also be included in the assessment to determine if the user has access to a graphical user interface (GUI) components, and how much he valuates it. API is defined as a set of routines, protocols and tools for building related software applications that would lead to further use (Masó et al., 2012; Welle Donker & Loenen, 2017; Zuiderwijk, 2015).

3.1.4 Indicators related to policies and standards

The fourth group is related to the assessment of policies and standards related to the portal, which are critical for the correct SDI and portal implementation.

13) Funding stability: This indicator assess how portals are financed. It tries to determine the origin of the funding and how often they are founded (Compvoets et al. 2004). From the user

approach under the intention of the thesis, this indicator does not seem as suitable as this does not directly concern the end-user.

14) Registration-only access: This indicator is included by Crompvoets et al. (2004) to measure the negative impact if could have on the end-user. Given that the community to be studied in the thesis is an expert community that might depend sometimes on obtaining this data and does it from a professional perspective, privacy does not seem a stopping driver for this community, and therefore, this indicator will be left out.

15) Metadata standard applied: This indicator deals with the compliance to the standards that allow for keeping information of content, quality, source and linage related to the data offer of the portal (Crompvoets et al. 2004). Useful specially for academic research that must justify and explain the source of every data they use for the validation of their findings.

After the description of the indicators in Crompvoets et al. (2004) they were used for a quantifiable assessment of the portal in Crompvoets and Bregt (2008), in which they assess NSDI calculating a final score value by assigning a score to each class of the indicator measured. All indicators were weighted by surveying near to 500 people related to the GI community. Classes ranges and weighting and scoring values for each indicator are shown in figure 7.

Clearinghouse Characteristic	Class 1	Class 1 weight*	Class 2	Class 2 weight	Class 3	Class 3 weight
Number of suppliers	> 16	0.08	2 - 16	0.04	1	0.00
Monthly number of visitors	> 4000	0.02	150 - 4000	0.01	< 150	0.00
Number of web references	> 250	0.04	20 - 250	0.02	< 20	0.00
Languages used	Multilingual including the national language	0.06	Monolingual using the national language	0.03	Monolingual using no national language	0.00
Frequency of web updates (in days)	< 4	0.10	4 - 365	0.05	> 365	0.00
Level of (meta) data accessibility	Data + standardised metadata	0.10	Standardised metadata	0.05	Non-standardised metadata	0.00
Number of datasets	> 1500	0.08	50 - 1500	0.04	< 50	0.00
Most recently produced dataset (in months)	< 2	0.02	2 - 60	0.01	> 60	0.00
Decentralised network architect.	Yes	0.08	Hybrid	0.04	No	0.00
Availability of view services	Yes	0.10	Prototype	0.05	No	0.00
Number of mecha-nisms (alternatives) for searching	> 5	0.18	2 - 5	0.09	1	0.00
Use of maps for searching	Yes, by locating an area of interest	0.04	Yes, by clicking on an area with predefined boundaries	0.02	No	0.00
Registration-only access	No	0.02	Partly	0.01	Yes	0.00
Funding continuity	Continuously funded	0.01	Piecemeal funded	0.01	Never funded	0.00
Metadata-standard applied	ISO/FGDC/CEN	0.07	National	0.03	No standard	0.00

(extracted from Crompvoets & Bregt, 2008)

FIGURE 7: END-PRODUCT INDICATORS CLASSES RANGES AND WEIGHTING AND SCORING VALUES.

From the fifteen indicators review, several of them were considered not important for the user (number of visitors, number of web references, most recently produced dataset, registration only and funding continuity). This consideration is further justified by the low weighting value in Crompvoets & Bregt, 2008, see figure 7. Some other indicators related to view services and searching mechanisms appear to be highly important to the user and demand deeper assessment than the one they used, see figure 7.

As a conclusion, most of the identified indicators are usable in the thesis but adaptation is needed to frame the methodology within the current times, given that this suitability index is was developed between 2004 and 2006 and web services have gained a lot of importance since then. It is necessary to include then more indicators relating the services, and new means to access the portals, such as APIs.

3.2 Participation approach to portal assessment

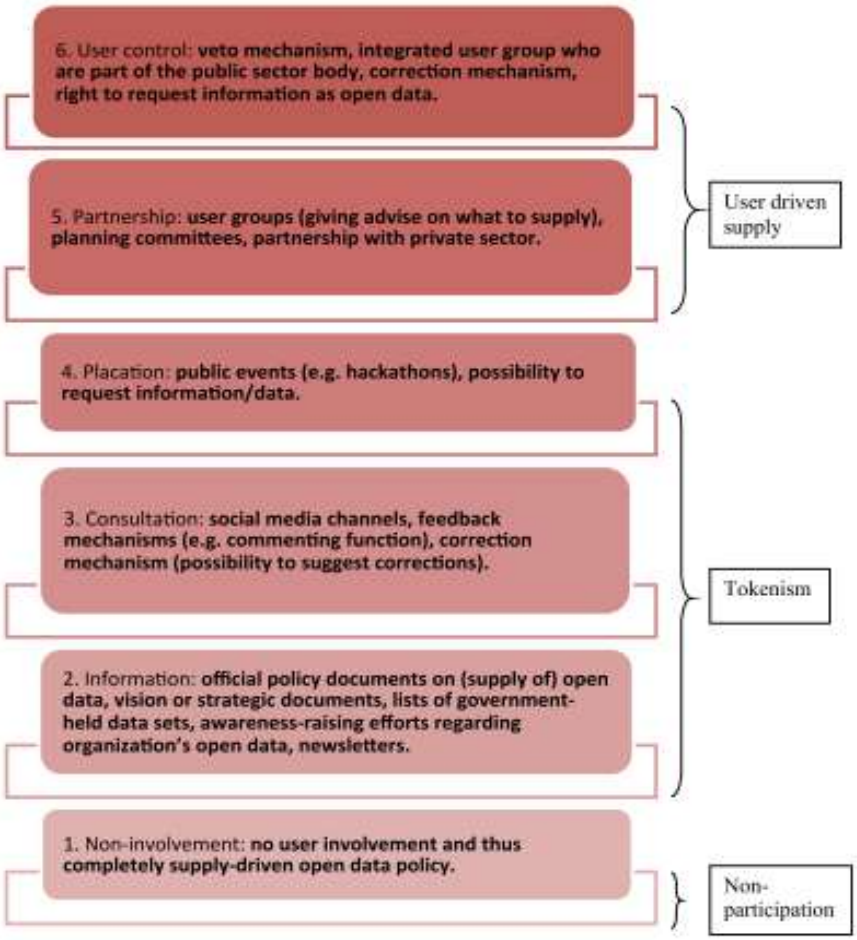
This assessment approach is based on the satisfaction of the users with participation in the development process of the portal. In other words, the involvement, or participation, users have in the portal development and how this feedback is adopted by the portal. Participation in development process is now related to the new public management, but this practice historically is more typical of private sector and contrasts with previous governance models where there is no competition when providing public services and therefore low incentive to enhance participation of the users (Olausson, 2016).

Therefore, NPM is an approach closely related to 3rd generation SDIs and open SDIs, and, although there is low previous experience, new public management is willing to allow the participation of different stakeholders to contribute to effective and efficient decisions and a feedback mechanism allows for citizens to feel as agents in the development, not passive receivers (Simmons et. al. 2011, Olausson 2016).

Because the assessment of public satisfaction depends on the end users, monitoring and taking their opinion into account is critical for the process assessment (Callahan & Gilbert 2005; Olausson, 2016). Thus, a challenge for the public sector in such participatory processes is to ensure that feedback mechanisms reward input from consumers, which demands monitoring by public authorities (Bishop & Davis 2002; Olausson, 2016). Scholars have noted that government utilizes ICT tools themselves but have not been able to apply them to their full extent regarding the management and engagement of citizen participation (Evans & Campos 2013; Olausson, 2016).

Participation is described by the World Bank (2001b, p3) as "*a process through which stakeholders influence and share control over development initiatives and the decisions and resources that affect them*". The most known tool for ranking participation was first described by the social scientist Arnstein in her "ladder of participation" from 1969, which ranks participation in eight rungs within three different levels. Having real power, according to Arnstein, implies that you can affect the outcome of decisions. Participation should involve a real transfer of power from government to citizen (Arnstein 1969; Olausson, 2016), when applied to the framework of the thesis, participation would mean real transfer of power from portal managers to users.

Arnstein's model has been reinvented several times since then and applied to many different settings (Tritter & McCallum 2009; Bruns 2003; Connor 1988). This shows the flexibility of the ladder. In order to adapt the model to an open data context, see figure 8 (Olausson 2016). By analysing the indicators and the levels of participation, a classification can be made that allows the measurement of the user involvement and the importance and satisfaction related to that involvement.



(source Olausson 2016)

FIGURE 8: MODIFIED LADDER OF USER INVOLVEMENT IN SUPPLY OF OPEN DATA

The ladder shows six different rungs within three levels of participation, and the intention is not to determine which level is more suitable (as this may vary depending on who the user is) but to state what indicators can be used to determine the current level of participation of SDIs.

The possible indicators within each rung of the ladder will be analysed and one indicator per rung will be selected for the use of the thesis. This will be done so that a one to one relationship between indicator and rungs can be used for the assessment.

3.2.1 Non- Participation

Is the first level in the Olausson open data participation ladder, the one designed by Arnstein 1969 initially had two rungs in this level, manipulation and therapy. When adapting the ladder to the open data environment, Olausson 2016 merged them into a single rung.

Non-involvement: Arnstein states that they represent a state of non-representation where the process is rather opposite: decision-makers use the interface to influence or educate citizens. Indicators for classification in this level are a lack of user involvement and a completely supply driven open data policy. When translating the situation to the SDIs and PSI environment, such a situation would be where citizens and users have no influence over what data is supplied as open

(source Olausson 2016)

data. Feedback is rarely gathered from the user community, and when it is, it is not implemented (Olausson, 2016).

Olausson's indicators are no user involvement and completely supply-driven open data policy. Because the thesis intends to focus on the user perspective for the assessment, and the surveyed community does not need to be aware of the policies, the clearest indicator and the one to be used in the thesis is the non-participation. Therefore, all the respondents that have not participated in any of the other rungs will be placed in this group.

3.2.2 Tokenism

The common attribute between the three rungs within this level (information, consultation, and placation,) is that all of them enable somehow for the user to create and voice their opinion, but it does not have mechanisms to ensure that the feedback is considered (Olausson 2016).

Information: Is the first step towards genuine participation as a correct reporting of the environment that allows users to gain the understating needed to form an opinion. To the context of the GI, it could be translated to providing information about changes in available datasets or portals. Providing this insight can help the user form an opinion about this matter, but it does not give means to gather feedback, therefore, nowhere to go to voice their concerns.

Olausson's indicators are official supply of on open data, vision or strategic documents, lists of government-held datasets (open to the public to access), open data repositories, awareness- raising efforts regarding organization's open data, newsletters. From the user perspective, relationship or need for strategic documents or full list of datasets might be extra work for the intended use, participation in a newsletter subscription on the portal developments is more relatable to the average user and will be used as the reference indicator for this rung of the ladder.

Consultation: Here, the public is not only informed, but welcomed to take part in the policy-making process. There will be mechanisms for citizens to participate and feedback will be gathered, but there are no mechanisms to implement this feedback, which could lead to a symbolic consultation (Olausson, 2016). Zuiderwijk-van Eijk & Janssen (2015) calls this type of user involvement social media sharing, which is a way for users to share what they did with the data via social media such as Twitter, Facebook and LinkedIn.

This would help dealing also with the identification of user groups threats determined before, as suppliers can see who the users are at such forums and stablish a closer contact through a more informal interaction (Lee & Kwak 2012). Relating to the GI, this could imply the possibility of leaving comments about what datasets are missing, however, this communication would be informal and different from an official request for information (Olausson, 2016).

Olausson's indicators are social media channels, feedback mechanisms (i.e. commenting function), possibility to suggest corrections, inventorying data (asking whether the organization has certain data, non-official request). Participation in informal feedback mechanisms is finally selected, as they might be specially affected by errors in any aspect of the accessed information.

Placation: Arnstein defines "placation" as a situation where citizens have a right to advise, but the eligibility of such advice is decided by power-holders. Olausson adds that by creating a request that will produce a clearer and more formal output. Relating it to the GI context, Khan & Foti (2015) speak about participatory prioritization. A process where formal feedback is gathered about which data to prioritize in decisions on supply, like request of datasets (Khan & Foti 2015: 14). Public events, such as hackathons, public debates, contests, and workshops, that seek to share information about open data policies where users' opinions are collected to afterwards be presented in a more formal way can be included within the placation rung (Olausson, 2016).

Olausson's indicators are therefore public events (i.e. hackathons), possibility to request open data. Participation in public events will be the chosen indicator, as the target population is a specialized community that should be actively invited and consulted when developing the portal, not leaving it to the willingness of each academic.

3.2.3 User-driven supply

This is the last level of user involvement and here real influence is given to them. In the adaptation of the ladder to the open data framework, Olausson stablishes two top rungs, partnership and user control. Within this participation level, there are not only mechanism to request for the user opinion but also to enforce that this opinion is implemented.

Partnership: Arnstein argues that there is a trade-off between the two actors in a more equal position, suggesting joint policy boards, planning committees or other forums. An indicator of partnership that can thus be suitable for open data supply is a user group where different stakeholders of the re-use community are part. In the UK Open Data Request Roadmap was thus paired with the Open Data User Group (ODUG). Through the roadmap, information can be shared with ODUG on what data users want to be opened. Consequently, they can act on this information (Savory 2013). The same can be said about relationships with private sector intermediaries (Khan & Foti 2015; Olausson).

Olausson's indicators for this rung are user groups to advice on what to supply, planning committee's participation, and lastly partnership with private sector, which is not the case in the thesis scenario. Given that the target population is one of the most demanding when relating to the supply of data, the participation in planning committees is selected as the indicator. Academic community shoud participate officially on what data to supply or other development issues.

User Control: Citizens have sufficient power to ensure accountability from policy-makers. In the case of open data, this veto capacity would translate to the ability to stop decisions on supply of data that they do not agree with (Arnstein 1969). The task of actively correcting data or even supplying specific data is given to integrated types of user groups. The last indicator is the capacity to request information as open data with legal implication. While there would still be limits, due to privacy or other legal constraints, it still provides a clearer way for users to get involved than with only a traditional request for public information (Olausson 2016).

Olausson's possible indicators are therefore an existing veto mechanism, integrated user group who are part of the public sector body, active and direct correction mechanism, right to request information as open data. To fully address the user control perception the indicator of the veto mechanism was selected.

The selected process indicators identified here are to be included in the survey design so that a one to one relationship can be stablished between the indicators and the level of participation. By classifying the user involvement within the rungs stablished by Olausson, the correlation between participation and overall user satisfaction with can be studied and the product indicators can help identify best practices and tendencies.

4. Conceptual Framework of the Portal Assessment

The main objective of the research is to design an academic-user oriented approach for portal development. To do this, the main tool will be a survey to the population of interest, academic users of GI in European trans-national portals. Within this section, the intention is to give a conceptual framework for the quantitative portal assessment, which includes the clear statement of the indicators that will be used and an explanation on how they will be used.

The importance to address academic community is because they represent the most up-to-date users concerning the use of spatial data. Because of the novelty surrounding academic research, they might be the first user group to identify new needs related to GI use that will be afterwards acquired by other user groups.

When considering the approach, the intention of the survey is multiple. A portal quantitative assessment is needed for both, end-product and participation approach to the user satisfaction, in order to bring the assessment methodology closer to the 3rd generation needs. Also, context information as associated research institution or frequency of use of the portals has to be ask, as well as open answer question concerning advice for development in a qualitative way related to each indicator.

In the following sections, the assessment for end-product and participation perspective will be clearly stated, and a list of the final indicators and an explanation on how they will be used is given. Context and open questions are specific for each indicator and will not be discussed here but a complete list of the questions will be included in the final appendices.

4.1 End-Product perspective assessment

The intention of this part of the survey is to compare the portals product from the academic-user perspective. The indicators for the end-product approach were selected from those already explained in section 3, but when considering the national nature of the researched studies, indicators had to be adapted accordingly to the trans-national framework and the current times that demand deeper intel about access methods and viewing services.

TABLE 1 END-PRODUCT INDICATORS

End- Product Indicators
Number of data suppliers;
Languages used;
Frequency of web updates;
Level of (meta)data accessibility;
Metadata-standard applied;
Number of datasets;
WCS accessibility;
WFS accessibility;
WMS accessibility;
CSW accessibility;
API accessibility;

Choices had to be made to keep the survey under 15 minutes to avoid rejection of the respondent, therefore, the final list of indicators, selected from the identified indicators by Crompvoets and Bregt (2008), had to be shortened. To achieve it, Number of visitors, number of web references, most recently produced dataset, registration only and funding continuity indicators were

excluded. The decision is partly personal, as no great interest for the user group can be justified but justification can also be found in the importance ratings for these indicators given by Crompvoets and Bregt (2008) in which the deleted indicators are the ones rated with least importance (see figure 7 in page 24).

On the other hand, the high importance that they register in the viewing services and searching alternatives demands a deeper approach to these indicators. For this access to WFS, WMS, WCS and CSW services will be assessed independently and not grouped as the previous authors did. The access through an Application Program Interface (API) should also be assessed to determine if the user has access to a graphical user interface (GUI) components, and how much he valuates it when developing an API that is constantly accessing the portal.

To assess the two portals from an end-product perspective in a quantitative way, two ranking scales questions will be asked for each of them. The first one will measure the importance given to the indicator (UI) in a (1 to 10) scale. The second one asking for the satisfaction perceived due to that indicator (S) level (from very bad (1) to excellent (10)) related to each indicator for both studied portals.

The different impact of each factor is considered within the weight factor. For each end-product indicator the weight factor (W) is calculated depending on the average importance (AI) given to that indicator by all users ($\sum UI$) divided by the number of users; a scale factor of 10 is added to adjust so that $\sum W$ goes from 0 to a 10, and the indicators and portal scores (see Table 2) from 0 to 100. This weighting factor allows to apply the methodology for different groups as the respondents themselves will be grading the indicators according to their needs. The generic formulas are showed below:

$$AI = \frac{\sum UI}{nº\ users}$$

$$W = \frac{AI}{\sum AI} * 10$$

With the calculated W and the S, previously obtained through the survey, a weighted score value for each indicator can be obtained, for every user (UISV) and the indicator average (ISV).

$$UISV = S \cdot W$$

$$ISV = \frac{\sum UISV}{nº\ Users}$$

By adding the scoring of all weighted indicator score values for a given user, we obtain the user portal score value (UPSV). The final portal score value (PSV) can be obtained by adding all UPSV and dividing by the number of users that answered the survey.

$$UPSV = \sum UISV$$

$$PSV = \frac{\sum UPSV}{nº\ users}$$

This will allow for detailed feedback on each indicator and allow for a comparison between the two portals at an indicator level. The final scoring for the portal is the portal score value, which allows for an overall product perspective comparison that considers all indicators and all users, defined by the formula above.

Table 2 shows below explain all the used variables and their meaning.

Symbol	Term	Definition	Used for
UI	User importance	Importance rating that an individual user gives to a specific indicator. Obtained through the survey	Initial input
S	User Satisfaction	Satisfaction that the users perceives from a given indicator	Initial input
AI	Average Importance	Averaged importance of an indicator considering the UI given by all users	Calculating the weighting factor for a given indicator
W	Weighting factor	Weights the importance of an indicator in relationship with the other indicators	Calculating the satisfaction taking into consideration the importance of each indicator
UISV	User Indicator score value	Individual user scoring of a single indicator	Allows for individual comparison at indicator level.
ISV	Indicator score value	Final scoring of an indicator considering all users	Allows for comparison between indicators.
UPSV	User Portal Score value	Individual single scoring for a whole portal	Allows to study the relationship between participation and perceived satisfaction
PSV	Portal Score Value	Final scoring of the portal considering all users	Allows for comparison between portals

TABLE 2 DEFINITION AND EXPLANATION OF THE USED SYMBOLS

The input needed for the calculation can be found within appendix 9.1. So that it is clear to the reader, table 3 has been included below with a definition of all the terms that are to be calculated.

	Repeat for the 11 End-Product Indicators						**Considers All indicators**	
Users	**UI**	**S**	**AI**	**W**	**UISV**	**ISV**	**UPSV**	**PSV**
1	Survey	Survey	Common Per Indicator	Common Per Indicator	Specific	Common Per Indicator	Specific	Common Per Portal
2	Survey	Survey			Specific		Specific	
3	Survey	Survey			Specific		Specific	
…					…		Specific	
n	Survey	Survey			Specific		Specific	

TABLE 3 MODEL SPREADSHEET FOR THE END-PRODUCT SCORING OF THE PORTALS

4.2 Participation perspective assessment

The methodology for the process approach is almost the same as in the end-product perspective. The survey procedure will ask firstly about the importance that the user gives in participating in a given rung. As mentioned in the previous section, one indicator will be selected for each rung of the ladder, so that there is a one to one relationship that will help to classify each user in a ladder rung (table 4) The idea is that the target population gives information of which are the processes they would be willing to participate, but they have not been able yet.

Product Indicators for each rung	
Indicator	**Rung**
No indicator is marked	Non- participation
Newsletter subscription	Information
Participation in informal feedback mechanisms	Consultation
Participation in public events	Placation
Participation in planning committees	Partnership
Participation in veto mechanism enforcement	User Control

TABLE 4 PARTICIPATION INDICATORS FOR EACH RUNG OF OLAUSSON'S LADDER OF PARTICIPATION

As in the end-product perspectives, a first block will be asked regarding the importance of the indicators (UI) followed by a last block of questions related to the satisfaction of the user with each of the processes he has been involved with (S). When evaluating the satisfaction, the user was asked to leave the questions empty if he had not participated in the indicator, non-answer will be considered a 0 for calculation purposes added to the 1-10 possible range of values. This will be done so that specific feedback relating the involvement experience of the different processes is obtained and recommendations can be given.

For each of the portals, the average rung of participation of the academic users will be calculated so that correlation can be studied between the satisfaction of the user with the portal and the participation in the processes. The average participation score will allow for the comparison of the portals from the process participation perspective in a quantitative way, and by analysing the difference between the participation in different processes, more detailed qualitative intel can be given. Below, table 5 shows a model of the final calculation table that can be found in appendix 9.1 and 9.2.

The calculation methodology and formulas are the same as explained in the previous section. As it can be seen in table 5, the only difference is the number of indicators.

	Repeat for the 5 Participation Indicators						**Considers All indicators**	
Users	**UI**	**S**	**AI**	**W**	**UISV**	**ISV**	**UPSV**	**PSV**
1	Survey	Survey	Common Per Indicator	Common Per Indicator	Specific	Common Per Indicator	Specific	Common Per Portal
2	Survey	Survey			Specific		Specific	
3	Survey	Survey			Specific		Specific	
…					…		Specific	
n	Survey	Survey			Specific		Specific	

TABLE 5 PARTICIPATION CALCULATION SPREADSHEET MODEL

The two-fold approach to the survey intends to allow for an analysis of the relationship between the End-product perceived satisfaction and the participation. Wanting to check whether the hypothesis of "the more participation, the more end-product satisfaction" is true or not. For this, the intention is to check for correlation with a Pearson Correlation test.

5. Indicator Qualitative Analysis

This chapter was included in the thesis to compensate for the lack of open questions answered in the survey. Therefore, it only intends to be a qualitative explanation of the indicators current state, and any expected development. The objective is to gather information that, together with the quantitative analysis done through the review, will help to give recommendations on the current state and future development of the studied indicators.

The review of most of the product indicators for the INSPIRE portal is based on the last Summary Report on Status of implementation of the INSPIRE Directive in EU (Cetl,et al, 2017) and through portal consultation. The European Data portal review is performed based upon the portal documentation including statistics, accessible through the EDP website.

5.1 End-product Indicator Analysis

5.1.1 Number of data suppliers

The direct suppliers of data in the INSPIRE portal are the National SDIs that each country is developing. Therefore, 36 different countries belonging to the EU or EFTA community are supplying data to INSPIRE portal. At the same time, these countries have regional and local organizations, INSPIRE. (2003) talks of around 240 regional or local organizations involved. The number of data providers to the NSDI varies widely depending on the size and level of implementation of the country that can need regional SDIs.

For the European Data Portal, "*a catalogue is a web-portal, which provides data for the European Data Portal*". Within the European Data portal, there are 78 other catalogues found, one or more per country member (country data portal, meteorological or geoportals) besides several European catalogues. The number of datasets for each data provider highly varies, from almost 200.000 datasets in the case of Czech National Data portal or the Czech geoportal, to barely 20 from some specific web-portals.

5.1.2 Languages used

The interface of European Data portal is currently shown in 24 EU official languages, but most metadata are currently available in a limited number of languages (English, French and German).

In the case of INSPIRE, their interface only offers the English language. Regarding the dataset, the language property is not mandated by ISO 19115, but is mandated for conformance to the INSPIRE Metadata Regulation 1205/2008/EC. It shall be encoded using one of the three-letter language codes of the ISO 639-2/B code list19, shown in figure 9.

The list of codes for the 24 official EU languages is:

Bulgarian – **bul**	Irish – **gle**
Croatian – **hrv**	Italian – **ita**
Czech – **cze**	Latvian – **lav**
Danish – **dan**	Lithuanian – **lit**
Dutch – **dut**	Maltese – **mlt**
English – **eng**	Polish – **pol**
Estonian – **est**	Portuguese – **por**
Finnish – **fin**	Romanian – **rum**
French – **fre**	Slovak – **slo**
German – **ger**	Slovenian – **slv**
Greek – **gre**	Spanish – **spa**
Hungarian – **hun**	Swedish – **swe**

FIGURE 9: OFFICIAL EU LANGUAGES CODELIST (ISO/TS 19139) BASED ON ALPHA-3 CODES OF ISO 639-2

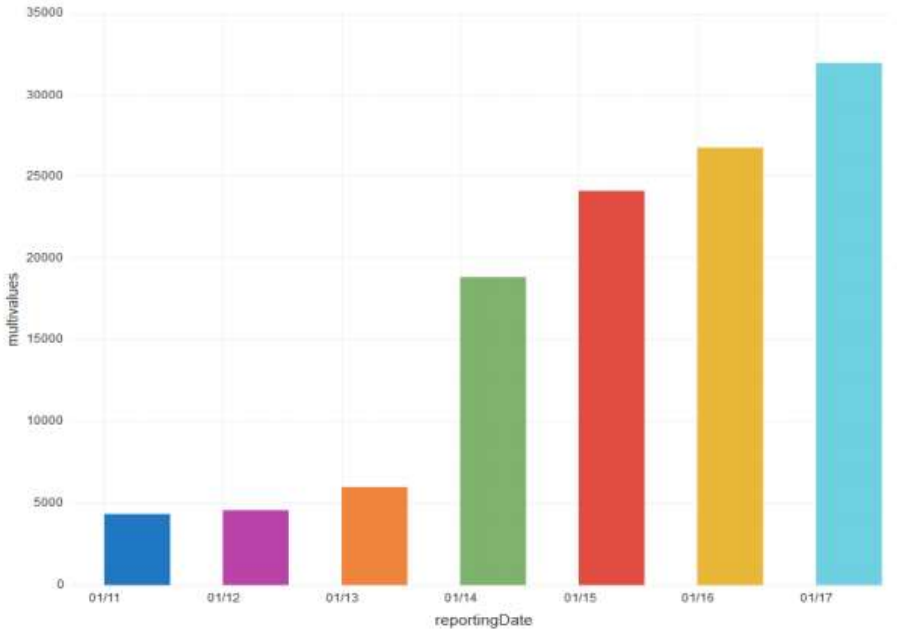
5.1.3 Frequency of web updates

To check for this indicator both portals were observed for a period of one week, were they both updated daily. This means that the portals are both constantly updating and sharing new data. As mentioned, this is useful for scientific work that usually needs often data updating or even timeseries of the same data.

No further improvement is demanded in this indicator besides that any serious portal change to adapt even more to user needs and automated harvesting of the data providers allows for a constant improvement in the number of datasets, so there are no expectations for great changes in the future regarding this indicator.

5.1.4 Level of data accessibility

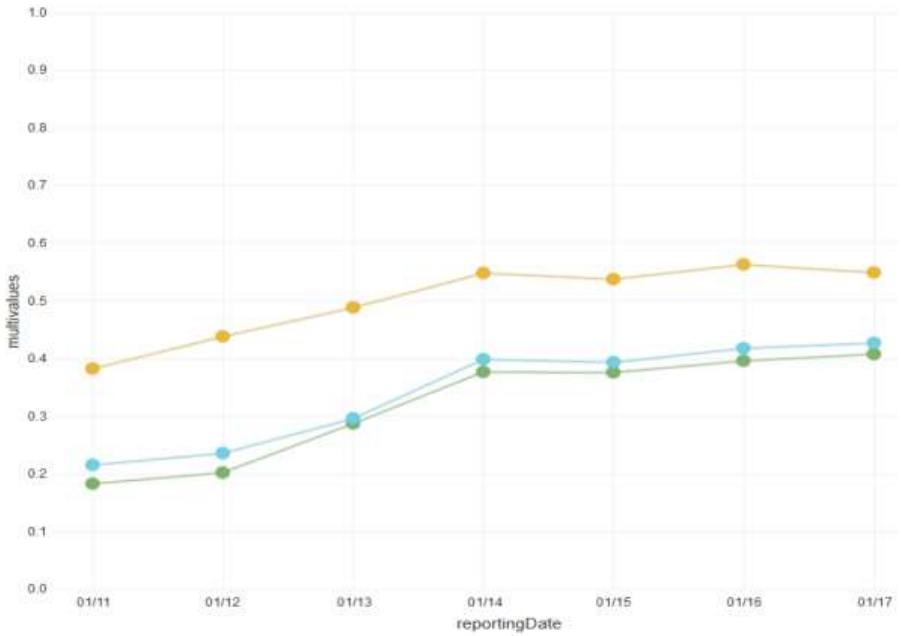
The evolution of the level of data accessibility has improved a lot for INSPIRE over the last decade, with the implementation of different spatial data services. More than 40000 view services and more than 30000 download services were available at the time of the report, see figure 10.



EXTRATED FROM CETL, VLADO. ET AL. 2017

FIGURE 10: EVOLUTION OF NUMBER OF SPATIAL DATA SERVICES

However, many of the identified spatial data sets are still not accessible through the services and there is space for further improvement. The overall technical conformity of the existing services is more than 50 %, which is low and should be also furtherly improved, see figure 11.



(green = with download +view Services, Yellow = with view Services and Blue = with download services)
Extracted from Cetl, Vlado.et al, 2017

FIGURE 11: EVOLUTION OF SPATIAL DATA ACCESSIBILITY (%) THROUGH DIGITAL SERVICES

96% of the datasets are reported accessible by EDP. In this case, accessible is understood as the dataset having an AccessURL according to the standards specifications. But, when checking for the DownloadURL existence, portal reports that only 29% of the datasets have it, and that only 36% of them use a machine-readable format.

Another difference is the way to present the datasets, while INSPIRE uses the topics of annexes I, II and III (described in the components chapter) to present their data, EDP presents its datasets according to the provider, which could lead to a less accessibility for the users, making the data harder to find.

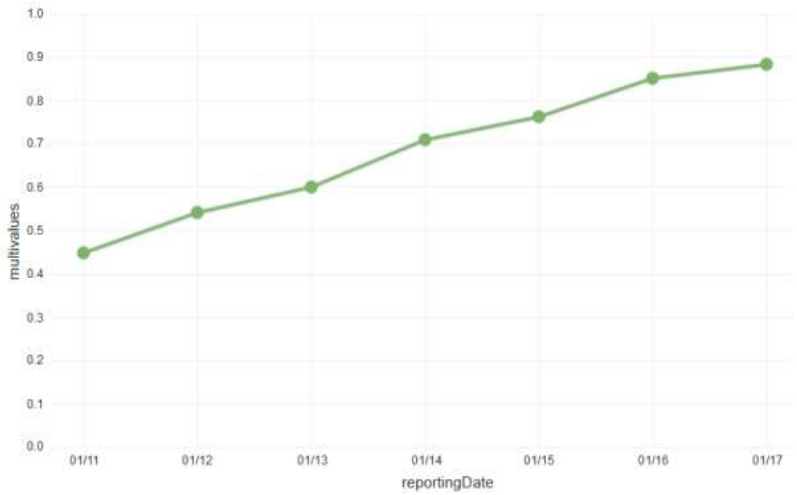
5.1.5 Metadata standards applied

Technical guidelines of INSPIRE metadata standards are based on EN ISO 19115 and EN ISO 19119.

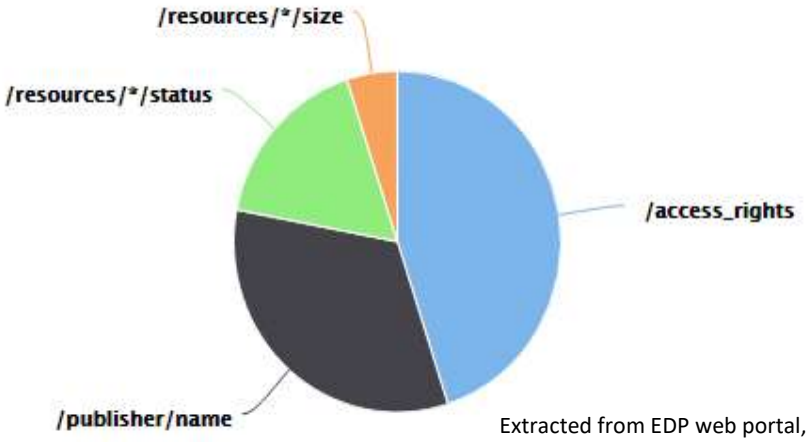
Figure 12 shows that, regarding the level of metadata, according to the summary status report 2017 for INSPIRE, overall, 87% of the metadata (data sets and services) conforms to the INSPIRE metadata specifications (Cetl, Vlado.et al, 2017).

FIGURE 12: EVOLUTION % OF SPATIAL DATASETS AND SERVICES CONFORMANT WITH METADATA STANDARDS

extracted from Cetl, Vlado.et al, 2017



In the case of European Data portal, only 5% of the offered datasets are considered not compliant with the metadata standards. The portal also reports the reasons for those datasets that are not compliant. Being access rights (45%) the top violation occurrence, followed by the publisher name (33%), the status (17) or the size (5%). Data extracted form EDP statistics webpage.



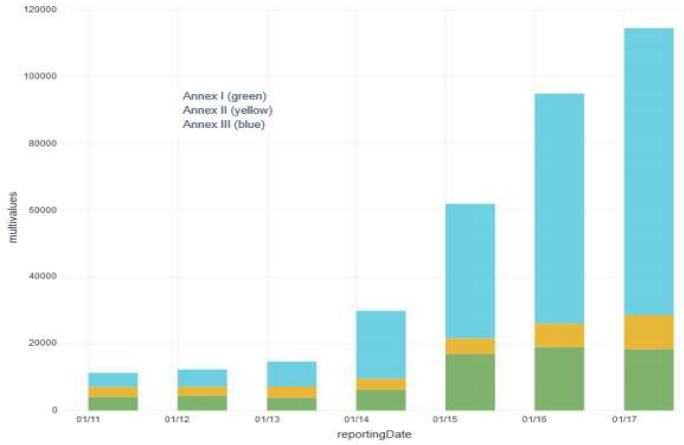
Extracted from EDP web portal, accessed 15/02/2019

FIGURE 13: EDP TOP VIOLATION OCCURRENCES FOR METADATA

Both portals are implementing now a geospatial extension of the current DCAT-AP, which is the metadata profile meant to provide an interchange format for data portals operated by EU Member States. It includes an additional RDF (resource description framework) syntax binding. The improvement of the metadata standard should enhance the sharing of many GI related metadata, such as temporal scale, georeferencing system among others. For further specifications on geoDCAT-AP please consult Perego, Andrea, 2018 webinar presentation on the topic.

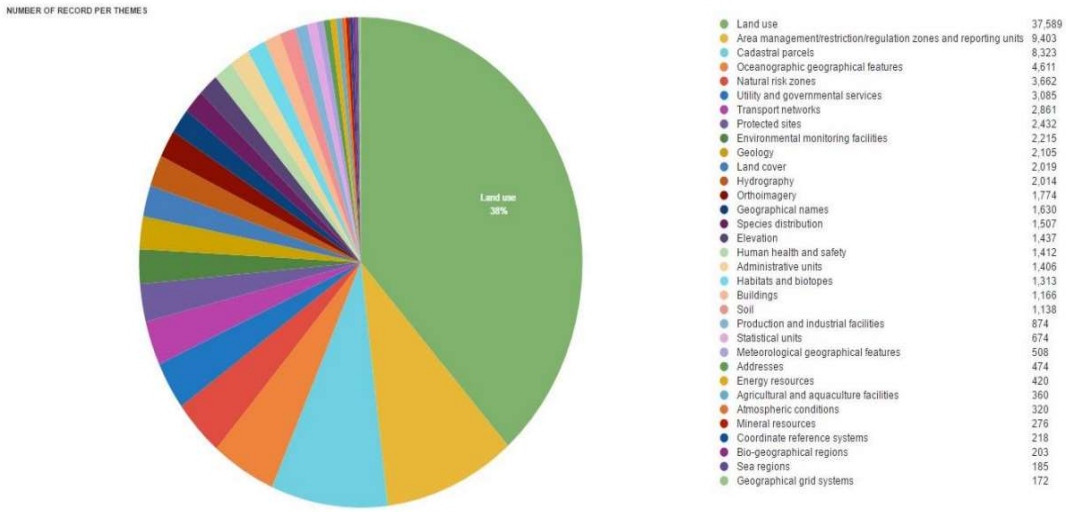
5.1.6 Number of datasets

According to the INSPIRE status Report, by mid-2017, more than 11000 spatial data sets with relation to the themes listed in the INSPIRE annexes, see figure 14. Clearly, the most used topic is the Land Use, being 38% of all datasets related to this topic (37589 datasets) followed by far by area management/restriction/regulation zones and reporting units (9403 datasets), see figure 15.



Extracted From Cetl.et al, 2017

FIGURE 14: NUMBER OF DATASETS EVOLUTION UNDER INSPIRE ANNEXES I, II AND III.



Extracted From Cetl, Vlado.et al, 2017

FIGURE 15: DATASETS AVAILABLE PER THEME (2015)

891,346 datasets can be found within the European Data portal. There is a wide variation between the participation of countries in publishing datasets, as just Czech Republic and Germany have more than 500,000 datasets.

In the case of the indicators 6 – 9 the criteria and standards followed are the same in the case of both portals, as European Data portal only links data from INSPIRE portal when presenting the services, therefore is not specifically mentioned but the findings apply. Figure 16 is also common for all the service indicators (from 6 to 9).

5.1.7 WCS accessibility

A WCS allows clients to query server's data, based on spatial constraints and other query criteria. The currently used standard is WCS 2.0 and coverages are defined according to ISO 19123. The objective of this standards is to improve alignment with coverage standards on the implementation level (e.g. ISO 19136 and the OGC Web Coverage Service) and to improve the harmonisation and interoperability on the use of coverages in INSPIRE.

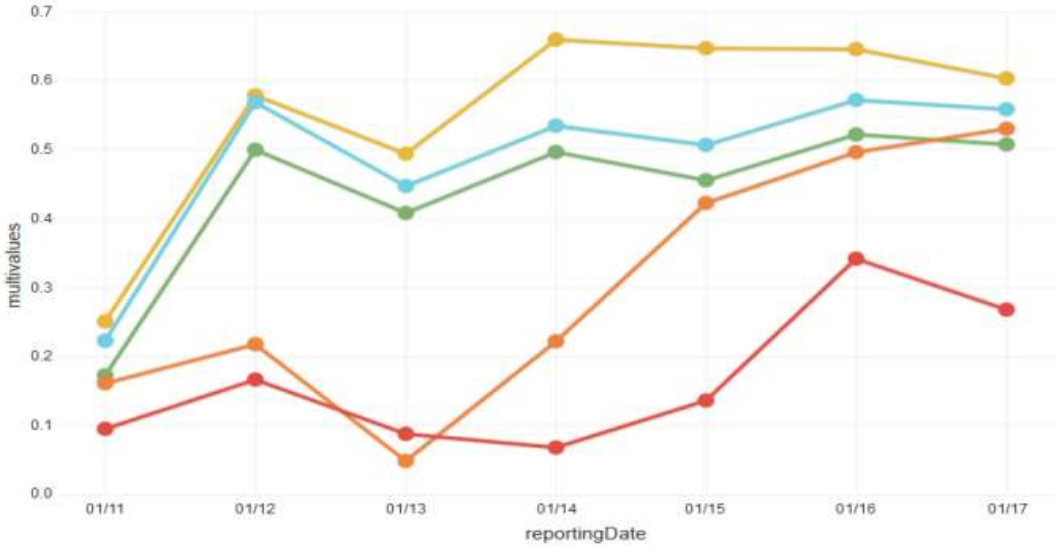
5.1.8 WFS accessibility

Download Services for INSPIRE are based, for direct access services, on the OGC WFS 2.0 specification which translates into ISO/DIS 19142 and 19143 standards.

5.1.9 WMS accessibility

View Services for INSPIRE are based on the OGC WMS 1.3.0 specification which translates into the ISO 19128 ISO/DIS standard. CSW accessibility

Discovery Services for INSPIRE are based on Metadata Specifications from ISO as well as on, as per the respective technical guideline, the OGC Catalogue Service for the Web 2.0.2 (CSW) ISO Application Profile. This are the services that have produced the highest conformity percentage, more than 60% CSW were considered conformant with the standards.

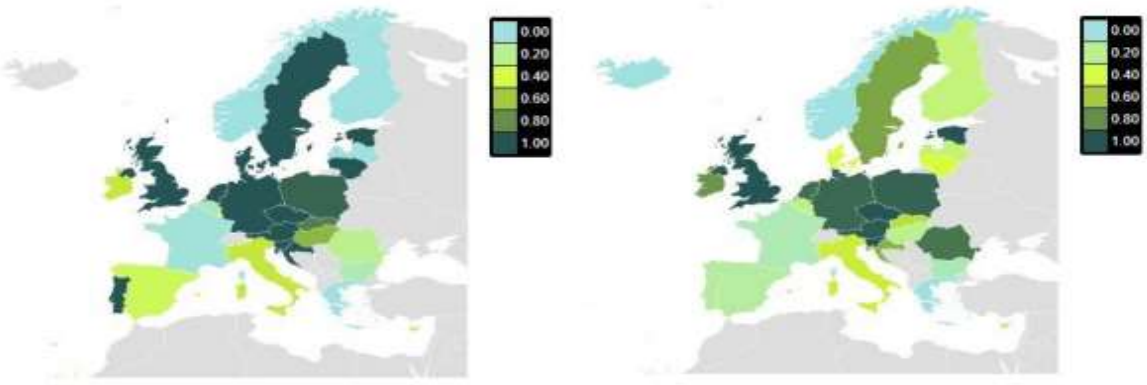


(GREEN = ALL, YELLOW = DISCOVERY SERVICES, BLUE = VIEW SERVICES, ORANGE = DOWNLOAD SERVICES, RED = TRANSFORMATION SERVICES)

EXTRACTED FROM CETL.ET AL, 2017

FIGURE 16: EVOLUTION OF DIGITAL SERVICES CONFORMITY (%) FOR INSPIRE

When looking at the spatial distribution of the conformance with services (figure 17) a clear distinction between east and west countries can be made (except for Portugal and UK. Further study on best practices should be performed in the eastern countries trying to apply them in the western and EFTA ones, where there is more margin for improvement.



EXTRATED FROM CETL, VLADO. ET AL. 2017

FIGURE 17: CONFORMITY OF DISCOVERY AND VIEW SERVICES PER COUNTRY (EU AND EFTA COUNTRIES)

5.1.10 API accessibility

APIs that are built on Web standards leverage the strengths of the Web. For example, using HTTP verbs as methods and URIs that map directly to individual resources helps to avoid tight coupling between requests and responses (Portele, 2017). All versions of the INSPIRE technical guidance and the standards are published on the INSPIRE website and the websites of the standards organisations. An issue might be that many complex documents need to be read to fully understand the API , which at this time are typically available as PDF only, not as HTML (Portele, 2017). There is a lot of technical information but not that much tutorial or best practices examples, therefore a lot of time investment is needed.

The Joint research centre of the European commission has started a study on the European Governmental APIs, APIs4DGov @INSPIRE 2018. It started in January 2018 and is to last for two years. This study reports 100 governmental APIs in Europe that use INSPIRE to gather data. Some of the most successful examples of API use related to INSPIRE (see table 6).

API case	Requests
Denmark's Addressers Web API (DAWA)	1,5 billion in 2017
Madrid MobilitiLabes API	480 million/year
Amsterdam City Data API	350 million/year
Flanders Underground – Cable and Pipe information portal	120 million/year

TABLE 6 INSPIRE RELATED API SUCCESSFUL USE CASES

WFS 3.0 specifications are also being fully re-built to adapt the trend of OpenAPI and ReST API, that should allow boost the final users of INSPIRE portal, as show the number of requests of the already studied APIs, they are also to cover completely the capabilities of WCS.

EDP gives API access URLs for CKAN and SPARQL, besides the needed documentation. The presentation of the API related documentation is not as extensive as in the case of INSPIRE They also present a list with 465 use cases all around Europe, but data about the uses number or the economic impact are missing.

Table 7 summarises the analysis made during the chapter, it gathers the situation of all the studied end-product indicators for the two studied portals

End-Product Indicator	INSPIRE	EDP
Nº Data Suppliers	36 country suppliers, around 250 if counting local and regional organizations	78 different providers between EU and national institutes.
Nº Languages used	24 official languages within the datasets. English only portal Interface	24 official languages for interface and datasets, metadata content is in language of data provider
Frequency of web update	Daily	Daily
Data accessibility	40% of the datasets are available for viewing and downloading	96% of the data has an access URL, 29% of datasets have download URL
Metadata standards	87% of metadata is compliant with ISO 10115 and OGC web service capabilities	95% of metadata is compliant with DCAT standards.
	GeoDCAT-AP is to be implement soon with improved spatial capabilities.	
Nº of Datasets	< 11,000 datasets	<800,000 datasets
WCS	WCS 2.0 No further development is expected	
WMS	WMS 1.3.0. No further development is expected soon	
WFS	WFS 2.0. WFS 3.0 is currently under development WFS 3.0 is supposed to comply to a full OpenAPI and RestAPI environment	
CSW	CSW 2.0.2 No further development is expected soon	
API	All documentation needed is included in the technical guidelines. A lot of effort is needed from the developer	EDP shows access API URLs for CKAN and SPARQL and the needed documentation.

TABLE 7 SUMMARY OF THE END-PRODUCT INDICATORS FINDINGS

5.2 Participation Indicator Analysis

In this section the intention is to review the possibilities that both portals offer when thinking about participation an involvement of the user.

5.2.1 Newsletter subscription

While a possibility to subscribe to a newsletter is easily available on the European data portal, there is no such a choice for the INSPIRE portal. Both portals show in their homepage a gathering of the most recent news and a link to check all past news. INSPIRE portal shows a total of 23 news starting in 2017, strictly related to the functioning of the portal. While EDP shows a total of 680 news related to any data initiative in Europe, being the first one published in 2015.

5.2.2 Informal Feedback participation

Only INSPIRE portal has an ad-hoc forum, such forum could not be found for EDP. Even in the case of INSPIRE, the forum is sponsored by the portal but does not belong to the portal administrators, but to the user community. The link for the official INSPIRE forum was not working at the time of the consult.

Also, both portals have presence in the social media most common platforms such as Facebook, LinkedIn and Twitter.

5.2.3 Public Events

When checking for public events related to EDP 169 past events were found all around Europe. More than that, this portal offers a calendar to check for future events somehow related to the portal but not fully about it. INSPIRE portal on the other hand shows a shorter list of 25 past events, but all are fully devoted to some specific aspects of the portal. Between the type of events, hackathons, workshops, webinars or conferences can be found.

5.2.4 Planning Committees

When checking for participation in planning committees, INSPIRE portal offers a pool of experts where you can register by filling a questionnaire related to your area of expertise. If your profile is considered valuable for the portal development, you would be selected to participate in planning committees. Also, the experts list is accessible. EDP, on the other hand does not give such an option, as the portal is developed by the European Commission with the support of a consortium led by Capgemini.

5.2.5 Veto mechanism enforcement

None of the portals show any sign of such mechanism for any user group but the portal developers. This is as expected because the veto mechanism is theoretical for now. The only intention for including it in the survey was to give representation to that level of the ladder of participation and to ask about the importance that the user would give to such a mechanism. In this indicator, therefore, we are neither expecting any participation nor future developments.

As in the previous section, table 8 shows a summary of the participation indicator findings presented above.

Indicator	INSPIRE	EDP
Newsletter Subscription	Not Available Narrow news topics	Available Broad news topics
Informal Feedback Participation	Community forum available Presence in social networks	No ad-hoc forum available Presence in social networks
Public Events	Held at national and European Level. Specific topics related to the portal	Offers information about multiple events related to data, No events specifically devoted to EDP.
Planning Committees	Option to sing up for experts committee.	No partnership available for users
Veto Mechanism	No mechanism was found, and none is expected	

TABLE 8 SUMMARY OF THE PARTICIPATION INDICATOR FINDINGS

6. Results and calculations

Survey was carried out through Google Forms. The survey window was initially planned from 15-January to 1-February, but this proved to be a short time for the minimum answers needed, so the window was extended to 22-February.

To address academic user in a trans-national environment the AGILE (Association of Geographical Laboratories in Europe) association was contacted. AGILE association was established in 1998 to promote academic teaching and research on GIS at the European level and englobes more than 80 university laboratories around Europe. The mission of AGILE is: "to promote academic teaching and research on GIS at the European level and to stimulate and support networking activities between member laboratories". Therefore, this target population can serve as representation of the GI related academic community. Besides that, more than 150 other university departments somehow related with spatial sciences have been contacted via e-mail.

Given to this same lack of answers, the initial strategy of forwarding the survey only trough AGILE community was quickly adapted, and more than 150 different departments of universities were used for them to forward the survey and 100 personal e-mail addresses of university teachers were used.

Another change from the plan design is that the order of the questions had to be changed and could not be asked in an indicator iterative order (asking one indicator and the satisfaction for both portals before moving to the next indicator) but rather grouped by portal so that filter option Never could be included when talking about the use of any of the portals. This might seem un-important, but it made the survey harder to follow by the respondent, pushing it away for participation. The result is a total of 36 answers of the survey, around the expected results given the constraints of the thesis research. The following analysis will be based on the gathered answers, full answer sheets can be found in the appendix 10.1 histograms of the answer in appendix 10.3.

The survey length was tested by fellow GIMA students and results were that, without answering open questions, the survey took already around 13 minutes to be completed. Therefore, trying to keep the survey as attractive to the respondent as possible, open questions were not mandatory. This decision lead to no answer of open questions by the respondents, and therefore no assessment of the open questions will be performed during the survey results.

6.1 Framework Questions Results

The minimum amount of personal data was required in the survey to avoid discouraging any potential respondent. Only name of the university and the respondent position were asked, to be able to frame our users spatially and in relation to their focus.

The minimum amount of personal data was required in the survey to avoid discouraging any potential answer. Only name of the university and the respondent position were asked, to be able to frame our users spatially and in relation to their focus.

Figure 18 shows the results for both questions, being the main group of respondents teachers/professors, including those that declared assisting in that position, 24 out of the total 36 respondents. The second group in numbers would be researchers, including assistants (8 of 36) followed by PhD students (3 of 36).

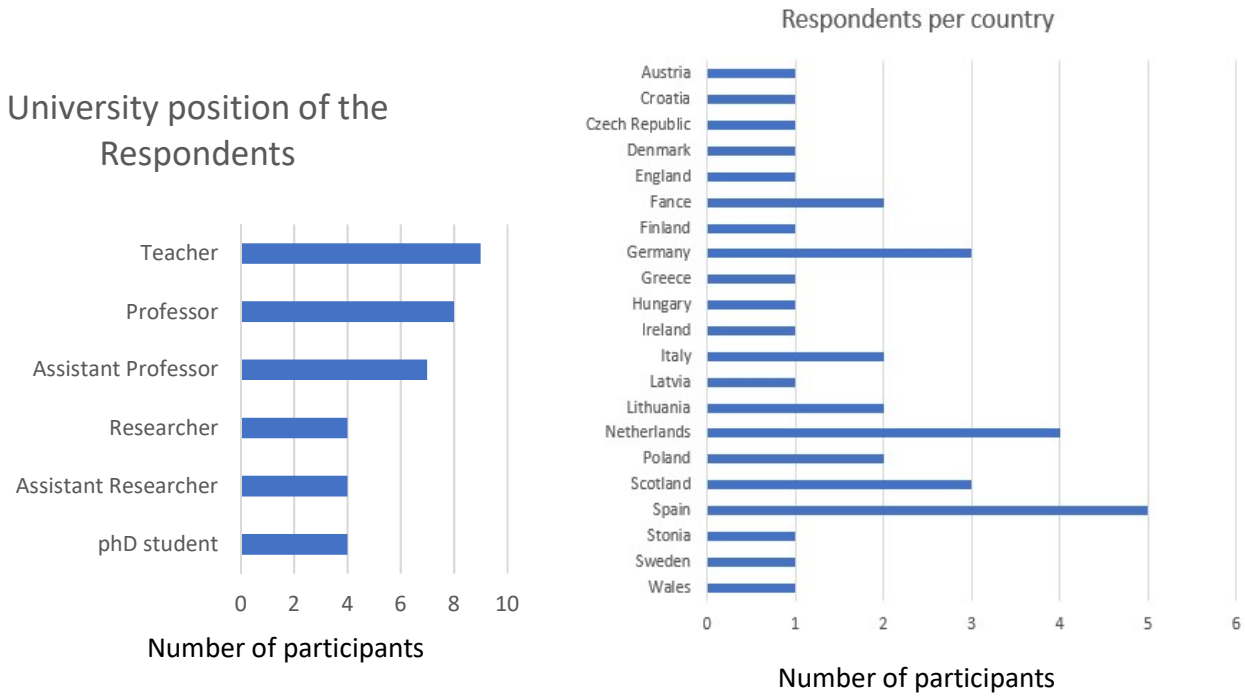


FIGURE 18: DISTRIBUTION OF THE RESPONDENTS PER POSITION AND PER COUNTRY

While considering the country were the respondant developes his work, most of the countries contributed only with one answer. This means that analysing the national influence of the trans-national portal satisfaction will not be doable here and should be left for future work.

The last context data gathered is the rate of use for this user group. Figure 19 shows how much the portals are used by the respondents. EDP shows 31% of respondents accessing the portal once every quarter, roughly the same number as INSPIRE (33%). Also, roughly the same percentage of respondents declared accessing the portal once a month (19% for EDP and 20% for INSPIRE). Differences start to appear in the number of respondents that access the portal more than once per month (20% INSPIRE against 3% of EDP), once a year (25% for EDP and 19% for INSPIRE) and those that declared never using the portal (22% EDP against the 8% of INSPIRE).

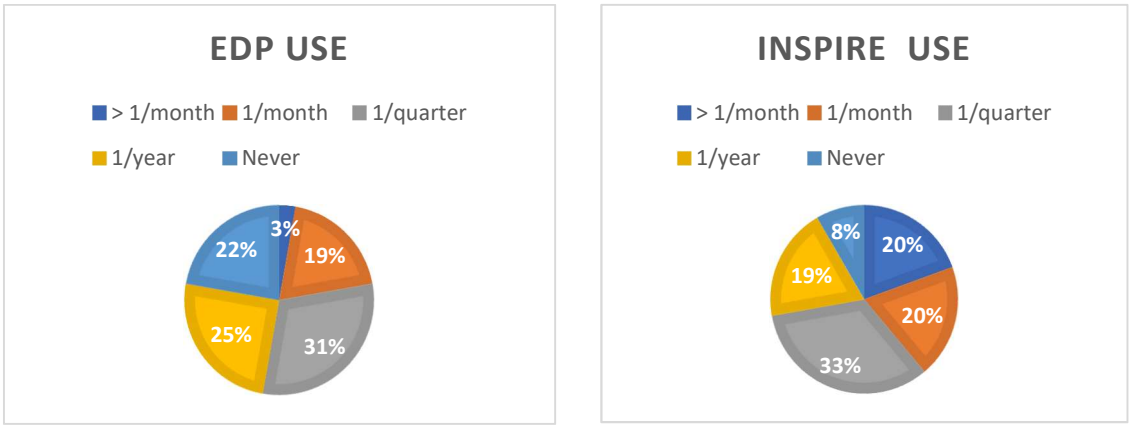


FIGURE 19: RATE OF USE OF THE PORTALS

6.2 Indicators Importance Results

When trying to score the portal it was necessary to consider each indicator as important as the average respondents considered it, so that the importance given to each factor depends on the user

group being surveyed, in this case the academic community. Because the user's satisfaction is rated from 1 to 10, the weighting factors (how much each indicator is worth in comparison to the others) must be re-scaled so that their sum must be 10, to have a final indicator and portal score value of 0 to 100.

This section shows the results of the weighting factor for all studied indicators. Importance is a characteristic of the indicator and common for both portals. Therefore, the same weighting value will be applied afterwards to the given indicator satisfaction results of both portals. Full user answers about the importance given to each indicator (UI) can be found in appendix 10.1 and the histograms figures in appendix 10.3.

6.2.1 End-Product Indicators Importance

When checking for the importance that the academic community gave to the selected end-product indicators, table 9 below shows the summary of all importance ratings (UI), average importance (AI) and weighting factor (W) for each end-product indicator. Histograms of the importance answers for the End-Product are shown in appendix 10.3.1 and full answer tables are shown in appendix 10.1.

Results show that the least importance is given to frequency of web updates, (3.28 AI and 0.53 W). It is followed by the other indicators related to human and organizational resources, number of data suppliers and number of languages (4.58 and 4.61 AI respectively and 0.75 W for both).

The indicators related to services were rated with almost the same importance, among them, WFS (5.81 AI and 0.95 W), CSW (5.97 AI and 0.97 W) and API (5.94 AI and 0.97 W) have slightly higher importance consideration than the other two service standards, WCS (5.69 AI and 0.93 W) and WMS (5.56 AI and 0.91 W).

End-Product Indicators: Intermediate Importance Calculations											
Variable	**nº data suppl.**	**nº lang.**	**freq. of update**	**data accessibility**	**metadata standards**	**nº of datasets**	**WCS**	**WFS**	**WMS**	**CSW**	**API**
∑UI	165	166	118	270	224	222	205	209	200	215	214
AI	4.58	4.61	3.28	7.50	6.22	6.17	5.69	5.81	5.56	5.97	5.94
∑AI	61.33										
W	0.75	0.75	0.53	1.22	1.01	1.01	0.93	0.95	0.91	0.97	0.97

TABLE 9 END-PRODUCT INDICATORS: IMPORTANCE CALCULATIONS

Finally, the most important group of indicators were the ones related to data. Within this group of three indicators, data accessibility was considered the most important one (7.50 AI and 1.22 W) while metadata standards and number of datasets had almost the same results (6.22 and 6.17 AI respectively and 1.01 W for both).

6.2.2 Participation Indicators Importance

Results regarding the importance of participation indicators are shown in table 10. The reader should keep in mind that results of the weighting factor are bigger for each indicator than in the end-product case, this is due to the number of indicators per approach. Less indicators considered in the approach for the same possible portal scoring (from 0 to 100) result in higher weighting values for each of them.

Respondents considered the indicator representing lowest rung of the participation ladder, newsletter subscription, as the least importance indicator (3.17 AI and 1.19 W). This is followed by the importance that respondents give to the indicator representing the highest rung of the ladder, veto mechanism (4.72 AI and 1.77 W). Informal participation though forums or social networks was not much higher, (5.00 AI and 1.87 W). Public events and Planning committee participation were rated close in importance and are the ones that the respondents give a higher

importance (6.86 AI with 2.57 W for public events, and 6.97 AI with 2.61 for planning committees).

As mentioned before, importance indicators are common for both portals, therefore there is no differentiation in this section about INSPIRE and EDP. The calculated weighting factor was used in the following section, together with the satisfaction gathered, to calculate the final indicator and portal scorings.

Participation Indicators: Intermediate Importance Calculations					
	Newsletter	**Informal Participation**	**Public Events**	**Planning Committees**	**Veto Mechanism**
∑UI	114	180	247	251	170
AI	3.17	5.00	6.86	6.97	4.72
∑AI			26.72		
W	1.19	1.87	2.57	2.61	1.77

TABLE 10 PARTICIPATION INDICATORS: IMPORTANCE CALCULATIONS

6.3 End-Product Results

To obtain the portal score values, several steps were needed. First, feedback about importance was gathered so indicators could be correctly weighted, and results transposed to a 0 to 10 range for the weighting factor. Results of the first step are shown in the previous section.

This section presents the results of the second step, giving a quantitative evaluation of the studied indicators and portals. For this, the feedback gathered about satisfaction (see appendix 10.1 tables and 10.3 histograms) was multiplied by the weighting factor of each indicator. This calculation was performed for each of the respondents, see appendix 10.2 for the individual results. The average of the indicator scoring for each user was used to calculate the Indicator Score Value (ISV) possibly ranged from 0 to 100. All the indicators were added to calculate the final portal score values, ranged from 0 to 100.

6.3.1 For INSPIRE Portal

When checking the individual satisfaction responses for INSPIRE portal without applying the weighting factor, see table 11, all indicators present a mean value between 5 and 8 from the 0 to 10 range possibility. Individual responses for INSPIRE end-product satisfaction can be found in appendix 10.1.

Highest satisfaction values were given to number of languages (7.96) and frequency of the web updates (7.27), the other organizational indicator, number of data suppliers, was not that well valuated and did not reach the 7 points average (6.48).

Indicators related to data are the next with a higher satisfaction, three of them scoring between 6.5 and 7 points average. Between them, metadata standards compliance obtains the highest mean (6.96), followed by number of datasets (6.81) and data accessibility (6.54).

The indicators related to services and access methods had the lowest satisfaction results, among them, the lowest average is for WMS accessibility (5.72), followed by WCS accessibility (5.78). The other three indicators, WFS, CSW and API were given average satisfaction (6.09).

TABLE 11: INSPIRE END-PRODUCT SATISFACTION SURVEYED RESULTS

Satisfaction answer per indicator	Average Satisfaction Answered	Sum Satisfaction answered
Number of data suppliers	6.48	214
Number of languages	7.96	293
Frequency of web update	7.27	240
Data accessibility	6.54	216
Metadata standards	6.96	230
Number of datasets	6.81	225
WCS accessibility	5.78	191
WFS accessibility	6.09	201
WMS accessibility	5.72	189
CSW accessibility	6.09	201
API accessibility	6.09	201

Table 12 shows the average and weighted indicator score values (ISV) and the INSPIRE portal score value (PSV). Here, the results are quite different from the ones obtained without weighting.

Now, the organizational related indicators are the ones with the lowest contribution to the portal satisfaction. Among them, the highest scoring is for the number of languages (5.99) while the number of data suppliers (4.85) and frequency of web update (3.89). The indicators related to data are the ones that more contribute to the overall portal satisfaction, being the first one data accessibility (8.00), followed by metadata standards (7.07) and number of datasets (6.86). Finally, for the service and access related indicators, WCS and WMS accessibility (5.37 and 5.19 respectively) scored less than WFS (5.77), CSW (5.93), and the API accessibility (5.90).

The calculated portal score value (PSV) for INSPIRE, considering all indicators and respondents, is 64.82 out of the 100 possible points.

INSPIRE END-PRODUCT: AVERAGE INDICATOR AND PORTAL SCORING (ISV + PSV)											
SCORE	**nº data suppl.**	**nº lang.**	**freq. of update**	**data access.**	**metadata standards**	**nº of datasets**	**WCS**	**WFS**	**WMS**	**CSW**	**API**
ISV	4.85	5.99	3.89	8.00	7.07	6.86	5.37	5.77	5.19	5.93	5.90
PSV	**64.82**										

TABLE 12 INSPIRE END-PRODUCT: AVERAGE INDICATOR AND PORTAL SCORING (ISV + PSV)

6.3.2 For European Data Portal

When checking for raw satisfaction answers related to EDP, see table 13, the organizational related indicators were the group that reported a higher satisfaction. Number of languages presented the highest average (7.89) of all indicators, followed by the frequency of web update (6.74). Number of data suppliers average is lower (6.21).

The least satisfactory indicators were, in the case of EDP, those related to data. Data accessibility (5.50) has the lowest satisfaction average of all indicators, followed by number of datasets (6.0). Metadata standards (6.25) is the most satisfactory for respondents among the indicators of this group.

Service and access methods indicators are rated with slightly higher average than the data related ones. Among them, the highest scoring is in the CSW accessibility (6.35) followed closely by WFS accessibility (6.33). API and WMS obtained the same average (6.25), and the lowest average among them is the one presented by the WCS accessibility (6.07).

TABLE 13: EDP END-PRODUCT SATISFACTION SURVEYED RESULTS

Satisfaction answer per indicator	Average Satisfaction Answered	Sum Satisfaction answered
Number of data suppliers	6.21	174
Number of languages	7.89	221
Frequency of web update	6.74	182
Data accessibility	5.50	154
Metadata standards	6.25	175
Number of datasets	6.00	168
WCS accessibility	6.07	170
WFS accessibility	6.33	171
WMS accessibility	6.25	175
CSW accessibility	6.35	178
API accessibility	6.25	175

When considering the weighting, the average satisfaction obtained per indicator offered different results, see table 14. As in INSPIRE, organizational indicators are now the ones that least contribute to the end-product satisfaction. Frequency of web updates (3.47) and number of data suppliers (4.64) are the lowest contributions to the portal score value among all indicators. Number of languages (5.93) reports a better situation.

Indicators about data are, as in INSPIRE, the ones that score higher indicator score values among the indicator groups. The highest rated indicator is the data accessibility (6.73), followed by metadata standards (6.34) and least satisfactory among this group, number of datasets (6.03).

Service and access related indicators present roughly the same result. WCS and WMS were the ones with lower score (5.64 and 5.66 respectively), followed by WFS (5.78), API (6.06) and CSW (6.19).

EDP END-PRODUCT: AVERAGE INDICATOR AND PORTAL SCORING (EP ISV + PSV)											
	nº data suppl.	nº Lang.	Freq. of update	data access.	metadata standards	nº of datasets	WCS	WFS	WMS	CSW	API
ISV	4.64	5.93	3.47	6.73	6.34	6.03	5.64	5.78	5.66	6.19	6.06
PSV	62.48										

TABLE 14: EDP END-PRODUCT: AVERAGE INDICATOR AND PORTAL SCORING (ISV + PSV)

6.4 Participation Results

As in the section before, this section presents the results of the gathered satisfaction and the scoring results for the indicators and portals. For this, the weighting factors calculated in section 5.2 will be used.

When reporting participation, the respondents were asked to mark only the processes in which they had participated, leaving those in which they had not empty. Empty answers for participation are considered a 0 scoring for that indicator and users. Taking this into account, results for both portals are showed in the following sections.

6.4.1 For INSPIRE portal

Participation average satisfaction for INSPIRE indicators is shown in table 15. Overall, the respondents indicate a low participation average. The highest one is for informal participation in forums or social networks (3.38), with 18 out of the 36 respondents indicating that they have participated in that indicator. Newsletter (2.19) reports, 21 respondents participated while for public events (1.02), only 5 of the respondents participated. Only 1 respondent said to have

participated in planning committees (0.19) and no respondents registered participating in veto mechanisms, For INSPIRE participation histograms see appendix 10.3.5.

TABLE 15: INSPIRE PARTICIPATION SATISFACTION SURVEYED RESULTS

Satisfaction answer per indicator	Average Satisfaction Answered	Sum Satisfaction answered	Nº of Participants
Newsletter subscription	2.19	79	21
Informal Participation	3.38	122	18
Public Events	1.02	37	5
Planning Committees	0.19	7	1
Veto Mechanism	0	0	0

The results after applying the weighting factor slightly vary, see table 16. The highest score for INSPIRE participation indicator was obtained in the Informal participation indicator (6.34). Public events and newsletter obtain almost the same score (2.64 and 2.60 respectively) and more than two points higher than planning committees (0.51). The number of participants for veto mechanism was 0, therefore this indicator has the same scoring.

This leaves the INSPIRE indicator with a 12.09, out of the 100 possible points, as a final portal score for participation when considering the academic community.

INSPIRE PARTICIPATION: AVERAGE INDICATOR AND PORTAL SCORING (ISV + PSV)					
SCORE	**Newsletter**	**Informal Participation**	**Public Events**	**Planning Committees**	**Veto Mechanism**
ISV	2.60	6.34	2.64	0.51	0.00
PSV	**12,09**				

TABLE 16 INSPIRE PARTICIPATION: AVERAGE INDICATOR AND PORTAL SCORING (ISV + PSV)

6.4.2 For European Data Portal

The raw participation results for EDP, without considering the weighting factor, are shown in table 17. Here, the number of participants and the average satisfaction answered is even lower than INSPIRE.

Informal participation in forums and social media has the highest satisfaction average (1.80) and reports the highest number of participants with 10. Is followed by newsletter (0.86) which shows 6 participants while only 1 participant is registered for public events. In EDP, no planning committee or veto mechanism participation was reported.

TABLE 17: EDP PARTICIPATION SATISFACTION SURVEYED RESULTS

Satisfaction answer per indicator	Average Satisfaction Answered	Sum Satisfaction answered	Nº of Participants
Newsletter subscription	0.86	31	6
Informal Participation	1.80	65	10
Public Events	0.19	7	1
Planning Committees	0	0	0
Veto Mechanism	0	0	0

Results after applying the weighting factors, see table 18, show that almost all the participation satisfaction of the EDP comes because of informal participation through forums or social networks (3.38). Planning committees and veto mechanisms add 0 score to the final participation

portal score value, therefore, public events (0.50) and newsletters (1.02) add the rest of the score to the final participation portal score value, that was 4.90 out of the 100 possible points.

EDP PARTICIPATION: AVERAGE INDICATOR AND PORTAL SCORING (ISV + PSV)					
SCORE	**Newsletter**	**Informal Participation**	**Public Events**	**Planning Committees**	**Veto Mechanism**
ISV	1.02	3.38	0.50	0.00	0.00
PSV	**4,90**				

TABLE 18 EDP PARTICIPATION: AVERAGE INDICATOR AND PORTAL SCORING (ISV + PSV)

6.5 Interaction of Participation with End-Product and Use

Now that the scoring of the portals and the indicator have been calculated, the last part of the results is to present a correlation analysis to assess the relationship between perceived end-product satisfaction and participation to check whether the hypothesis "the more participation the more end-product satisfaction" is true or not. This was done by plotting against the two user portal scores (UPSV) for end-product and participation, for each portal (see appendix 10.2) and calculating the correlation between them. Figure 20 below shows the Participation and end-product scoring for every user to the INSPIRE portal. The correlation analysis gave a strong direct correlation in the case of inspire, which suggest that the hypothesis is true, at least in the case of INSPIRE portal and the surveyed community.

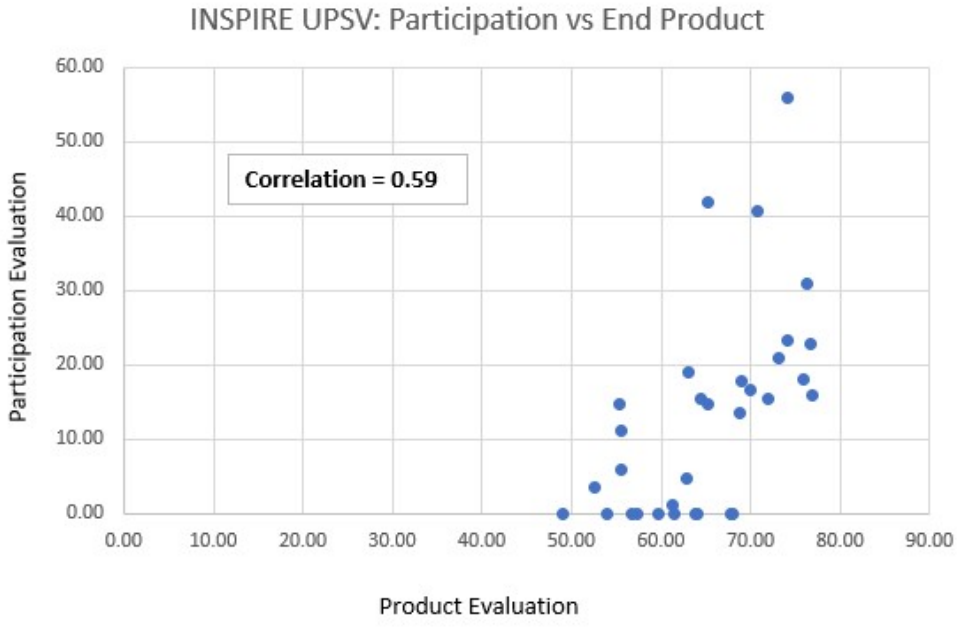


FIGURE 20: INSPIRE CORRELATION ANALYSIS, END-PRODUCT VS. PARTICIPATION

EDP correlation analysis is presented in Figure 21, below, here there is also a direct correlation. These results mean that the new strategies of involving the users are havign a positive effect, at least for the surveyed community in terms of satisfaction.

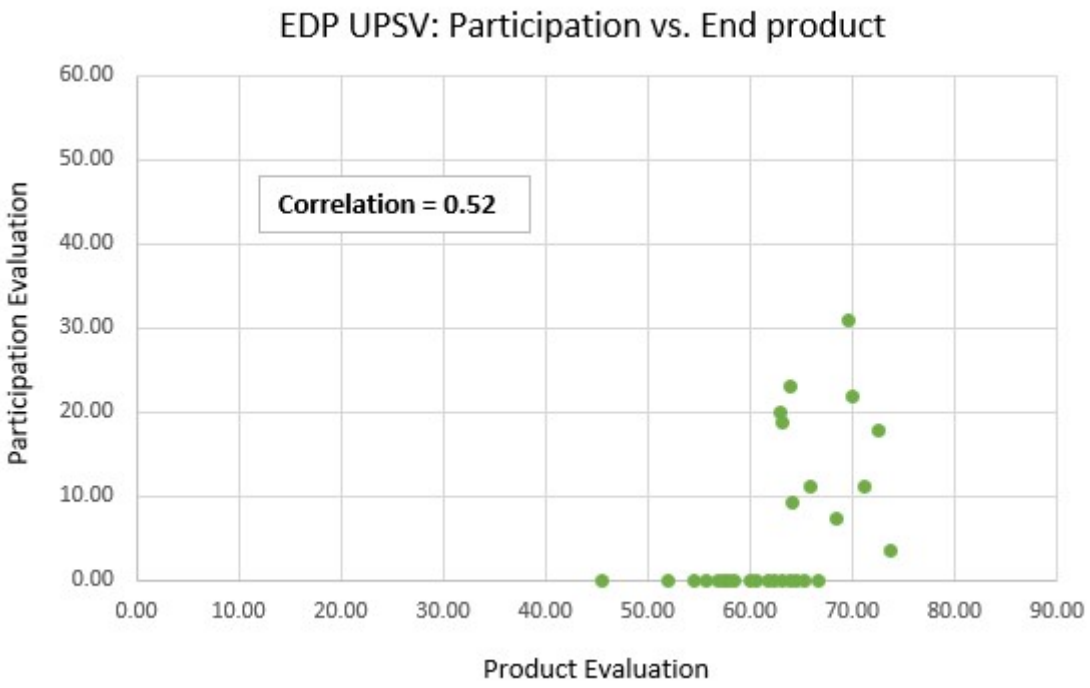


FIGURE 21: EDP CORRELATION ANALYSIS, END-PRODUCT VS. PARTICIPATION

The sample is too small to talk about generalizations as the interval of confidence for the correlation does not reach the minimum 0.05 required. The strong correlations of above 0.5 in both cases suggest that the relationship exists. To have statistical certainty of it though, it would be needed to gather more answers to add robustness to the analysis.

The relationship between the participation and use was analysed by performing a correlation analysis between the user portal score values (UPSV) and the use reported by the respondents. For the analysis, the use choices were given a value for 1 to 4, giving higher number to higher use choices. Results showed no significant correlation for any of the portals, 0.19 for INSPIRE and 0.12 in the case of EDP, figures 22 and 23 respectively.

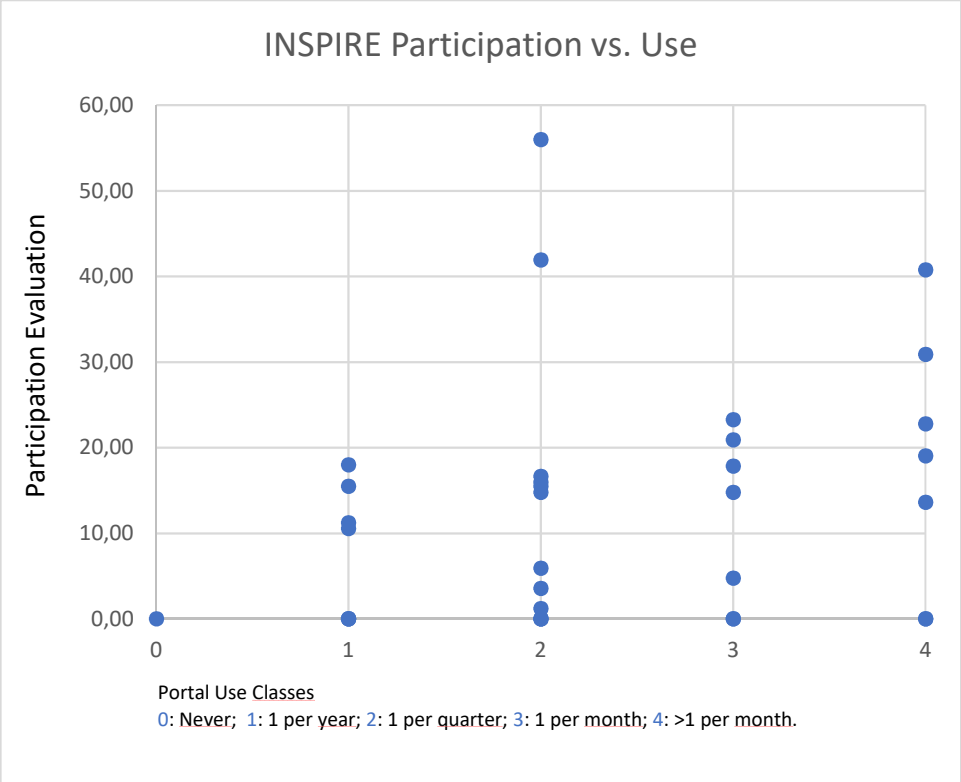


FIGURE 22: INSPIRE CORRELATION ANALYSIS: PARTICIPATION VS USE

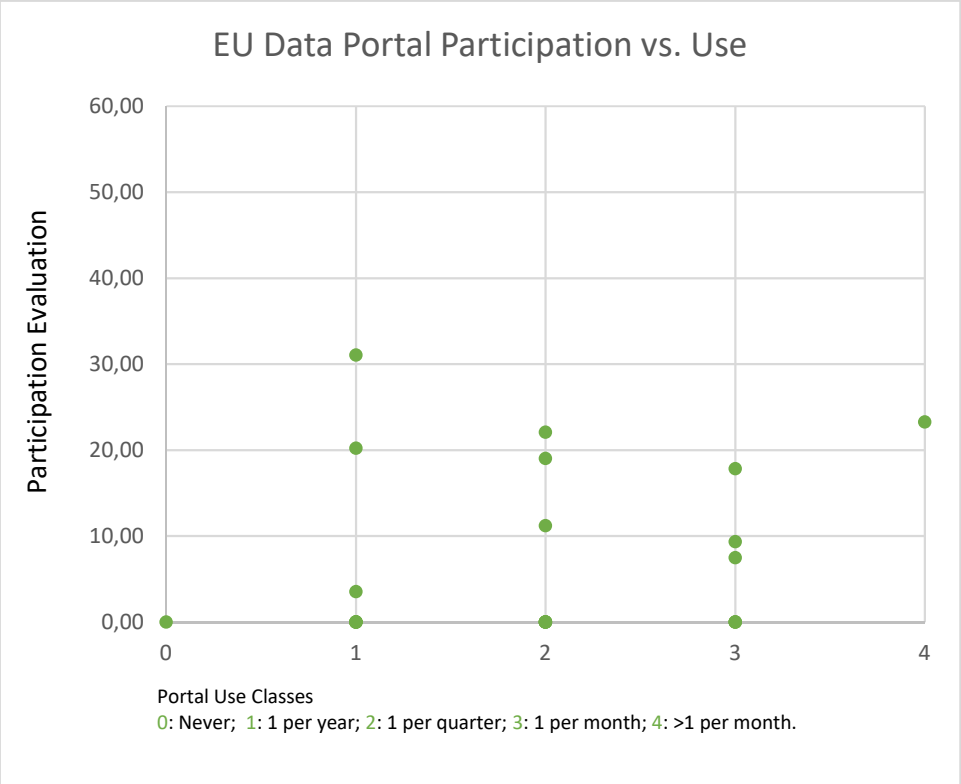


FIGURE 23: EDP CORRELATION ANALYSIS: PARTICIPATION VS. USE

7. Discussion

Within this chapter, the intention is to comment on the quantitative results and use the open questions of the survey to add qualitative assessment. Although the calculation methodology itself was clear, the major constraints, and adaptations needed were related to the survey. The thesis timelines allowed only for a narrow surveying window and the non-answer threat was the highest concern.

A model of the survey was tested by fellow GIMA students and unfortunately, was found to be over 17 minutes. This was addressed by reducing the number of indicators to be included, which lead to an average of 13 minutes. Maybe because a 15 minutes survey was still too long, and open questions were not mandatory, these questions were left unanswered by all the respondents. Therefore, in order of giving recommendations and at least an overview of the current state of the art for a qualitative analysis, portal research was performed to assess the different portal indicators and findings were included in chapter 5. Those findings are now used to give justification to the findings and recommendation to the portals.

Also, because after one week of surveying only 2 responses were gathered. The initial intention of using the AGILE community as the only target community was quickly changed to a more open approach that considered contacting as many universities and academics as possible, more than 150 university departments and 100 personal e-mail addresses were contacted. Finally, the open window that was planned from January 15th to February 1st was extended to February 22nd to gather as many answers as possible.

The changes in the target community could have led to a bias in the number of respondents per country or academic interests, as the contacts were performed through my personal network, Spanish and Dutch respondents are therefore the biggest group. This is a minor issue that needed to be assumed so that the non-answer threat could be dealt with.

Even with the adaptations, the number of respondents was low, reaching a total of 36. Determining the number of people contacted over all is challenging, as several organizations and individuals forwarded the survey to their contacts. Assuming 5 people contacted on average by each university department (not all departments forwarded the survey), the potential number of people contacted was between 700 and 900.

Anyhow, this number of responses does not allow for an interval of confidence lower than 0.05, which is the threshold that allows for generalization, therefore the analysis only is applicable to this user group and not the whole academic community. Nevertheless, results depict interesting findings that could be use as guidance for future work. The calculation methodology is valuable because of the applicability in different user groups, given the included weighting factor. This allows for future work comparing the results for different user groups and allowing for a quantitative differentiation of their needs.

7.1 About the Importance Results

When considering the End-Product approach, the indicators related to human resources (data suppliers, languages, web update frequency) were considered the least important for the surveyed community. When concerning indicators related to services, WCS WFS and WMS standards appear to be less significant for the user than CSW and the API accessibility. All services indicators are less important than the indicators about data. Data availability is the foremost important indicator. Figure 24 shows the final weighting factor for each of the End-Product indicators.

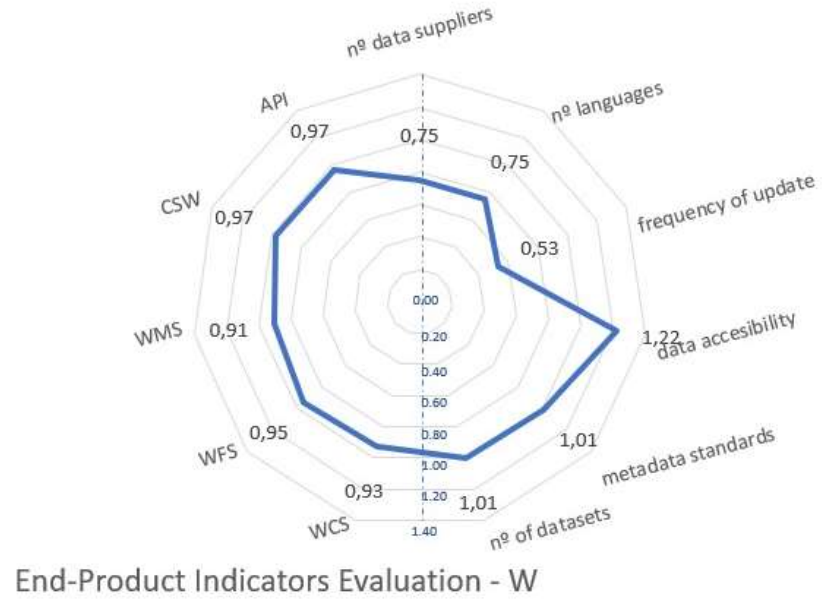


FIGURE 24: WEIGHTING FACTOR FOR THE END PRODUCT INDICATORS

If looking to the participation approach, see figure 25, the newsletter is considered the least important for the user. The importance of the newsletter subscription can be low given that the academic user is normally looking for specific information. Critically reflecting on the results, maybe the newsletter subscription indicator was not the best suited for the portal representation of the information rung of the participation ladder. A more suited indicator for information could have been technical guidelines readings, tutorials or webinars, which better represent the specific information need that a portal user has.

Although no veto mechanism is available for any user group within these portals, the importance that the user gives to having such mechanism was asked, so that at least a comparison with the other indicators could be made in the willingness to participate in such processes. Results show that resondents even do not consider the veto mechanism to be a priority and would rather focus on participation in planning committees or public events, the ones that are given the highest importance.

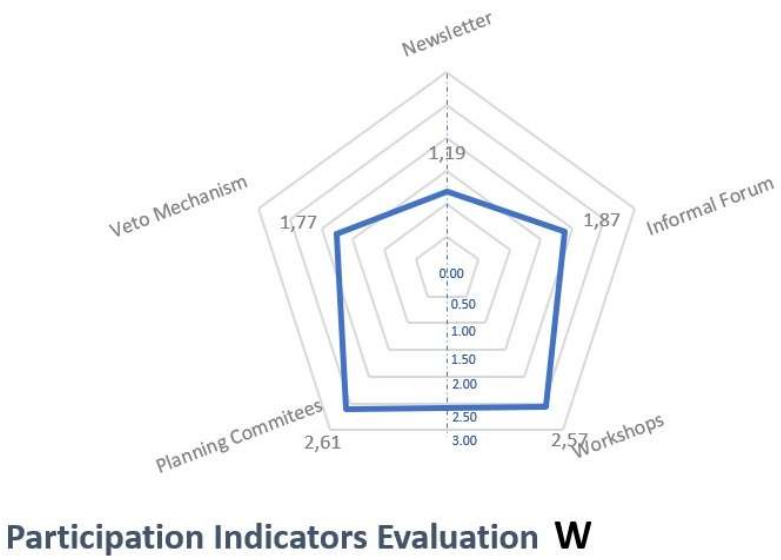


FIGURE 25: WEIGHTING FACTOR FOR THE PARTICIPATION INDICATORS

7.2 About End-Product Results

With regards to the End-product, the only noticeable difference between both scorings are the three indicators related to data (nº datasets, data accessibility and metadata standards, see figure 26. The score is high not only because the perceived satisfaction is high, but because the it had the highest weighting values.

Both portals already offer tutorial and examples on how to use the portals. The Technical guidelines offered within INSPIRE plus the specific and devoted thematic and interface for accessing the different topics (annexes I, II and III) should be transposed somehow to the confusing presentation of datasets in EDP, which falls to the catalogue (providers) folder. As the specific intention of EDP is to harvest open data from national and subnational portals, is not specifically devoted to any given topic and data accessibility might be hindered. In terms of improvements, both portals are implementing geoDCAT-AP, a new geospatial extension that produces additional RDF syntax binding to the current DCAT-AP, allowing for improvements in description of spatial data, such as spatial resolution, reference system, or dataset topic category. Implementing this update could help bridge the gap between the two portals soon.

With regards to the human, or organizational indicators (nº data suppliers, frequency of web update and nº of languages) these indicators obtained, for both portals, the highest scores but the lowest importance. It indicates that these issues, more related to organizational manners of 1st generation SDIs, have already been taken care of, and now are even taken for granted. For both portals, the number of providers is high, and websites are updated daily during the week screening window. One difference is worth mentioning with regards to the number of languages, although the quantitative analysis did not reflect it: EDP has an interface that allows navigation though the main portal pages in any of the 24 official EU languages, while INSPIRE is only offered in English. This difference is not translated to the survey findings, probably because the surveyed community has a high English level, and this does not affect their satisfactions. Results could be different if another user group were analysed.

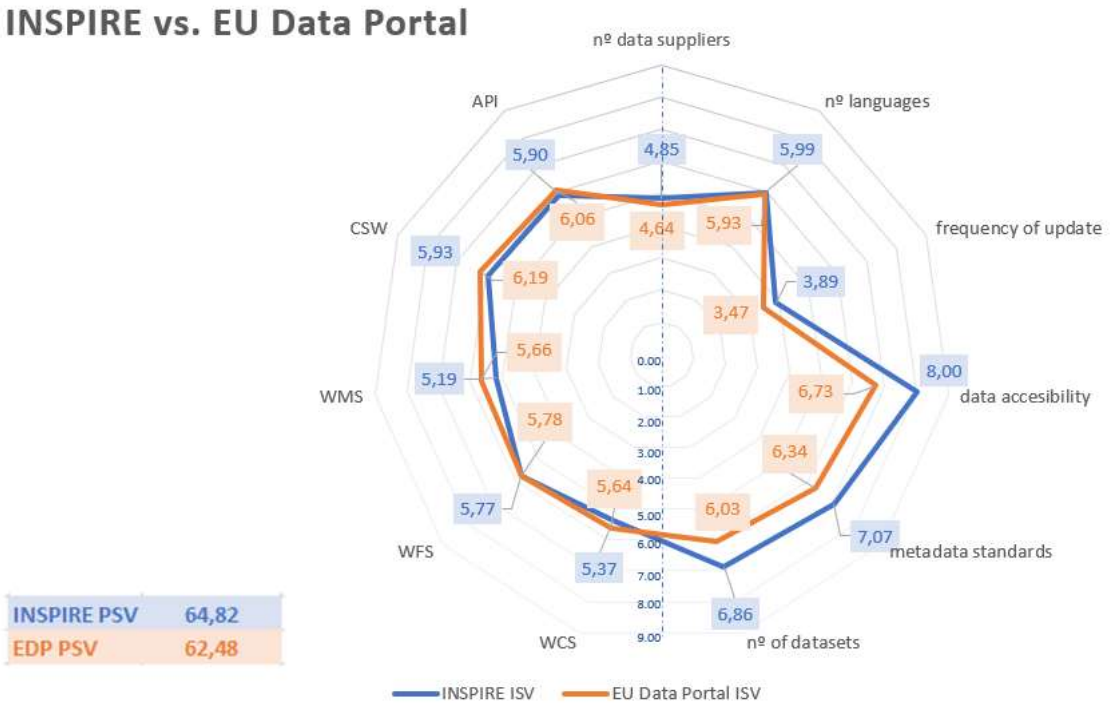


FIGURE 26: COMPARISON OF BOTH PORTALS END-PRODUCT INDICATOR SCORE VALUES

When talking about the services, both portals work under the same standards, and although scores show that they barely obtain a five, this is the area were more improvements are planned. Indicators related to services and access methods show a big margin of improvement and there is no big difference among them, although WFS, CSW and API are more highly considered by the users than WCS and WMS. Qualitative research performed allow for justification of this findings as WFS 3.0, currently under development, specifications are supposed to cover the functionalities of WCS 2.0.2 and part of the WMS ones. Additionally, WFS 3.0 is related to the API accessibility in the sense that it will be compliant with OpenAPI and RestAPI.

7.3 About Participation results

The results gathered for participation indicated there is a long way to go in the involvement of the academic community. INSPIRE scored 12 and EDP scored 4,9 out of the 100 possible points. Taking a deeper look at an indicator level, see figure 27 significant participation is only registered in newsletter and information through informal means like forums or social networks. Participation for the last three indicators was marginal or inexistent. When relating it to Olausson's (2016) adapted ladder of participation, INSPIRE obtained 13 from the 36 respondents (36%) in a non-information level, while tokenism levels of participation are achieved by 22 of them (61%). Only 1 respondent was in a user-driven level (2%). In the case of EDP, non-participation levels were registered for 25 respondents (69%), leaving 11 respondents in a tokenism level (30%), and 0 respondents in a user-driven level.

No participation was reported for a veto mechanism, which was as expected given that none of the portals offers such possibility, but the importance rating was also below five, meaning that the users are not really interested in having such a mechanism.

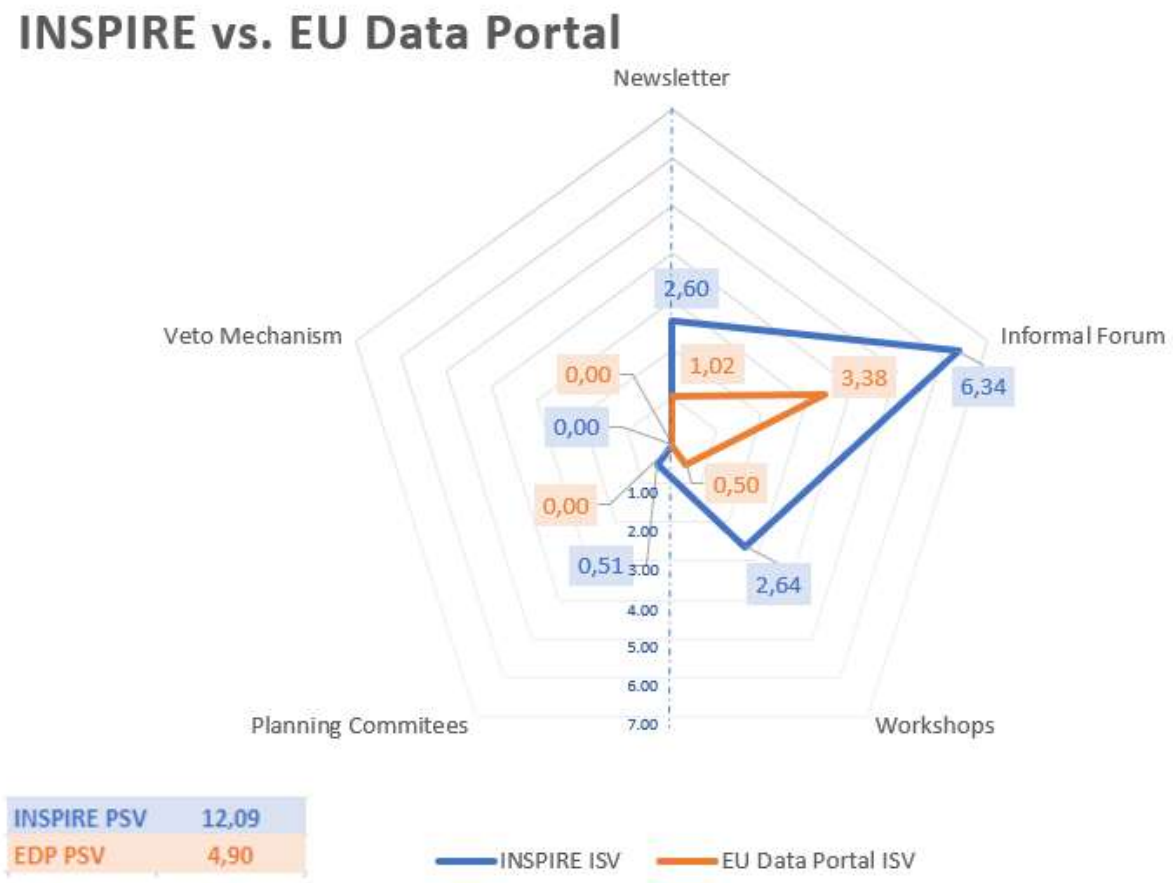


FIGURE 27: COMPARISON OF BOTH PORTALS PARTICIPATION INDICATOR SCORE VALUES

As explained in the indicator review, newsletter subscription and the EDP calendar allows to get valuable information on events going on in Europe related to the world of data, but these events and information are not specifically related to the functioning of the portal. Although this could be useful information, certainly most of the times it will be perceived as spam, and therefore ignored and considered useless. INSPIRE, on the other hand, does not have a subscription system, and posts limited news in their portal homepage, all news are strictly related to INSPIRE and therefore seem more informative and obtains a higher score. Narrowing the topics of the information could be useful for EDP while implementing the e-mail newsletter subscription system is recommended for INSPIRE.

The other big difference in scoring is the informal means of communication via forum or social media. EDP does not have a forum while INSPIRE has a community forum been powered by the portal, existing since 2014. An official INSPIRE forum is supposed to be available but when consulting it the link did not work. Having a forum available could mean the difference in rating this type of participation, therefore EDP is recommended to develop one and, although user needs might be covered by the community forum, INSPIRE should fix their official portal. Both portals have also presence in the main social media platforms, and several forums such as reddit or GitHub offer topics on the portals, which could explain EDP scoring in the indicator.

When talking about the participation in public events, this indicator was considered of high importance by the users. INSPIRE is already giving workshops on different aspects of the portal and its data all around Europe. The fact that this is not reflected in the survey could mean either that the academic community is not invited to participate in these events, they are not interested,

which contrasts with the importance given to the indicators, or simply that, because the sample of the survey is too low, this has not been reflected in the respondents. In case it was the first or second cases, the recommendation is to create specific events for research with INSPIRE or with the academic community straight forward.

In the case of EDP, only one respondent said to have participated in their workshops. Although their webpage constantly offers information about multiple events somehow related to sharing data but does not share information relating to specific events devoted to the use of the portal or its development, doing so could help to build knowledge and therefore, not only increase their participation score but also their data accessibility end-product indicator.

Partnership was represented by the indicator "participation in planning committees" and only one respondent said having participated at this level with INSPIRE, while no one reported it for EDP. As the main interest of the administration is in partnership with private and public organizations that obtain commercial value from GI, academic users are being pushed aside and not really considered within this agenda. Nonetheless the target user groups want to participate in these event, given the importance they assign to the indicator.

7.4 About the Participation relationship with end-product and use

Besides rating the portals in accordance with the academic community and proposing best practices and a guideline for the next steps forward, another objective of the thesis was to check for the correlation between the participation and the perceived end-product satisfaction. For this, a correlation analysis was performed plotting participation against the perceived End-product satisfaction and use of the portal.

Findings suggest that there is a moderate strong positive correlation between the portal perceived end-product satisfaction and the participation, 0.59 for INSPIRE and 0.52 for EDP. This means that participation has a direct relationship in the perceived end-product satisfaction. Therefore, participation should be used as a tool to achieve the level of involvement necessary for the user to become a data provider (produser) and successfully implement 3rd generation and open SDIs.

When testing for the relationship between participation and use, no correlation was found. Possibilities that could justify these findings would be is that the sample size is too few, or that the user community accesses the portals for professional reasons and without an alternative, which leads to using the portal no matter what. If the second was the case, the methodology should be applied to other user groups to check if there is a variation in the use/participation correlation depending on the type of user.

8. Conclusions

8.1 Answer to Research Objectives

The main research question of the thesis was to determine if the involvement of the user in portal development results in a higher usage and perceived satisfaction. Through the thesis, a methodology has been developed to assess in a quantitative manner the Infrastructure for Spatial Information in Europe (INSPIRE) and the European Data Portal (EDP), two trans-national portals that publish GI within the European Union and EFTA countries.

Two different perspectives are considered, end-product and participation: End-product measures the final satisfaction of the user with the portals while the participation perspective addresses the involvement of the user in the portal development.

The methodology is designed so that it considers the relative importance given by the users to the indicators to adjust the satisfaction scored for each of them in the survey according to its importance.

The studied portals have been assessed with the proposed methodology and scored between 0 and 100. Results show a close scoring for the End-product perspective, 63 points for INSPIRE and 60 for EDP, and overall low for the participation perspective 12 and 4,9 points respectively.

With regards to the End-product, the only noticeable difference between both scoring are the three indicators related to data (nº datasets, data accessibility and metadata standards), in which INSPIRE scored a weighted average of 71 compared to the 61 of EDP. The score is high not only because the perceived satisfaction is high, but because the importance given to this indicator by the respondents was also high. Such differences can be explained by the topic presentation offered by the annexes I, II, and III. Transposition of EDP to that type of interface instead of the current data provider sorted presentation.

End-product indicators related to organizational or human resources (nº of data suppliers, nº of languages, and frequency of web update) had the lowest weighting factors, therefore, although their satisfaction was high, their final scorings were the lowest of all groups. Users are already used to the implementation of these indicators, and thus the low scoring.

Those indicators related to services and access the network obtained roughly the same results, although WFS, API and CSW score higher than WCS and WMS. Probably due to the trend of migrating to OpenAPI and RestAPI environments in the case of the first two, and the importance of discovery services for the third one.

When looking towards the participation approach, the results gathered reflected that there is a long way to go in the involvement of the academic community. INSPIRE scored 12 and EDP scored 4,9 out of the 100 possible points.

Taking a deeper look, significant participation is only registered in the newsletter and information through informal means like forums or social networks. Participation for the last three indicators was marginal or inexistent.

When relating it to Olausson's (2016) adapted ladder of participation, 36% of INSPIRE respondents were in a non-information level, while 61% are in the tokenism level. Only 1 respondent, 2% was classified to be in the user-driven level. In the case of EDP, the non-participation level was registered for 69% of respondents, leaving the 30% left in a tokenism level, and 0 respondents in a user-driven level.

From the low participation reported in the thesis, an overall conclusion can be derived: both portals, and specially EDP, focus their development on the technical issues and improvements, but not considering the users' opinion or, at least not facilitating the means for their participation

in development. That, together with the strong correlation observed between participation and satisfaction, allows to conclude that none of them are yet user oriented as is expected for fully implemented 3rd generation and open SDIs and further efforts are needed to involve the produser.

The greatest value of the methodology developed through the thesis, besides considering the participation approach, is that it is adaptable to different user groups. The weighting factor is the key element for this adaptability, as the respondents will rate the importance of indicators themselves. This allows for comparison between user groups and detection of any specific group needs.

8.2 Reflection and future work

The first thing that needs to be said, is that the research has not achieved the number of answers necessary for the generalization of the survey to the whole target group. This was initially considered out of the scope already, given the resource and time constraints of the thesis, but nevertheless it should be pointed out. Therefore, the conclusions of the assessment are only valid when considering the group of individuals that have participated in the research and are not generalizable to the whole academic community.

Also, the initial intention was to analyse 15 of the end-product indicators presented by Crompvoets and Bregt 2008, but because the survey over was 17 minutes duration and worrying about how it could discourage the respondents, a decision was made to cut out those considered least important, leaving a total of 11 end-product indicators to analyse, leaving it in less than 15 minutes. Anyhow, this could not be avoided as the respondents left the open questions blank, as too much time was needed, which prevented getting recommendations from the community. To solve this, chapter 5 evaluated the potential of the indicators, looking for current trends and state of play that would allow for recommendations to be made.

When evaluating the newsletter subscription indicator for participation, results found were low in importance rating and satisfaction for both portals. When choosing the indicators for every rung of participation, the decision was to select newsletter as a representative indicator. Maybe this was not the best choice possible, as it depicts an overall information of the portal, and not specific information about its use. Webinars, technical guidelines, or tutorials are also offered by both portals and they could better represent the information rung for the specific needs of the user.

Even with the minor issues mentioned before, success has been achieved when developing a methodology that graded the portals from the user perspective. Considering the weightings of importance as a key point as it makes the methodology adaptable for any user groups, as the different indicators will adapt to the user groups considerations.

This portal assessment methodology could help the portal developers to implement some best practices from each other, and the value of proving black against white this relationship can help decide also public bodies and funding organizations to go forward in the SDI evolution an invest more in this type of satisfaction, as it pays off in terms of use, and therefore, economically.

When thinking in future work related to this thesis, the first thing that comes to mind is to keep surveying the user community so that the results can be generalized to the whole European academic community. If these results are proven true by a more robust sample, it could serve as justification and a stepping point for organizations to go a step forward and start looking for partnerships with specific outside user groups (not stakeholders). Also, a bigger sample spread through Europe would allow to study the influence of the National environment with the satisfaction of trans-national portals.

Also, applying the methodology developed in the thesis to different user groups would allow for comparison between them. This should help further study the differences between user groups need and perceived satisfaction.

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10. Appendix

10.1 Answers Gathered by the survey

General Information About the Respondents		
University	**Country**	**Position**
Universität Innsbruck	Austria	Teacher
University of Zagreb	Croatia	Researcher
Brno University of Technology	Czech Republic	Teacher
University of Copenhagen	Denmark	PhD student
University of Portsmouth	England	Professor
Aalto University	Finland	Assistant Researcher
Université Toulouse	France	Teacher
Université Rennes	France	Assistant Professor
LMU Munich	Germany	Assistant Researcher
Universität Münster	Germany	Assistant Researcher
Universität Münster	Germany	Teacher
Aristotle University of Thessaloniki	Greece	Professor
University of West-Hungary	Hungary	Professor
University College Cork	Ireland	Professor
Politecnico Di Milano	Italy	Assistant Professor
University of Pisa	Italy	Teacher
University of Latvia	Latvia	Researcher
Vilnius University	Lithuania	Researcher
Vilnius University	Lithuania	Professor
Twente University	Netherlands	PhD student
Twente University	Netherlands	Assistant Professor
Utrecht University	Netherlands	Teacher
vrije universiteit amsterdam	Netherlands	Assistant Professor
University of Warmia	Poland	Professor
University of Warsaw	Poland	Professor
Glasgow University	Scotland	Research Associate
University of Edimburg	Scotland	PhD student
University of Glasgow	Scotland	Assistant Professor
Autonoma de Madrid	Spain	Professor
Autonoma de Madrid	Spain	Assistant Professor
Universidad Autonoma de Barcelona	Spain	Teacher
Universitat Jaume I	Spain	Researcher
Universitat Jaume I	Spain	Teacher
Tartu University	Stonia	Teacher
Stockholm University	Sweden	phD student
Aberystwyth University	Wales	Assistant Professor

TABLE 19 GENERAL INFORMATION ABOUT THE RESPONDENTS

INSPIRE and EDP End-Product: Indicators Importance Evaluation (UI)										
nº data suppliers	**nº languages**	**frequency of update**	**data access.**	**metadata standards**	**nº of datasets**	**WCS**	**WFS**	**WMS**	**CSW**	**API**
4	3	2	8	7	7	5	6	6	7	6
5	4	3	7	7	6	6	8	7	8	9
6	3	1	5	8	7	7	7	7	7	8
3	4	4	7	8	5	5	5	4	6	5
3	3	5	9	8	5	6	7	7	7	4
3	6	4	7	7	7	6	6	5	6	5
4	4	3	6	6	4	5	4	5	4	4
4	5	2	7	8	5	7	8	7	8	5
5	6	4	8	8	4	7	6	6	5	6
4	4	4	7	8	7	5	7	6	8	7
4	7	2	10	8	8	6	5	5	5	6
4	6	6	8	4	5	5	5	5	5	5
4	5	3	8	3	5	4	3	5	5	5
5	2	4	8	8	8	4	6	5	6	7
5	5	3	9	4	6	7	7	6	6	6
3	4	3	8	9	9	5	5	5	5	8
6	8	2	6	6	6	5	6	6	7	6
2	7	2	9	9	6	7	6	6	6	6
4	2	4	8	8	6	5	5	4	5	5
8	6	7	9	9	8	8	8	7	8	9
4	2	6	5	3	7	4	4	5	5	6
4	3	4	6	3	8	8	8	6	3	6
3	3	1	2	3	4	3	2	3	3	4
8	6	5	8	7	7	8	7	7	8	6
4	6	4	10	4	3	6	6	6	6	6
6	3	3	7	8	7	6	6	6	7	6
6	4	1	7	6	7	8	8	6	4	7
5	4	2	9	2	5	3	3	2	5	4
3	2	4	6	6	9	6	6	4	8	6
7	8	4	9	9	8	4	6	7	7	7
7	3	3	7	8	7	6	6	7	7	7
4	7	3	7	7	8	7	7	6	6	6
6	8	2	9	3	5	8	8	8	8	8
5	6	2	9	3	2	4	4	5	6	5
3	5	5	7	6	5	4	3	3	3	3
4	2	1	8	3	6	5	5	5	5	5

TABLE 20 INSPIRE AND EDP END-PRODUCT: INDICATORS IMPORTANCE EVALUATION (UI)

INSPIRE Participation: Indicators Importance Evaluation (UI)				
Newsletter	**Informal Participation**	**Public Events**	**Planning Committees**	**Veto Mechanism**
2	5	7	8	5
4	5	4	7	4
1	7	8	7	4
1	4	9	8	3
4	7	8	8	7
4	8	7	7	4
3	4	7	8	7
3	8	7	6	6
3	5	8	7	5
1	3	5	6	5
2	4	7	7	3
2	7	5	6	4
3	2	6	7	7
4	5	6	7	4
1	3	7	6	5
1	7	8	8	4
5	7	8	8	5
6	6	8	8	5
2	6	7	6	7
6	8	8	8	7
2	6	4	7	3
1	3	8	7	5
1	1	9	7	5
4	4	9	9	6
3	3	5	8	5
6	8	8	6	4
4	1	8	8	6
4	1	5	4	5
3	6	8	8	4
7	6	8	7	4
5	2	6	6	3
5	3	7	4	4
2	5	8	5	6
1	7	5	7	4
6	7	6	8	3
2	6	3	7	2

TABLE 21 INSPIRE PARTICIPATION: INDICATORS IMPORTANCE EVALUATION (UI)

INSPIRE End-Product: Indicator Satisfaction Evaluation (S)											
Portal Use	**nº data suppl.**	**nº Lang.**	**Freq. of update**	**data access.**	**metadata standards**	**nº of datasets**	**WCS**	**WFS**	**WMS**	**CSW**	**API**
1x3 months	9	9	6	6	7	8	7	8	7	8	7
+1x1 month	8	10	8	8	8	7	6	8	7	7	8
1x3 months	8	10	8	8	8	8	7	7	6	7	8
1x1 month	6	8	7	4	5	5	4	4	4	4	5
1x1 year	6	8	9	7	6	6	7	6	5	6	6
1x1 month	5	7	9	7	6	6	6	6	6	6	6
Never											
1x3 months	6	7	7	5	6	5	4	5	4	5	5
1x3 months	5	7	6	7	8	7	6	7	7	5	6
1x3 months	7	8	7	4	5	6	6	6	4	5	5
+1x1 Month	7	9	7	7	8	8	6	6	6	6	6
1x1 year	5	8	6	8	7	7	5	6	5	5	5
+1x1 month	8	6	7	6	6	6	5	5	5	5	5
1x1 month	7	9	8	6	8	7	5	7	6	7	7
+1x1 month	7	8	7	6	7	8	5	5	5	6	6
1x3 months	6	9	7	7	7	8	6	6	7	6	8
1x1 month	8	6	9	7	8	8	7	8	7	7	7
+1x1 month	7	9	8	8	8	8	7	7	7	8	7
1x3 months	6	7	8	5	7	5	6	5	5	5	5
1x1 year	8	7	7	8	8	7	7	8	8	8	7
1x1 year	6	7	6	7	7	6	7	7	7	7	7
Never											
1x3 months	5	7	7	8	7	8	5	5	5	5	5
+1x1 month	9	7	7	8	7	7	7	7	6	7	6
1x1 year	5	9	7	4	6	5	5	5	5	5	5
1x1 month	8	9	8	8	7	7	7	7	7	7	6
1x1 month	6	9	7	7	6	8	6	6	6	7	7
1x3 months	4	8	8	6	7	6	6	6	7	7	6
1x3 months	7	9	8	6	7	7	5	6	5	7	6
1x1year	6	8	6	5	6	6	4	5	5	6	5
1x3 months	5	8	7	8	7	7	6	6	5	5	6
Never											
+1x1 month	6	7	6	5	7	7	6	6	5	5	6
1x1 month	6	7	6	6	7	7	4	4	4	5	5
1x3 months	7	8	8	8	9	8	6	6	5	7	7
1x1 year	5	8	8	6	7	6	5	5	6	5	5

TABLE 22 INSPIRE END-PRODUCT: INDICATOR SATISFACTION EVALUATION (S)

INSPIRE Participation: Indicators Satisfaction Evaluation (S)				
Newsletter	**Informal Participation**	**Public Events**	**Planning Committees**	**Veto Mechanism**
5	6	8	7	0
5	9	0	0	0
4	6	0	0	0
0	0	0	0	0
2	7	0	0	0
4	0	0	0	0
0	0	0	0	0
3	0	0	0	0
3	6	0	0	0
5	0	0	0	0
2	6	0	0	0
0	0	0	0	0
0	0	0	0	0
4	7	0	0	0
5	7	0	0	0
3	7	0	0	0
7	8	0	0	0
3	5	7	0	0
0	0	0	0	0
0	0	7	0	0
0	0	0	0	0
0	0	0	0	0
1	0	0	0	0
6	7	8	0	0
0	0	0	0	0
5	8	0	0	0
0	0	0	0	0
0	0	0	0	0
6	9	7	0	0
0	6	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
3	6	0	0	0
2	7	0	0	0
1	5	0	0	0

TABLE 23 INSPIRE PARTICIPATION: INDICATORS SATISFACTION EVALUATION (S)

EDP END-PRODUCT: INDICATORS SATISFACTION EVALUATION (S)											
Portal Use	**nº data suppl.**	**nº Lang.**	**Freq. of update**	**data access**	**metadata standards**	**nº of datasets**	**WCS**	**WFS**	**WMS**	**CSW**	**API**
1x1 year	7	10	8	7	7	6	7	8	7	7	8
1x3 months	7	9	8	6	6	5	5	7	6	6	6
1x1 year	6	8	7	5	4	5	5	6	6	6	6
1x1 month	7	8	6	6	6	5	4	5	5	5	5
1x1 month	6	8	7	5	6	5	6	6	6	7	7
1x3 months	7	6	5	4	6	4	3	4	4	4	4
1x3 months	5	6	7	6	6	8	7	7	7	7	7
Never											
Never											
1x1 year	5	8	6	4	5	6	6	7	5	6	6
1x3 months	7	9	7	5	6	6	6	6	6	6	6
Never											
1x3 months	5	6	8	6	4	6	6	5	5	5	5
1x3 months	8	9	7	6	7	7	7	7	7	7	7
1x3 months	6	7	7	5	7	6	7	7	7	7	7
+1x1 month	7	9	6	5	7	7	8		7	8	7
1x1 month	6	8	6	6	7	7	7	7	7	8	6
1x1 month	8	8	7	5	5	6	7	7	7	6	6
1x1 year	6	7	5	4	7	7	5	6	6	6	7
1x1 year	7	7	6	7	7	7	7	7	7	7	7
1x1 month	6	7	6	6	6	5	7	7	7	7	7
1x3 months	6	10	6	6	6	6	6	6	6	6	6
Never											
1x3 months	7	8		7	8	7	7	7	8	8	7
Never											
1x3 months	6	8	6	5	6	6	5	6	6	5	6
1x1 year	5	8	8	6	7	7	6	6	6	6	6
1x1 year	5	7	6	7	7	7	6	7	7	6	6
1x1 year	6	9	8	4	7	5	6	6	6	8	6
Never											
Never											
1x1 month	8	8	8	5	8	6	8	8	8	7	7
1x1 month	4	9	7	7	7	5	5	5	5	5	5
1x3 months	5	6	7	5	5	5	5	5	5	5	5
1x1 year	6	8	7	4	5	6	6	6	6	7	7
Never											

TABLE 24 EDP END-PRODUCT: INDICATOR SATISFACTION EVALUATION (S)

EDP Participation: Indicators Satisfaction Evaluation (S)				
Newsletter	**Informal Participation**	**Public Events**	**Planning Committees**	**Veto Mechanism**
3	0	0	0	0
5	7	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	6	0	0	0
0	6	0	0	0
7	8	0	0	0
0	4	0	0	0
0	5	0	0	0
0	0	0	0	0
0	7	7	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
6	8	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
6	7	0	0	0
0	0	0	0	0
0	0	0	0	0
4	7	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

TABLE 25 EDP PARTICIPATION: INDICATORS SATISFACTION EVALUATION (S)

10.2 Calculation related tables

INSPIRE End-Product: User Indicators and Portal Score Values (UISV + UPSV)											
nº data suppl.	nº lang.	freq. of update	data access.	metadata standards	nº of datasets	WCS	WFS	WMS	CSW	API	UPSV
66.12	70.25	30.85	74.66	71.67	78.97	65.24	75.30	63.31	77.87	67.49	**74.17**
58.77	78.05	41.14	99.54	81.91	69.10	55.92	75.30	63.31	68.14	77.13	**76.83**
58.77	78.05	41.14	99.54	81.91	78.97	65.24	65.89	54.27	68.14	77.13	**76.91**
44.08	62.44	36.00	49.77	51.19	49.36	37.28	37.65	36.18	38.93	48.21	**49.11**
44.08	62.44	46.28	87.10	61.43	59.23	65.24	56.47	45.22	58.40	57.85	**64.38**
36.73	54.64	46.28	87.10	61.43	59.23	55.92	56.47	54.27	58.40	57.85	**62.83**
44.08	54.64	36.00	62.21	61.43	49.36	37.28	47.06	36.18	48.67	48.21	**52.51**
36.73	54.64	30.85	87.10	81.91	69.10	55.92	65.89	63.31	48.67	57.85	**65.20**
51.42	62.44	36.00	49.77	51.19	59.23	55.92	56.47	36.18	48.67	48.21	**55.55**
51.42	70.25	36.00	87.10	81.91	78.97	55.92	56.47	54.27	58.40	57.85	**68.86**
36.73	62.44	30.85	99.54	71.67	69.10	46.60	56.47	45.22	48.67	48.21	**61.55**
58.77	46.83	36.00	74.66	61.43	59.23	46.60	47.06	45.22	48.67	48.21	**57.27**
51.42	70.25	41.14	74.66	81.91	69.10	46.60	65.89	54.27	68.14	67.49	**69.09**
51.42	62.44	36.00	74.66	71.67	78.97	46.60	47.06	45.22	58.40	57.85	**63.03**
44.08	70.25	36.00	87.10	71.67	78.97	55.92	56.47	63.31	58.40	77.13	**69.93**
58.77	46.83	46.28	87.10	81.91	78.97	65.24	75.30	63.31	68.14	67.49	**73.93**
51.42	70.25	41.14	99.54	81.91	78.97	65.24	65.89	63.31	77.87	67.49	**76.30**
44.08	54.64	41.14	62.21	71.67	49.36	55.92	47.06	45.22	48.67	48.21	**56.82**
5.98	5.26	3.74	9.78	8.12	7.04	6.50	7.57	7.25	7.79	6.78	**75.81**
44.08	54.64	30.85	87.10	71.67	59.23	65.24	65.89	63.31	68.14	67.49	**67.76**
36.73	54.64	36.00	99.54	71.67	78.97	46.60	47.06	45.22	48.67	48.21	**61.33**
66.12	54.64	36.00	99.54	71.67	69.10	65.24	65.89	54.27	68.14	57.85	**70.84**
36.73	70.25	36.00	49.77	61.43	49.36	46.60	47.06	45.22	48.67	48.21	**53.93**
58.77	70.25	41.14	99.54	71.67	69.10	65.24	65.89	63.31	68.14	57.85	**73.09**
44.08	70.25	36.00	87.10	61.43	78.97	55.92	56.47	54.27	68.14	67.49	**68.01**
29.38	62.44	41.14	74.66	71.67	59.23	55.92	56.47	63.31	68.14	57.85	**64.02**
51.42	70.25	41.14	74.66	71.67	69.10	46.60	56.47	45.22	68.14	57.85	**65.25**
44.08	62.44	30.85	62.21	61.43	59.23	37.28	47.06	45.22	58.40	48.21	**55.64**
36.73	62.44	36.00	99.54	71.67	69.10	55.92	56.47	45.22	48.67	57.85	**63.96**
44.08	54.64	30.85	62.21	71.67	69.10	55.92	56.47	45.22	48.67	57.85	**59.67**
44.08	54.64	30.85	74.66	71.67	69.10	37.28	37.65	36.18	48.67	48.21	**55.30**
51.42	62.44	41.14	99.54	92.15	78.97	55.92	56.47	45.22	68.14	67.49	**71.89**
36.73	62.44	41.14	74.66	71.67	59.23	46.60	47.06	54.27	48.67	48.21	**59.07**

TABLE 26 INSPIRE END-PRODUCT: USER INDICATORS AND PORTAL SCORE VALUES (UISV + UPSV)

EDP End-Product: User Indicators and Portal Score Values (UISV + UPSV)											
nº data suppl.	nº lang.	freq. of update	data access.	metadata standards	nº of datasets	WCS	WFS	WMS	CSW	API	**UPSV**
51.42	78.05	41.14	87.10	71.67	59.23	65.24	75.30	63.31	68.14	77.13	**73.77**
51.42	70.25	41.14	74.66	61.43	49.36	46.60	65.89	54.27	58.40	57.85	**63.13**
44.08	62.44	36.00	62.21	40.96	49.36	46.60	56.47	54.27	58.40	57.85	**56.86**
51.42	62.44	30.85	74.66	61.43	49.36	37.28	47.06	45.22	48.67	48.21	**55.66**
44.08	62.44	36.00	62.21	61.43	49.36	55.92	56.47	54.27	68.14	67.49	**61.78**
51.42	46.83	25.71	49.77	61.43	39.49	27.96	37.65	36.18	38.93	38.57	**45.39**
36.73	46.83	36.00	74.66	61.43	78.97	65.24	65.89	63.31	68.14	67.49	**66.47**
36.73	62.44	30.85	49.77	51.19	59.23	55.92	65.89	45.22	58.40	57.85	**57.35**
51.42	70.25	36.00	62.21	61.43	59.23	55.92	56.47	54.27	58.40	57.85	**62.35**
36.73	46.83	41.14	74.66	40.96	59.23	55.92	47.06	45.22	48.67	48.21	**54.46**
58.77	70.25	36.00	74.66	71.67	69.10	65.24	65.89	63.31	68.14	67.49	**71.05**
44.08	54.64	36.00	62.21	71.67	59.23	65.24	65.89	63.31	68.14	67.49	**65.79**
51.42	70.25	30.85	62.21	71.67	69.10	74.56	0.00	63.31	77.87	67.49	**63.88**
44.08	62.44	30.85	74.66	71.67	69.10	65.24	65.89	63.31	77.87	57.85	**68.30**
58.77	62.44	36.00	62.21	51.19	59.23	65.24	65.89	63.31	58.40	57.85	**64.05**
44.08	54.64	25.71	49.77	71.67	69.10	46.60	56.47	54.27	58.40	67.49	**59.82**
5.23	5.26	3.21	8.56	7.10	7.04	6.50	6.63	6.34	6.82	6.78	**69.47**
44.08	54.64	30.85	74.66	61.43	49.36	65.24	65.89	63.31	68.14	67.49	**64.51**
44.08	78.05	30.85	74.66	61.43	59.23	55.92	56.47	54.27	58.40	57.85	**63.12**
51.42	62.44	0.00	87.10	81.91	69.10	65.24	65.89	72.36	77.87	67.49	**70.08**
44.08	62.44	30.85	62.21	61.43	59.23	46.60	56.47	54.27	48.67	57.85	**58.41**
36.73	62.44	41.14	74.66	71.67	69.10	55.92	56.47	54.27	58.40	57.85	**63.87**
36.73	54.64	30.85	87.10	71.67	69.10	55.92	65.89	63.31	58.40	57.85	**65.15**
44.08	70.25	41.14	49.77	71.67	49.36	55.92	56.47	54.27	77.87	57.85	**62.87**
58.77	62.44	41.14	62.21	81.91	59.23	74.56	75.30	72.36	68.14	67.49	**72.36**
29.38	70.25	36.00	87.10	71.67	49.36	46.60	47.06	45.22	48.67	48.21	**57.95**
36.73	46.83	36.00	62.21	51.19	49.36	46.60	47.06	45.22	48.67	48.21	**51.81**
44.08	62.44	36.00	49.77	51.19	59.23	55.92	56.47	54.27	68.14	67.49	**60.50**

TABLE 27 EDP END-PRODUCT: USER INDICATORS AND PORTAL SCORE VALUES (UISV + UPSV)

INSPIRE Participation User Indicators and Portal score values (UISV + UPSV)					
Newsletter	Informal Participation	Public Events	Planning Committees	Veto Mechanism	UPSV
5.93	11.23	20.54	18.26	0.00	**55.96**
5.93	16.84	0.00	0.00	0.00	**22.77**
4.74	11.23	0.00	0.00	0.00	**15.97**
0.00	0.00	0.00	0.00	0.00	**0.00**
2.37	13.10	0.00	0.00	0.00	**15.47**
4.74	0.00	0.00	0.00	0.00	**4.74**
3.56	0.00	0.00	0.00	0.00	**3.56**
0.00	0.00	0.00	0.00	0.00	**0.00**
3.56	11.23	0.00	0.00	0.00	**14.78**
5.93	0.00	0.00	0.00	0.00	**5.93**
2.37	11.23	0.00	0.00	0.00	**13.60**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
4.74	13.10	0.00	0.00	0.00	**17.84**
5.93	13.10	0.00	0.00	0.00	**19.02**
3.56	13.10	0.00	0.00	0.00	**16.65**
8.30	14.97	0.00	0.00	0.00	**23.26**
3.56	9.36	17.97	0.00	0.00	**30.88**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	17.97	0.00	0.00	**17.97**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
1.19	0.00	0.00	0.00	0.00	**1.19**
7.11	13.10	20.54	0.00	0.00	**40.75**
0.00	0.00	0.00	0.00	0.00	**0.00**
5.93	14.97	0.00	0.00	0.00	**20.89**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
7.11	16.84	17.97	0.00	0.00	**41.92**
0.00	11.23	0.00	0.00	0.00	**11.23**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
3.56	11.23	0.00	0.00	0.00	**14.78**
2.37	13.10	0.00	0.00	0.00	**15.47**
1.19	9.36	0.00	0.00	0.00	**10.54**

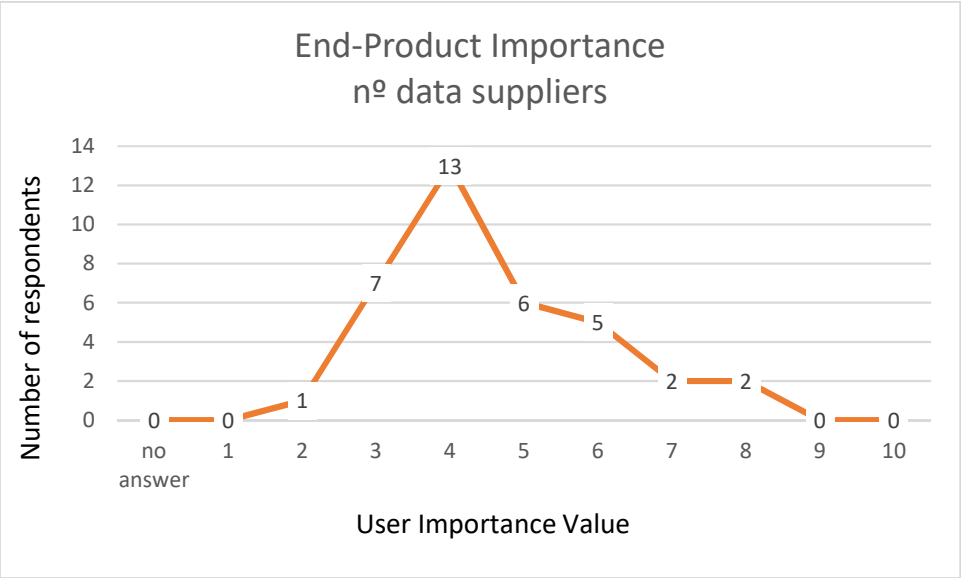
TABLE 28 INSPIRE PARTICIPATION: USER INDICATOR SCORE VALUES + USER PORTAL SCORE VALUES

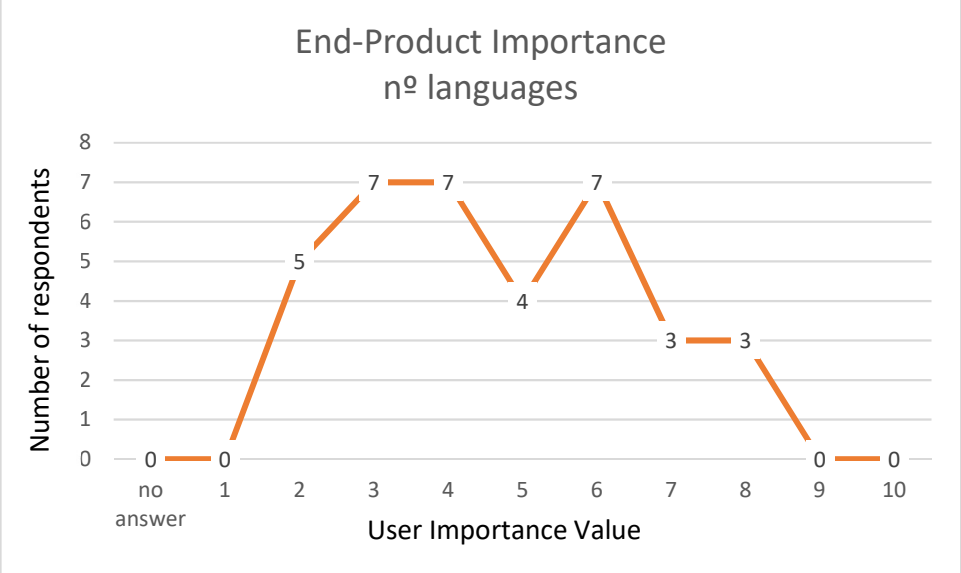
EDP Participation User Indicators and Portal score values (UISV + UPSV)					
Newsletter	**Informal Participation**	**Public Events**	**Planning Committees**	**Veto Mechanism**	**UPSV**
3.56	0.00	0.00	0.00	0.00	**3.56**
5.93	13.10	0.00	0.00	0.00	**19.02**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	11.23	0.00	0.00	0.00	**11.23**
0.00	11.23	0.00	0.00	0.00	**11.23**
8.30	14.97	0.00	0.00	0.00	**23.26**
0.00	7.48	0.00	0.00	0.00	**7.48**
0.00	9.36	0.00	0.00	0.00	**9.36**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	13.10	17.97	0.00	0.00	**31.07**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
7.11	14.97	0.00	0.00	0.00	**22.08**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
7.11	13.10	0.00	0.00	0.00	**20.21**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
4.74	13.10	0.00	0.00	0.00	**17.84**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	0.00	0.00	**0.00**

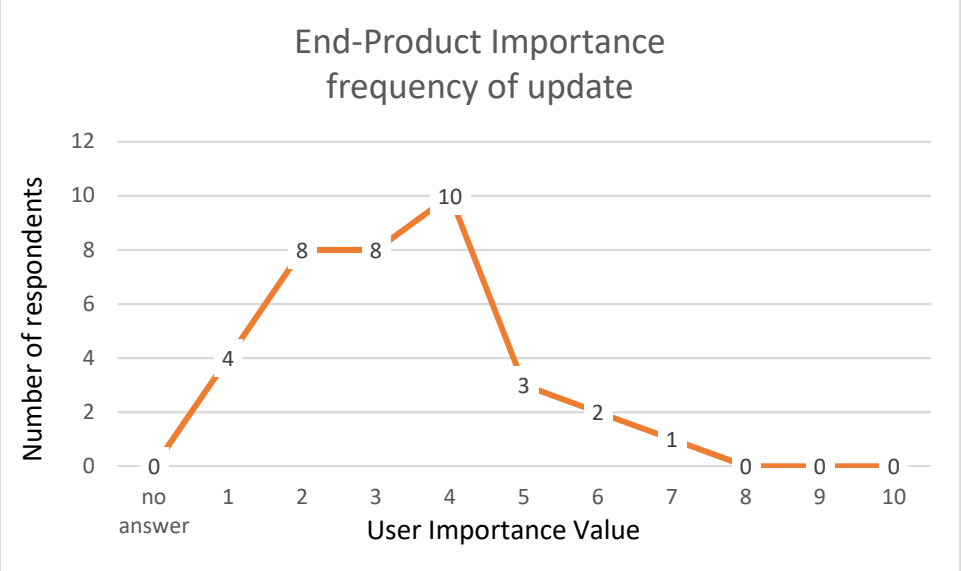
TABLE 29 EDP PARTICIPATION: USER INDICATOR SCORE VALUES + USER PORTAL SCORE VALUES

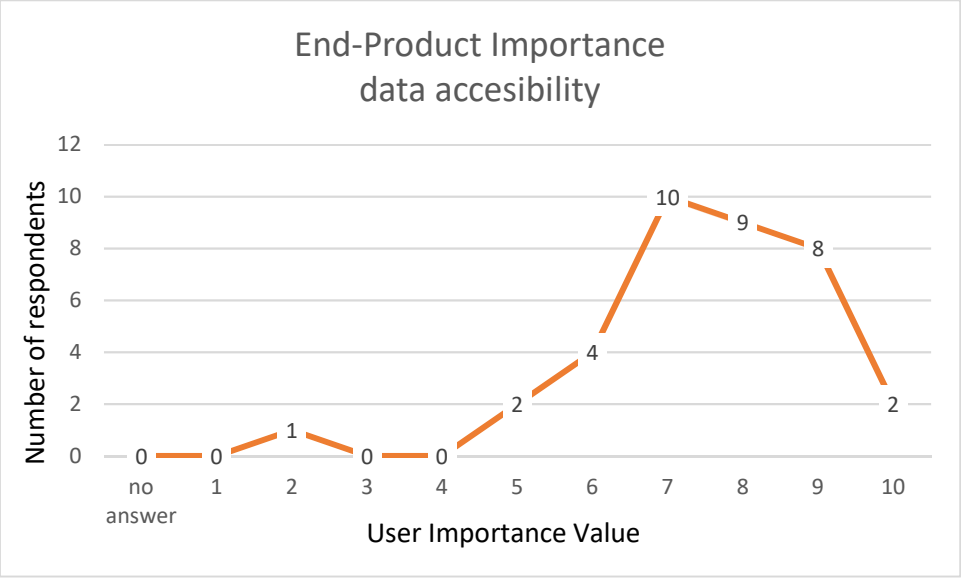
10.3 Histograms

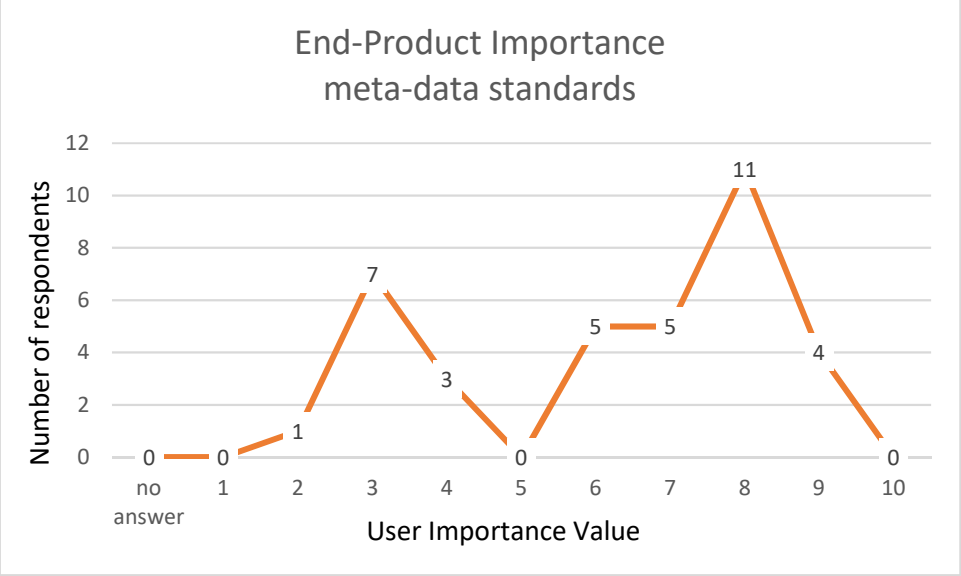
10.3.1 About End-Product Indicator Importance Histograms

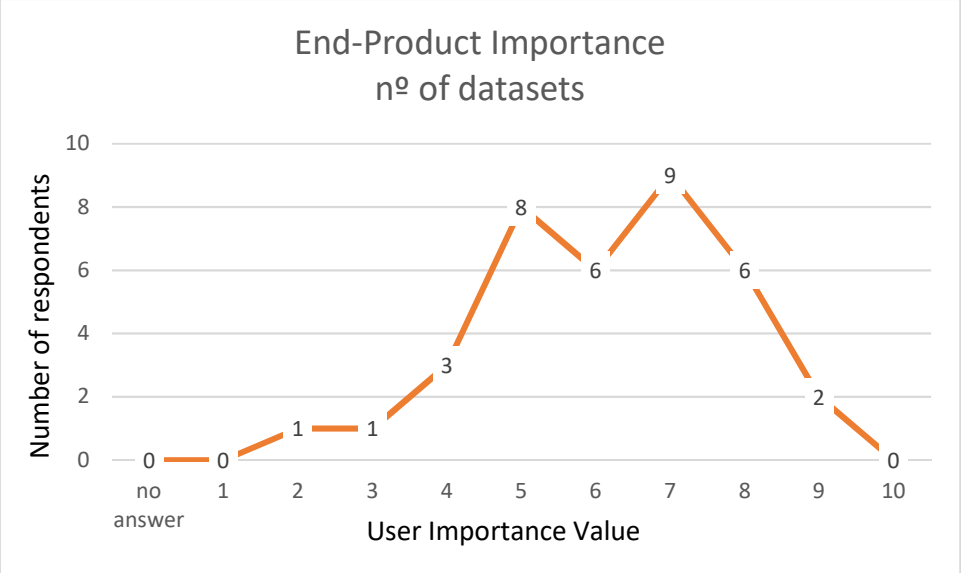


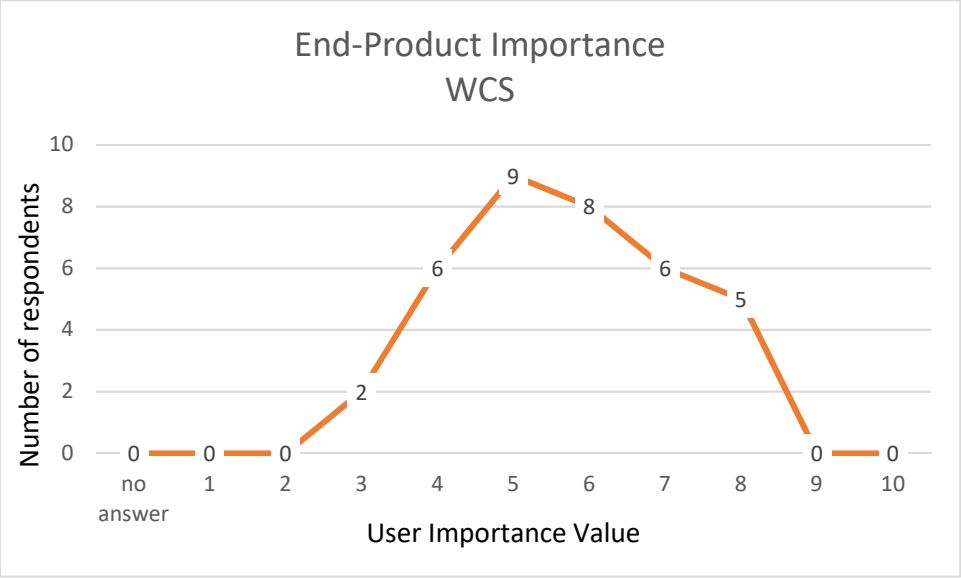


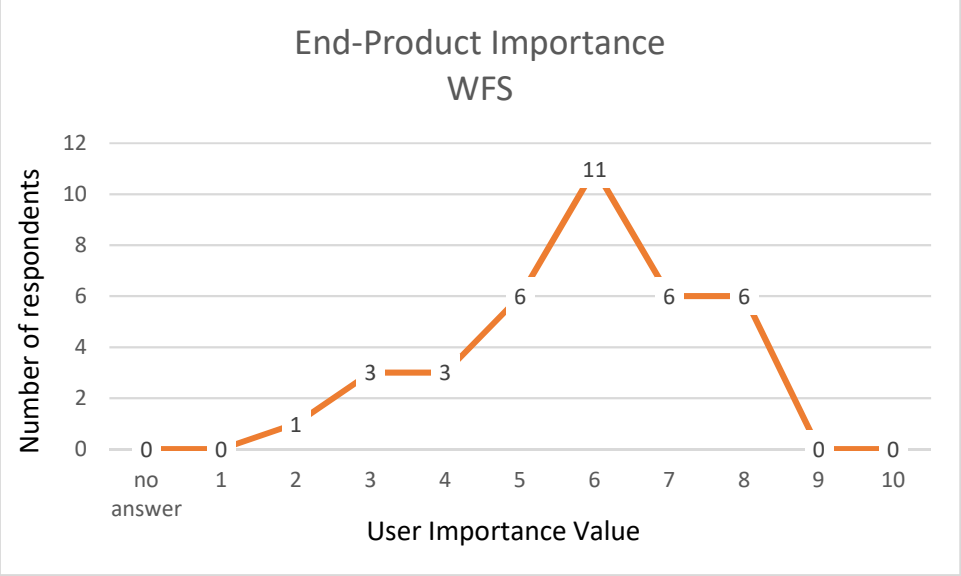


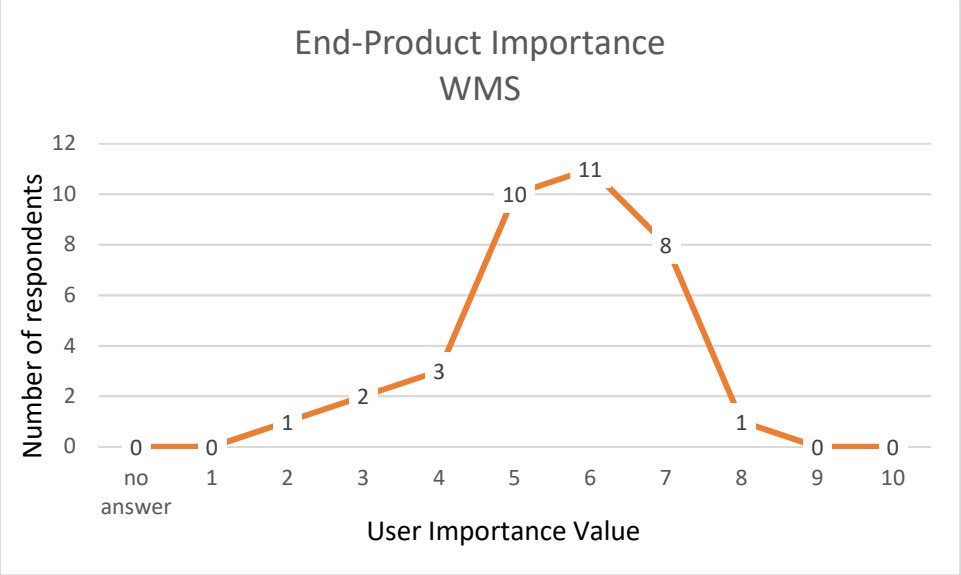

End-Product Importance
data accesibility
Number of respondents
12
10
8
6
4
2
0
0
0
1
0
0
2
4
10
9
8
2
no answer
1
2
3
4
5
6
7
8
9
10
User Importance Value

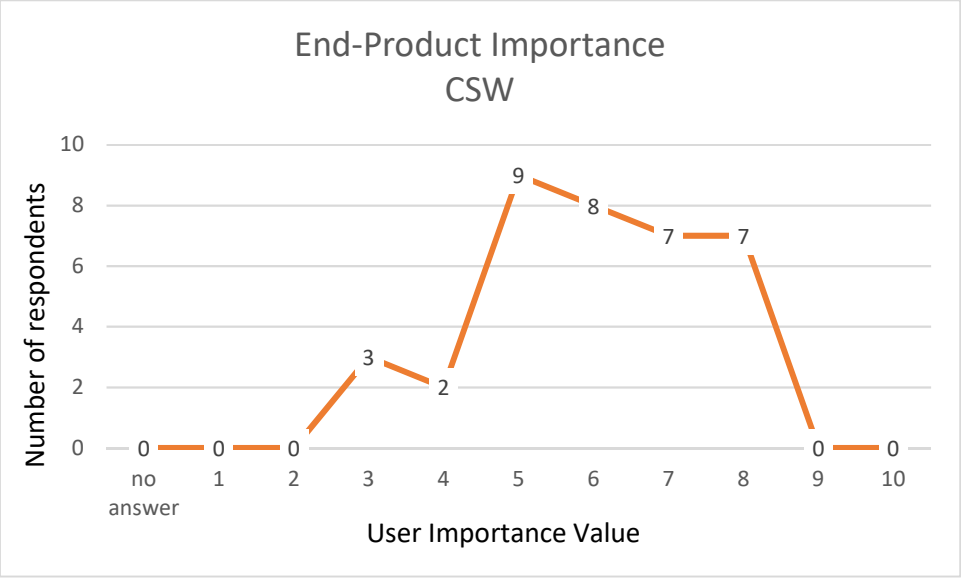

End-Product Importance
meta-data standards
Number of respondents
12
10
8
6
4
2
0
0
0
1
7
3
0
5
5
11
4
0
no answer
1
2
3
4
5
6
7
8
9
10
User Importance Value

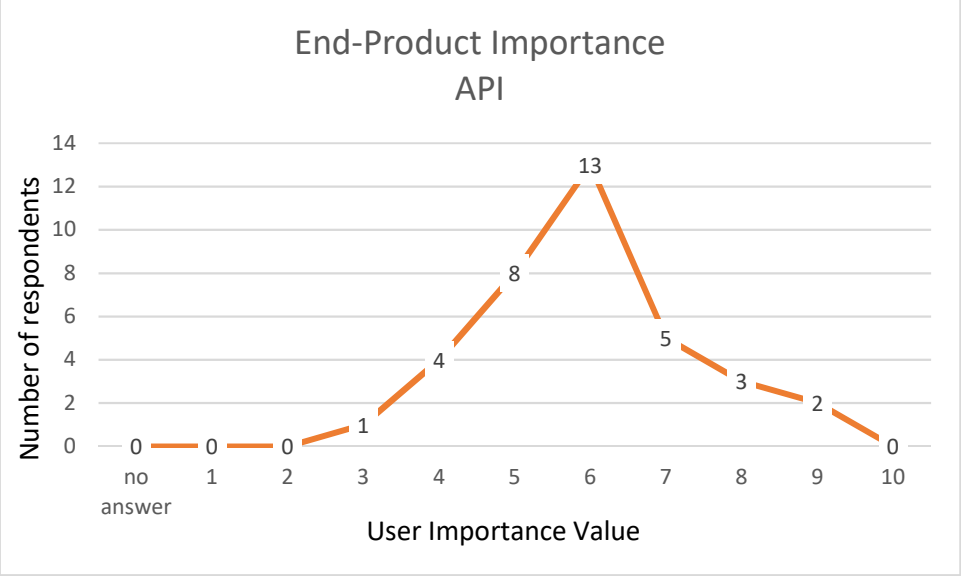

End-Product Importance
nº of datasets
Number of respondents
10
8
6
4
2
0
0
0
1
1
3
8
6
9
6
2
0
no answer
1
2
3
4
5
6
7
8
9
10
User Importance Value


End-Product Importance
WCS
Number of respondents
User Importance Value
no answer
0 0 0 2 6 9 8 6 5 0 0

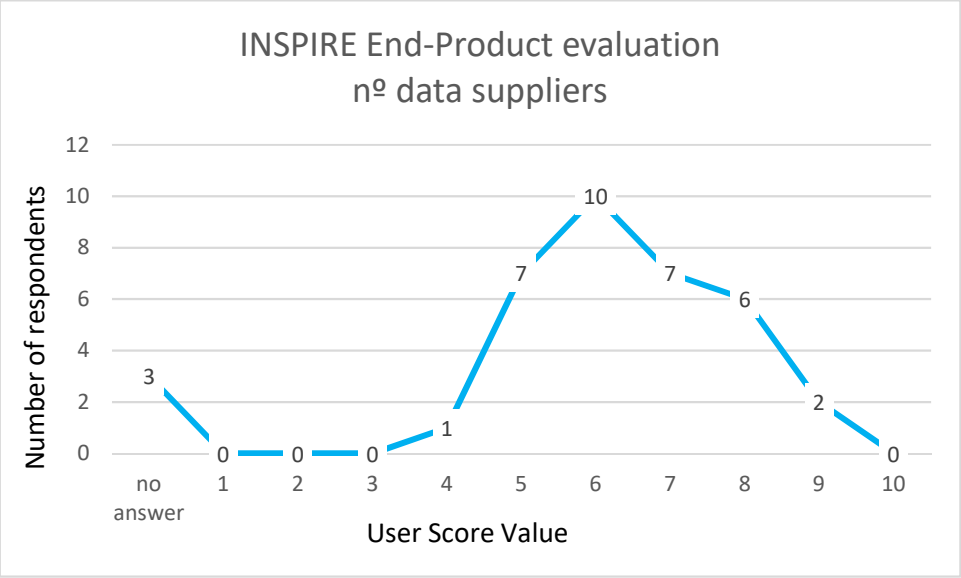

End-Product Importance
WFS
Number of respondents
User Importance Value
no answer
0 0 1 3 3 6 11 6 6 0 0

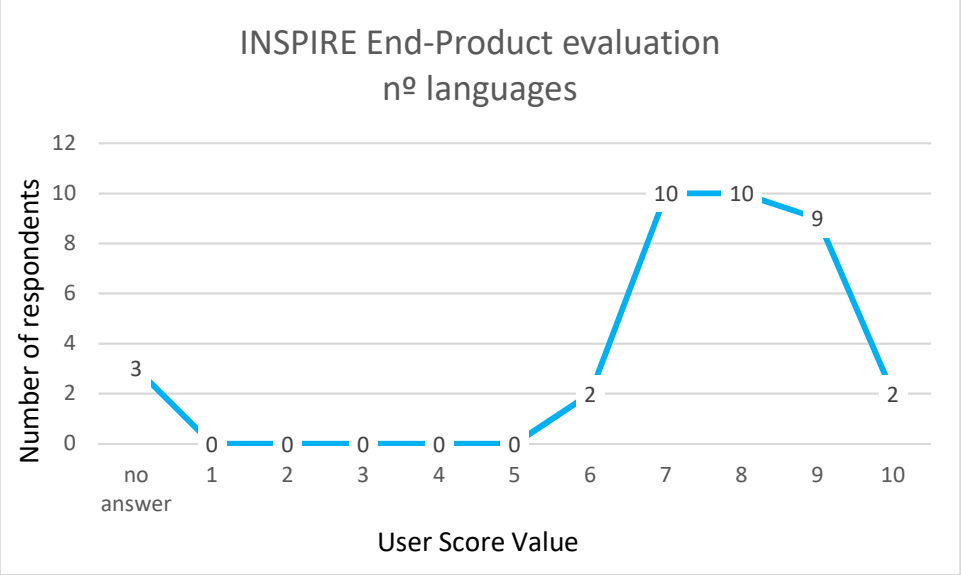

End-Product Importance
WMS
Number of respondents
User Importance Value
no answer
0 0 1 2 3 10 11 8 1 0 0

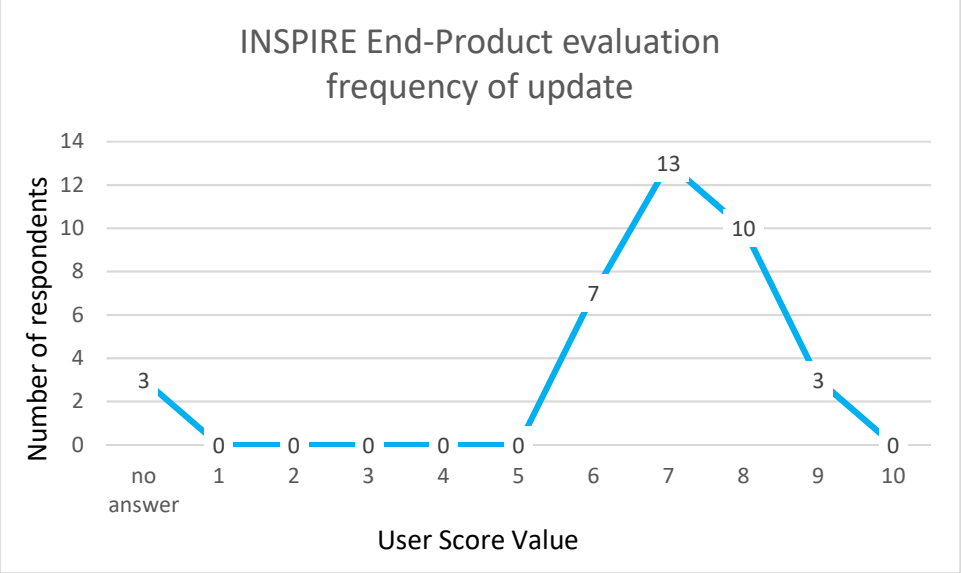

End-Product Importance
CSW
Number of respondents
10
8
6
4
2
0
0
0
0
3
2
9
8
7
7
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Importance Value

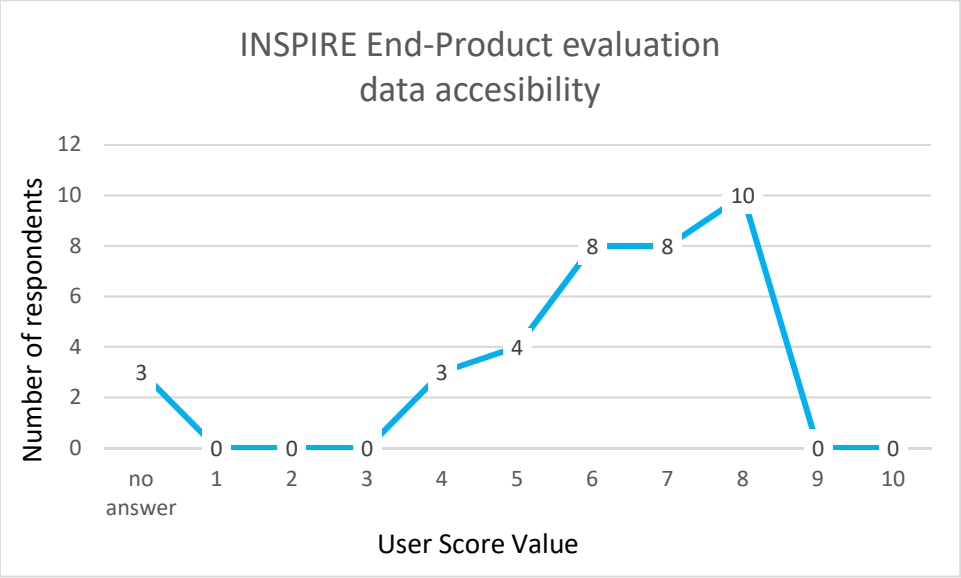

End-Product Importance
API
Number of respondents
14
12
10
8
6
4
2
0
0
0
0
1
4
8
13
5
3
2
0
no answer
1
2
3
4
5
6
7
8
9
10
User Importance Value

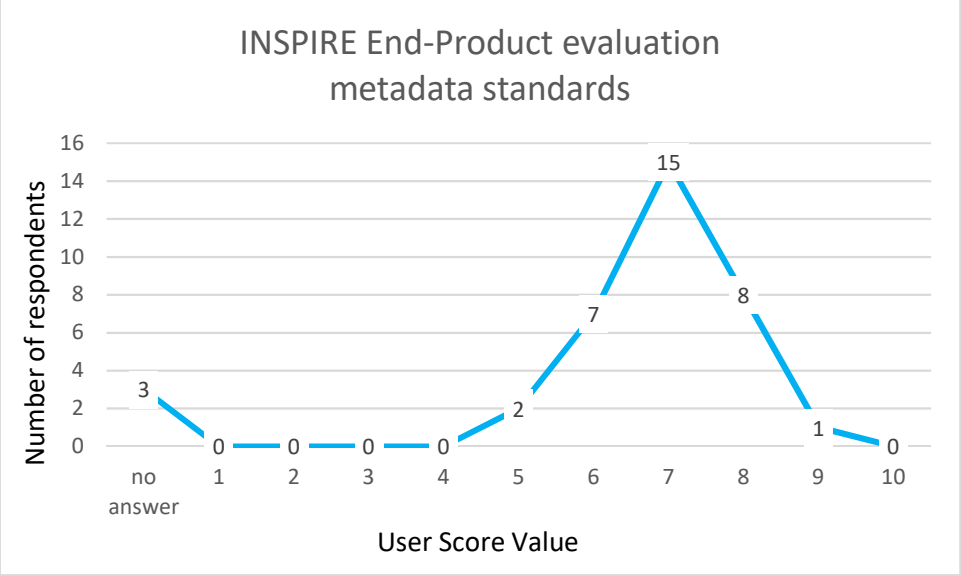
10.3.2 About End-Product INSPIRE satisfaction

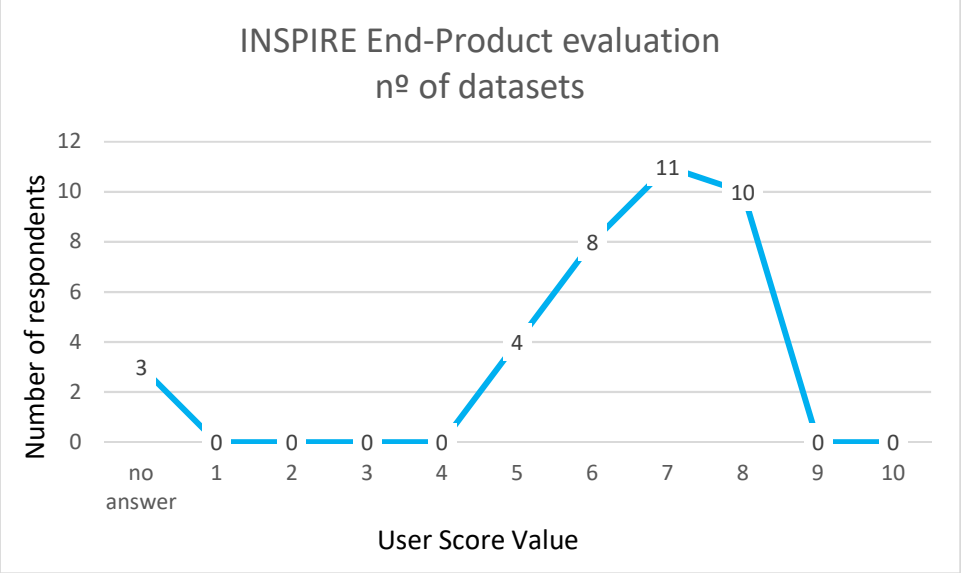


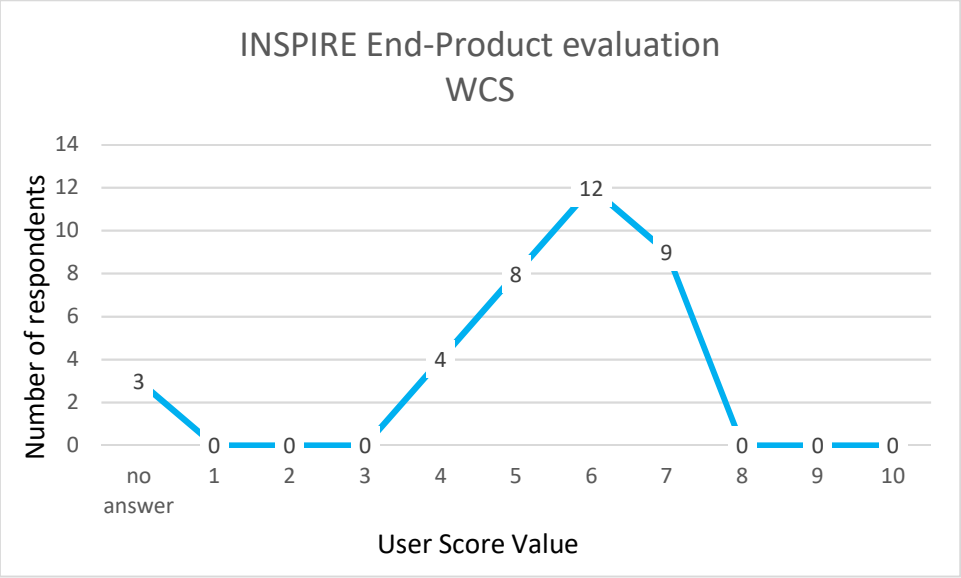


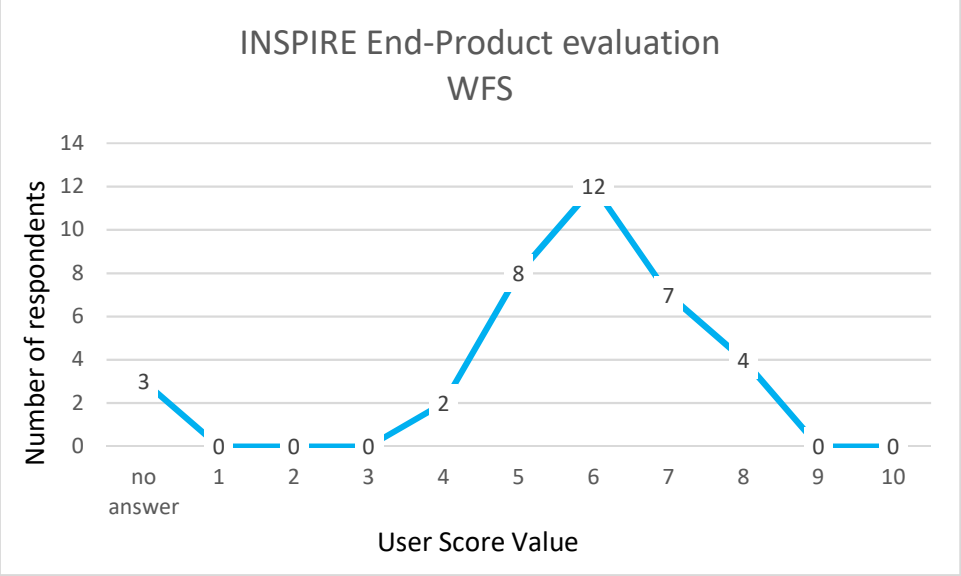


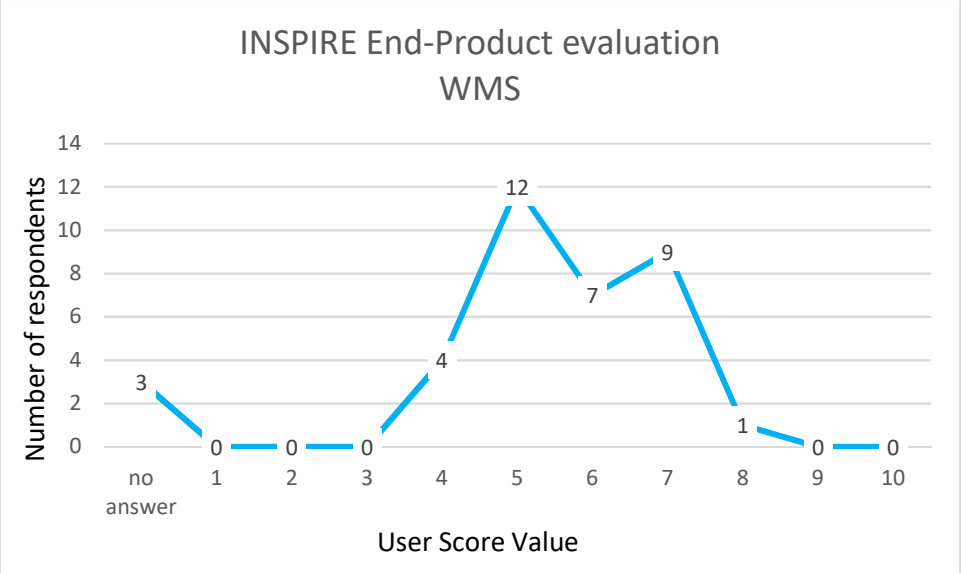

INSPIRE End-Product evaluation
data accesibility
Number of respondents
12
10
8
6
4
2
0
3
0
0
0
3
4
8
8
10
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

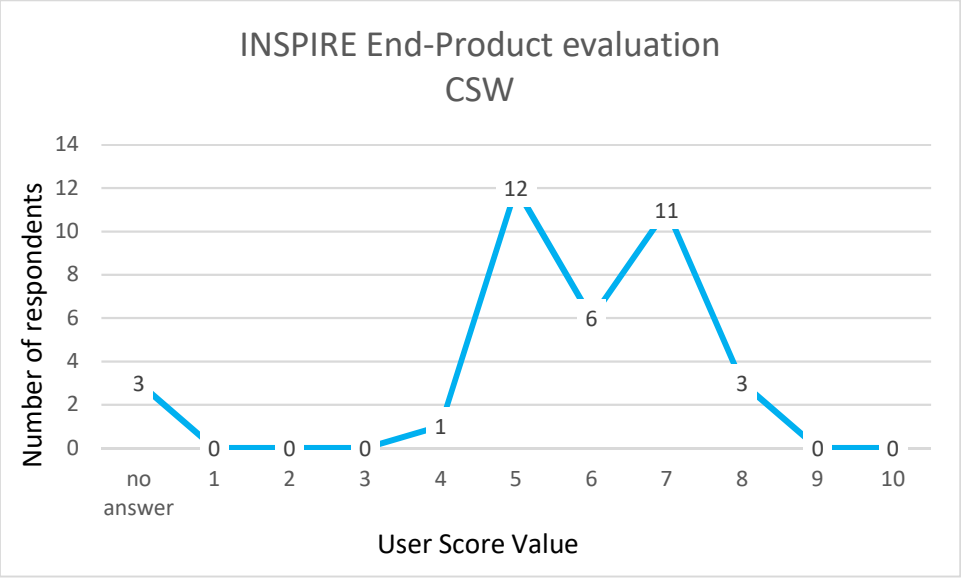

INSPIRE End-Product evaluation
metadata standards
Number of respondents
16
14
12
10
8
6
4
2
0
3
0
0
0
0
2
7
15
8
1
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

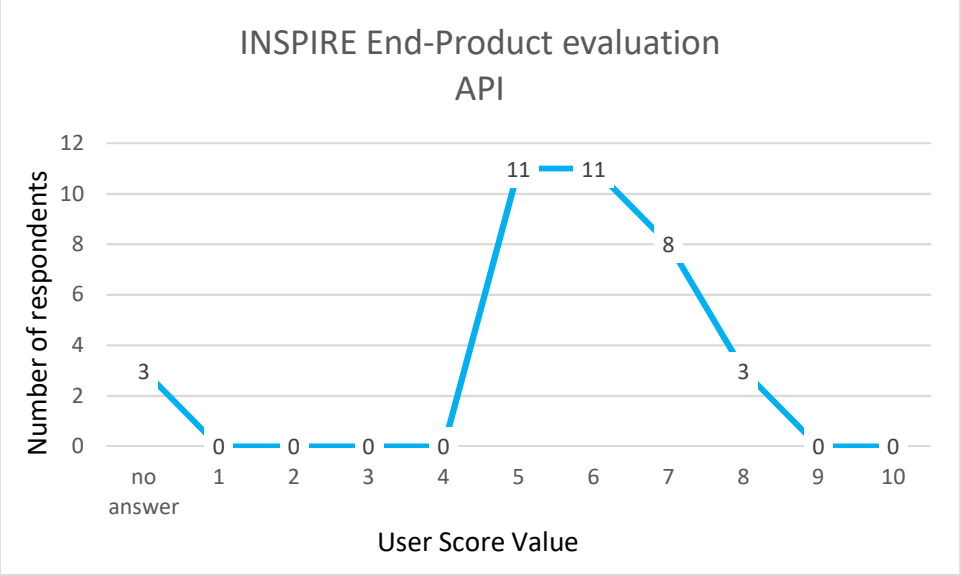

INSPIRE End-Product evaluation
nº of datasets
Number of respondents
12
10
8
6
4
2
0
3
0
0
0
0
4
8
11
10
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value


INSPIRE End-Product evaluation
WCS
Number of respondents
14
12
10
8
6
4
2
0
3
0
0
0
4
8
12
9
0
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

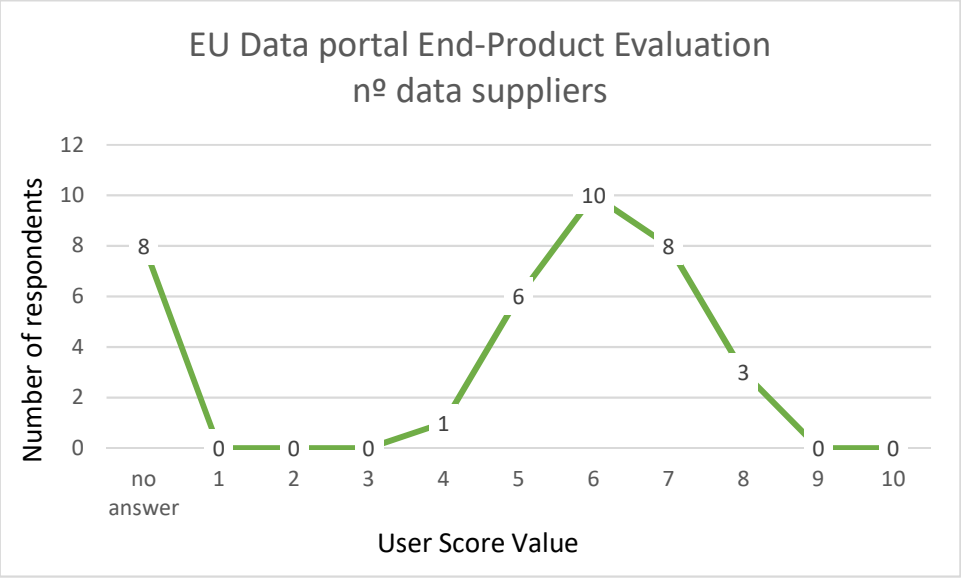

INSPIRE End-Product evaluation
WFS
Number of respondents
14
12
10
8
6
4
2
0
3
0
0
0
2
8
12
7
4
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

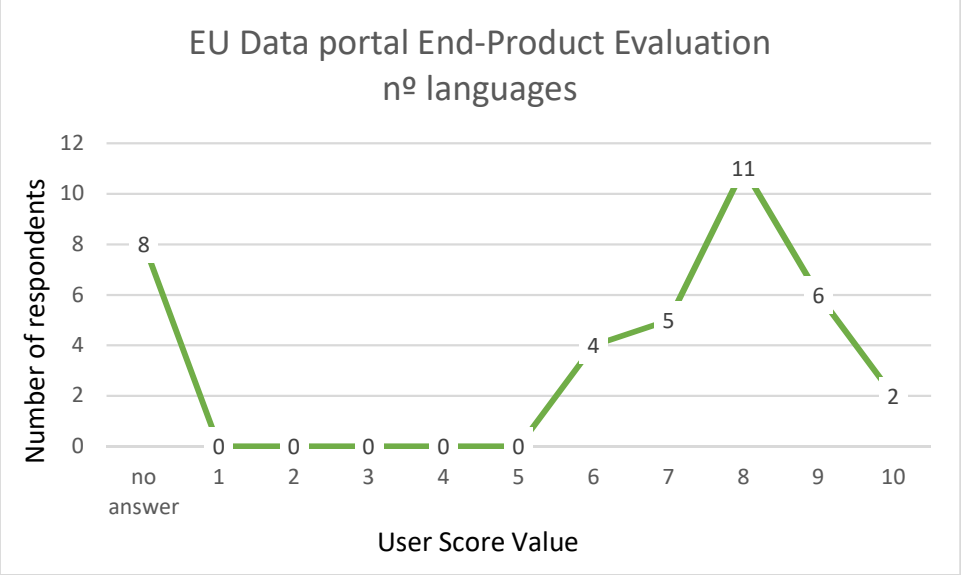

INSPIRE End-Product evaluation
WMS
Number of respondents
14
12
10
8
6
4
2
0
3
0
0
0
4
12
7
9
1
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

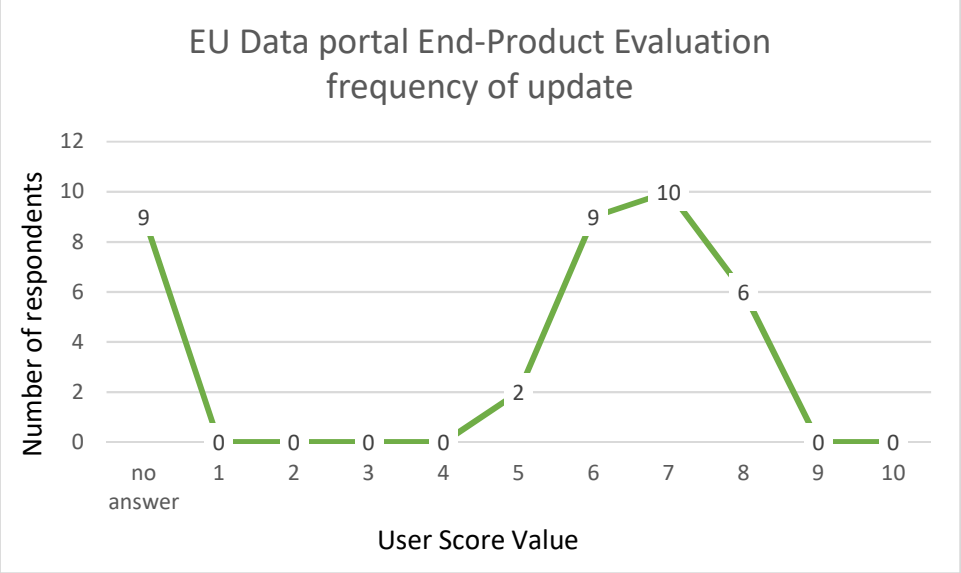

INSPIRE End-Product evaluation
CSW
Number of respondents
14
12
10
8
6
4
2
0
3
0
0
0
1
12
6
11
3
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

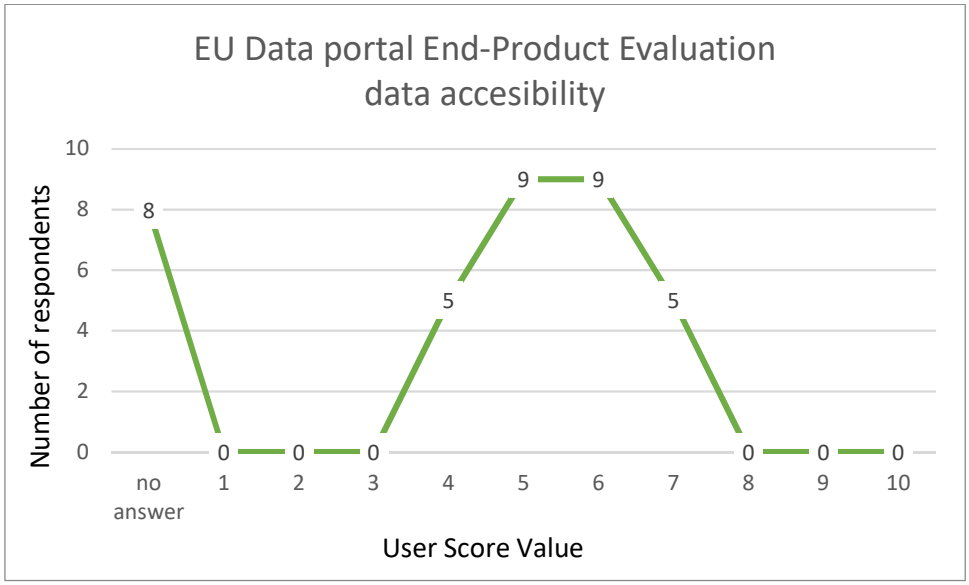

INSPIRE End-Product evaluation
API
Number of respondents
12
10
8
6
4
2
0
3
0
0
0
0
11
11
8
3
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

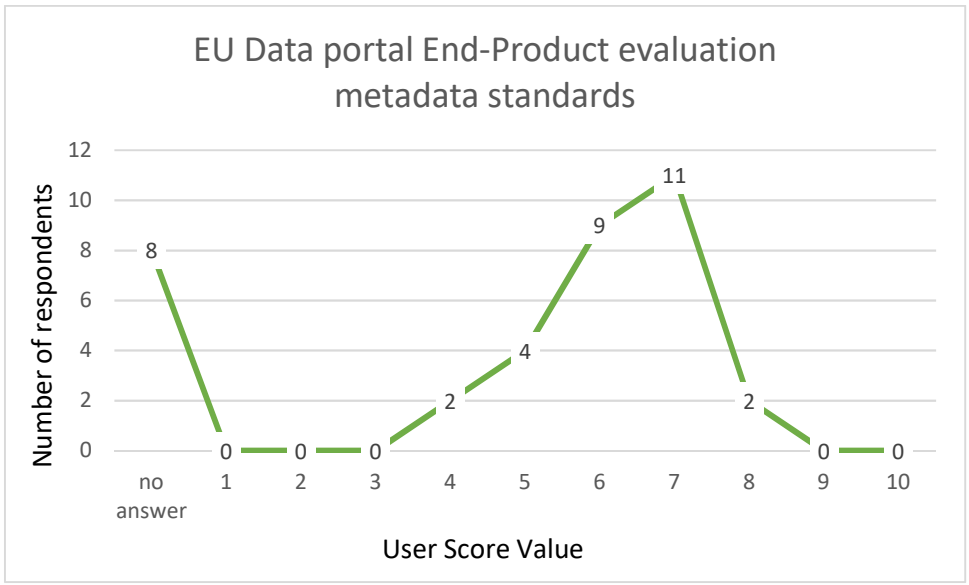
10.3.3 About End-Product European Data Portal Satisfaction








EU Data portal End-Product Evaluation
data accesibility
Number of respondents
10
8
6
4
2
0
8
0
0
0
5
9
9
5
0
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value


EU Data portal End-Product evaluation
metadata standards
Number of respondents
12
10
8
6
4
2
0
8
0
0
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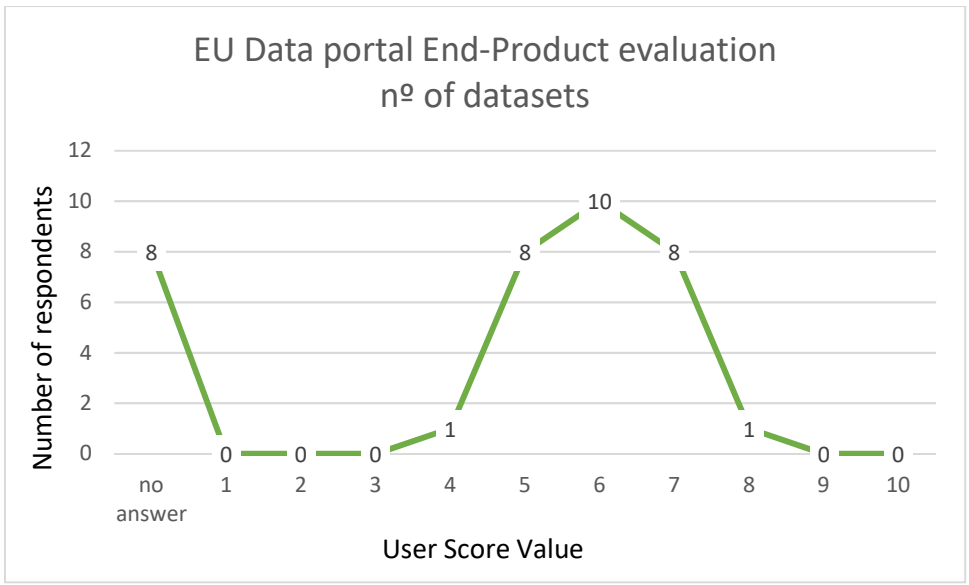
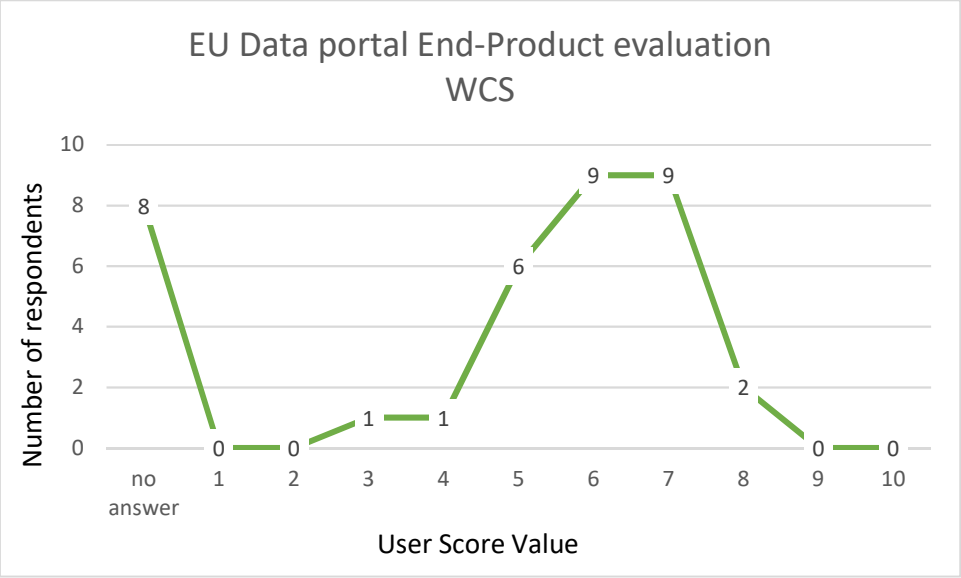
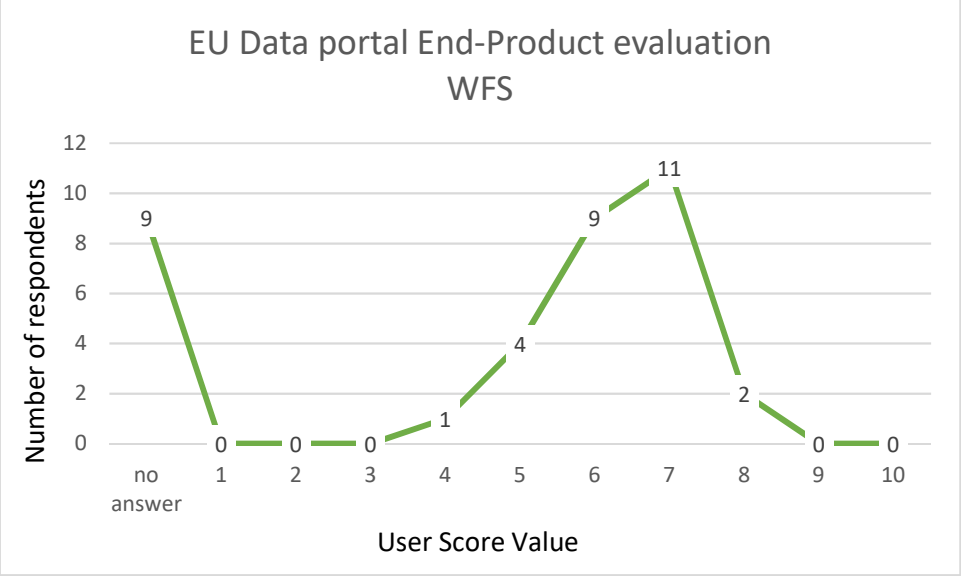
2
4
9
11
2
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value


EU Data portal End-Product evaluation
nº of datasets
Number of respondents
12
10
8
6
4
2
0
8
0
0
0
1
8
10
8
1
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value


EU Data portal End-Product evaluation
WCS
Number of respondents
User Score Value
no answer
1
2
3
4
5
6
7
8
9
10
8
0
0
1
1
6
9
9
2
0
0


EU Data portal End-Product evaluation
WFS
Number of respondents
User Score Value
no answer
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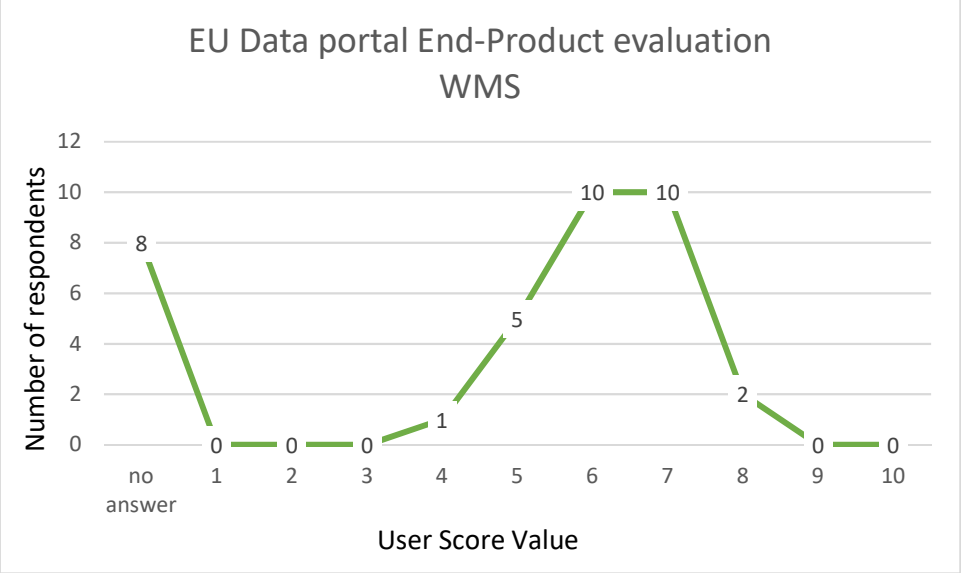
2
3
4
5
6
7
8
9
10
9
0
0
0
1
4
9
11
2
0
0


EU Data portal End-Product evaluation
WMS
Number of respondents
User Score Value
no answer
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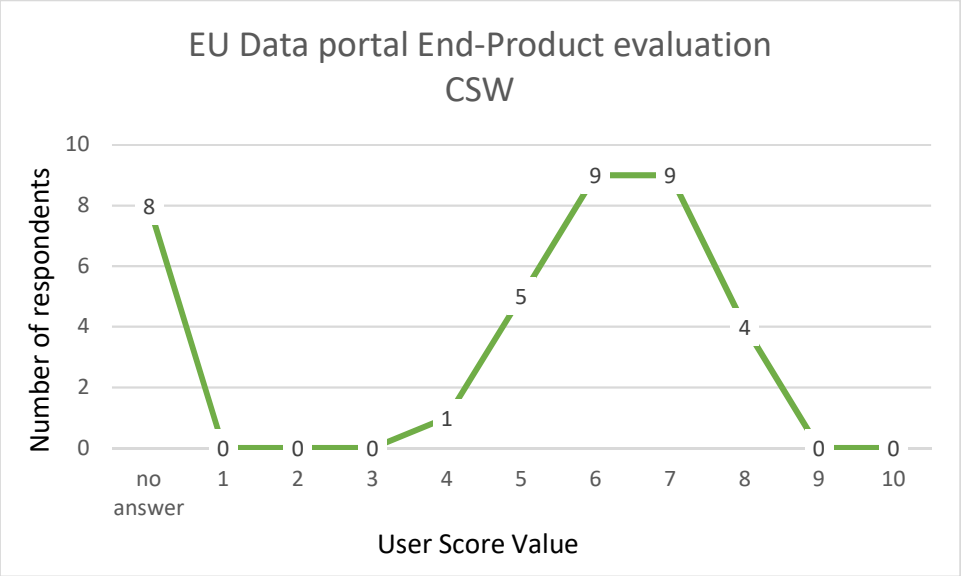
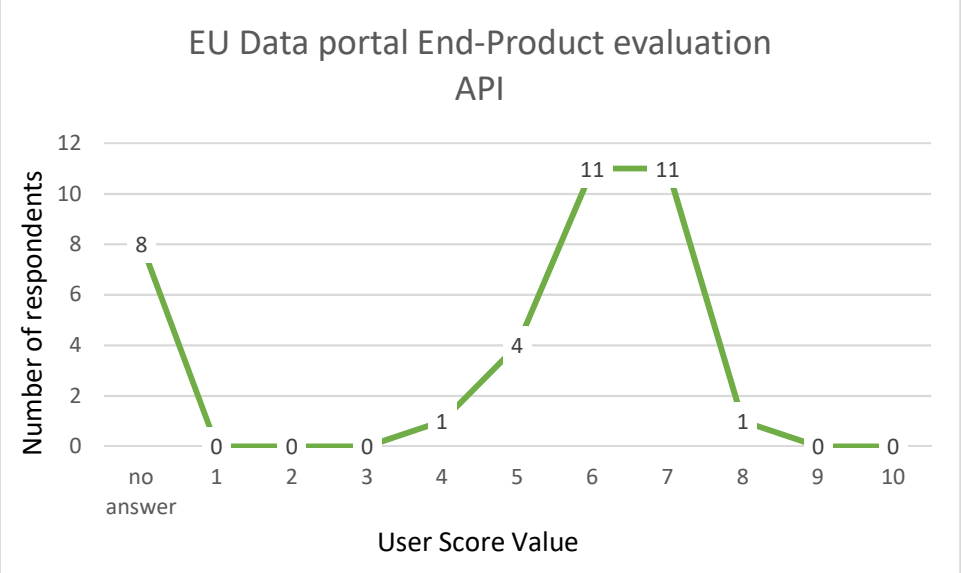
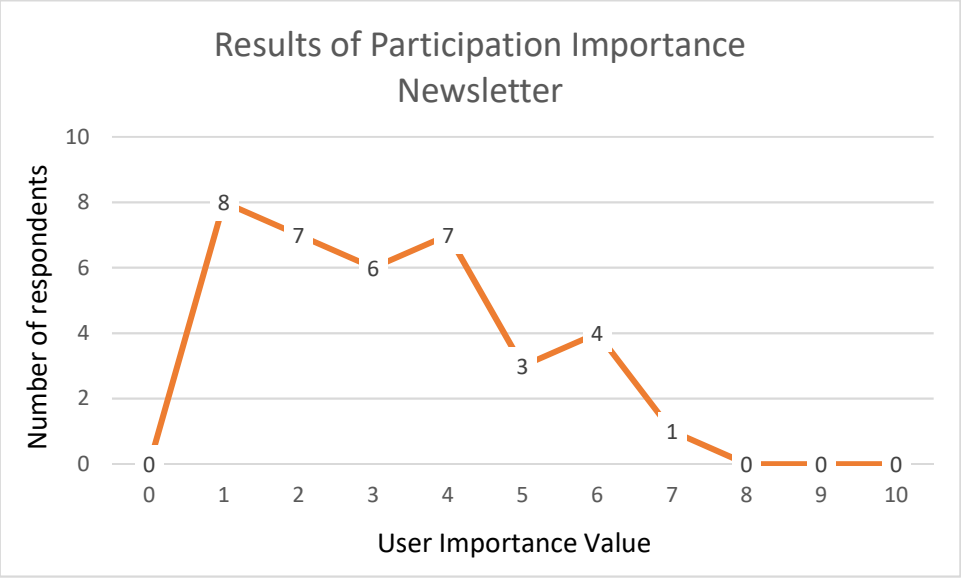
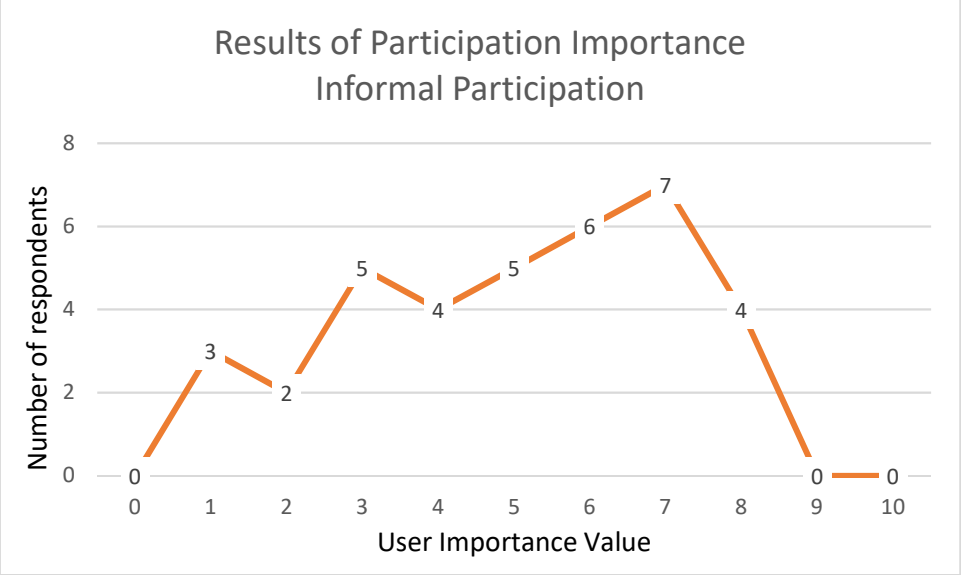
2
3
4
5
6
7
8
9
10
8
0
0
0
1
5
10
10
2
0
0

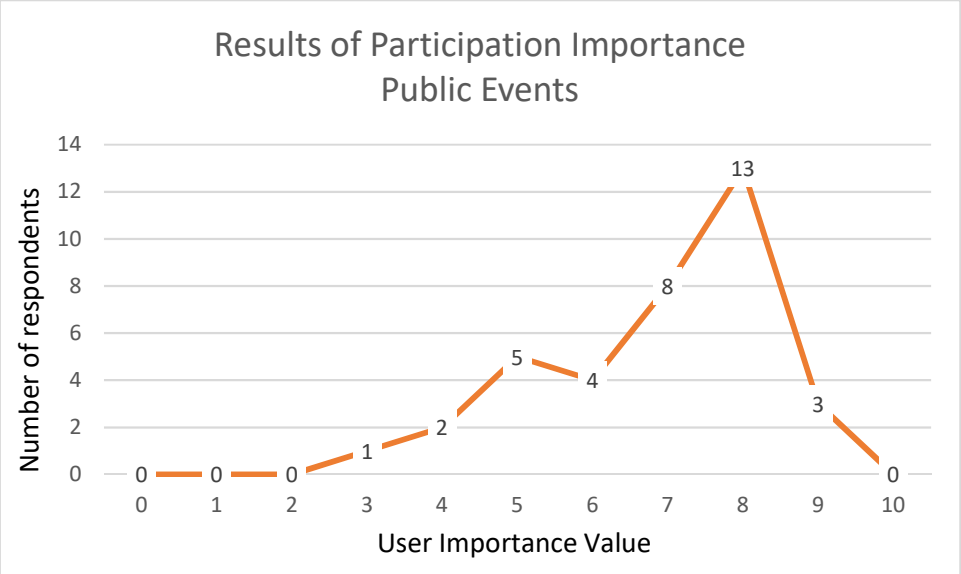

EU Data portal End-Product evaluation
CSW
Number of respondents
10
8
6
4
2
0
8
0
0
0
1
5
9
9
4
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

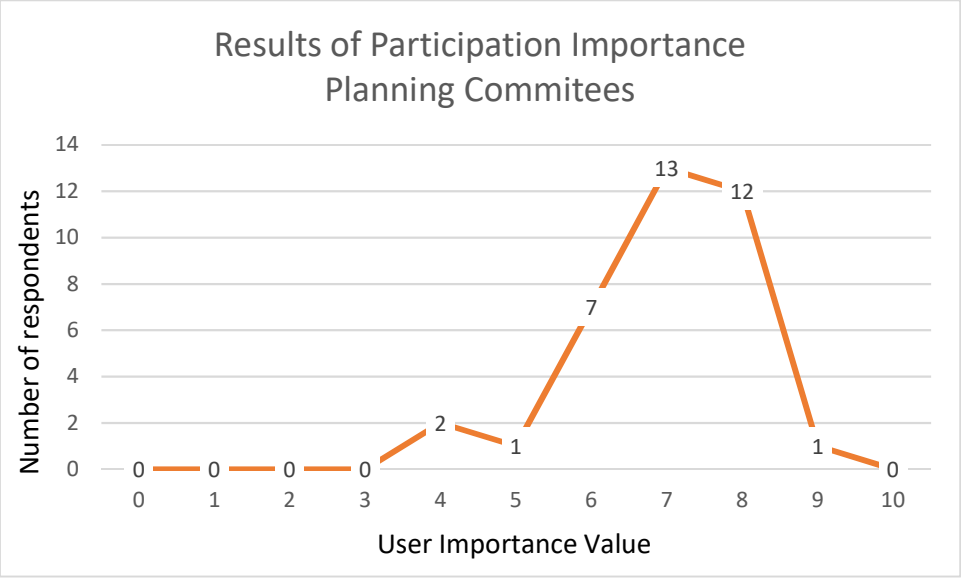

EU Data portal End-Product evaluation
API
Number of respondents
12
10
8
6
4
2
0
8
0
0
0
1
4
11
11
1
0
0
no answer
1
2
3
4
5
6
7
8
9
10
User Score Value

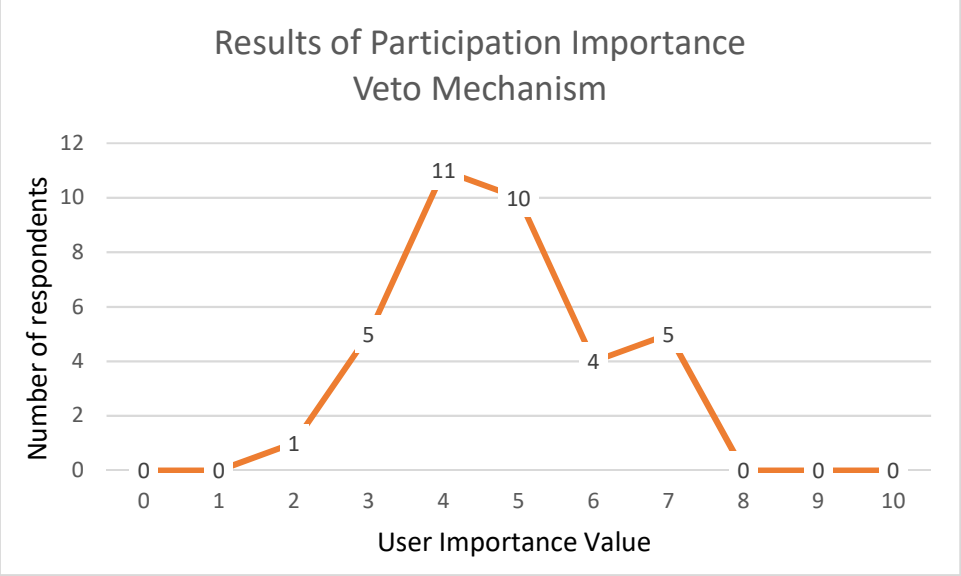
10.3.4 About Participation Indicator Importance



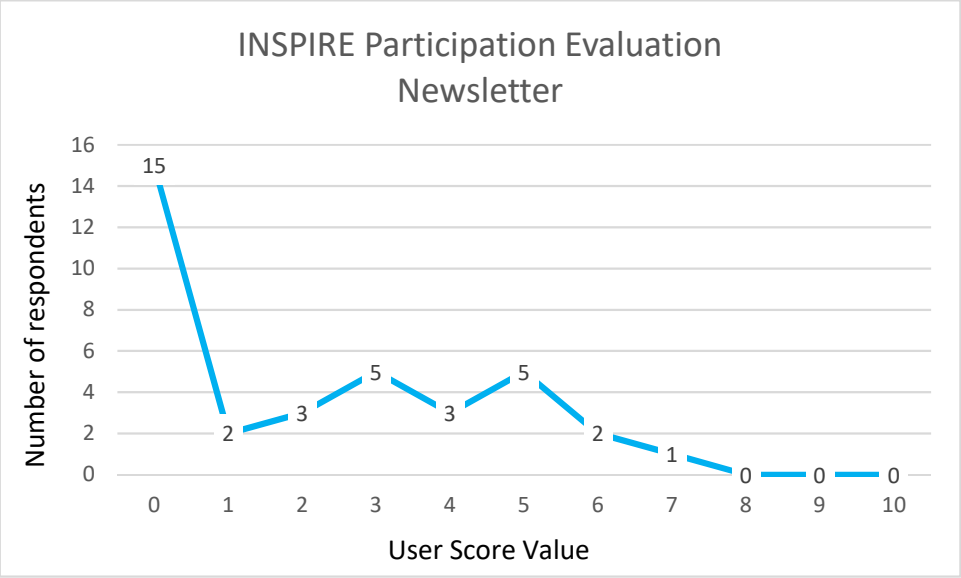


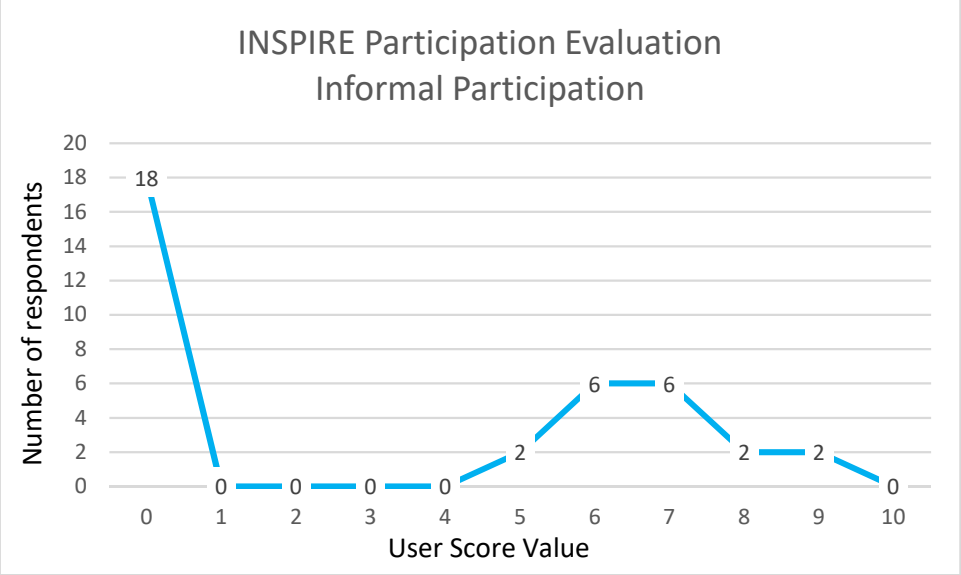


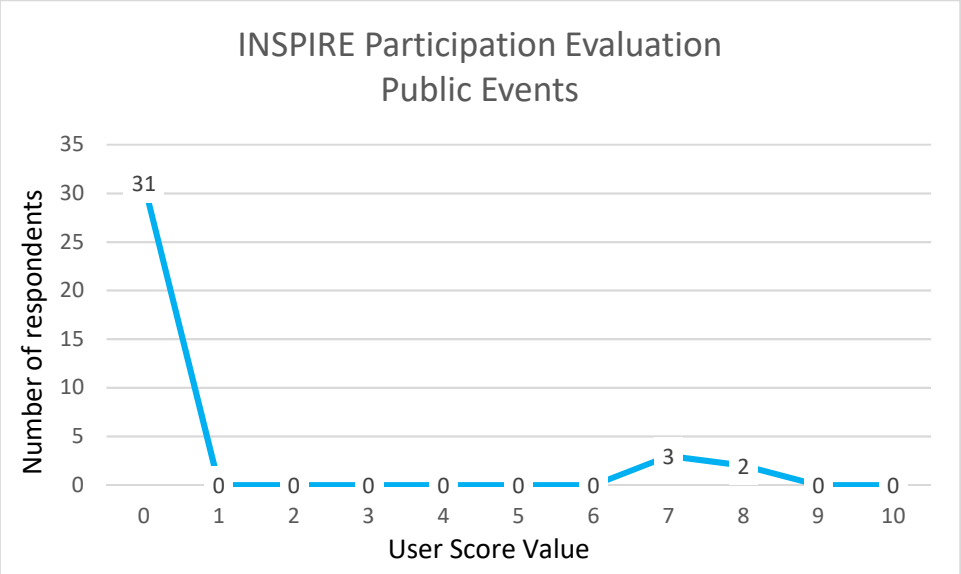

Results of Participation Importance
Planning Commitees
Number of respondents
User Importance Value
0 0 0 0 2 1 7 13 12 1 0
0 1 2 3 4 5 6 7 8 9 10

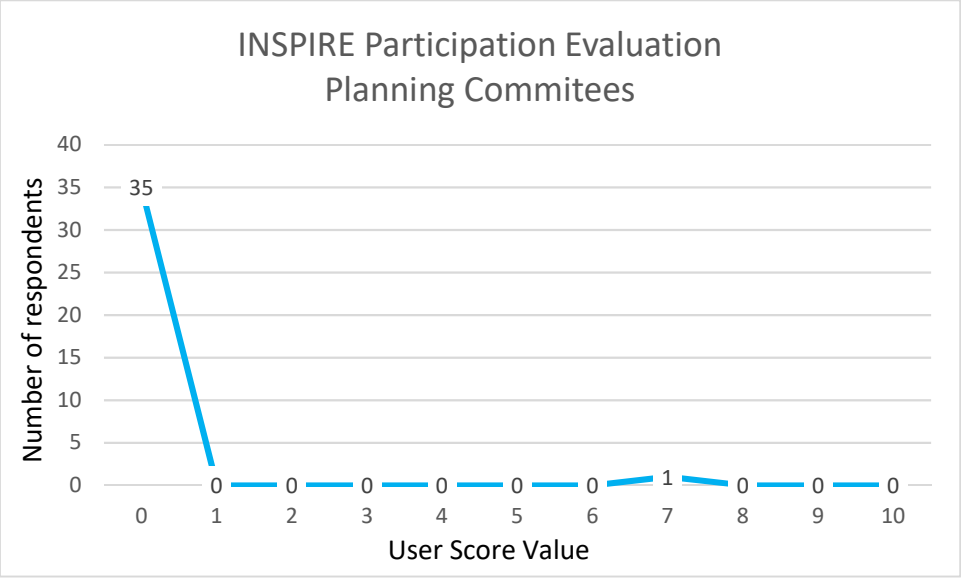

Results of Participation Importance
Veto Mechanism
Number of respondents
User Importance Value
0 0 1 5 11 10 4 5 0 0 0
0 1 2 3 4 5 6 7 8 9 10

10.3.5 About Participation in INSPIRE








INSPIRE Participation Evaluation
Planning Commitees
Number of respondents
User Score Value
35
0
0
0
0
0
0
1
0
0
0
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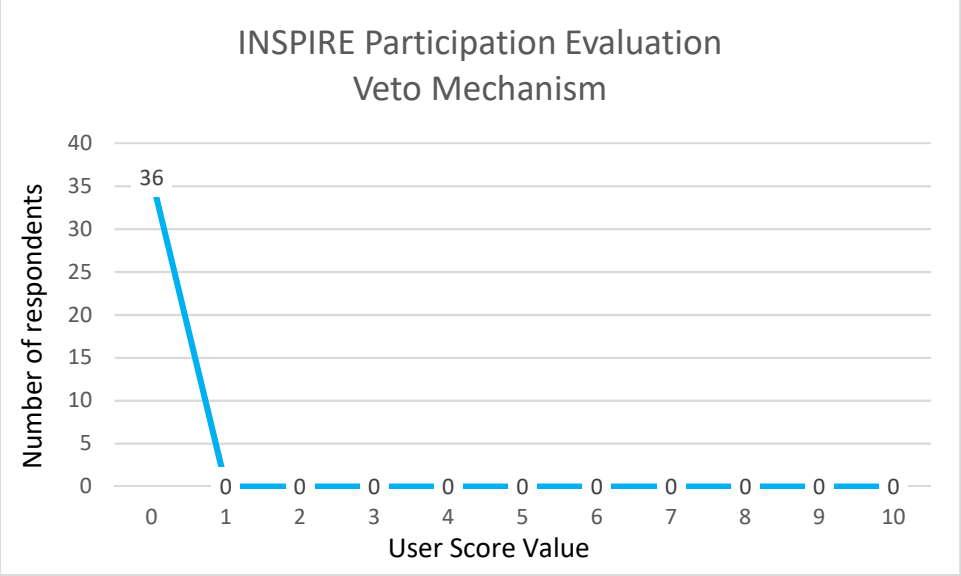
1
2
3
4
5
6
7
8
9
10


INSPIRE Participation Evaluation
Veto Mechanism
Number of respondents
User Score Value
36
0
0
0
0
0
0
0
0
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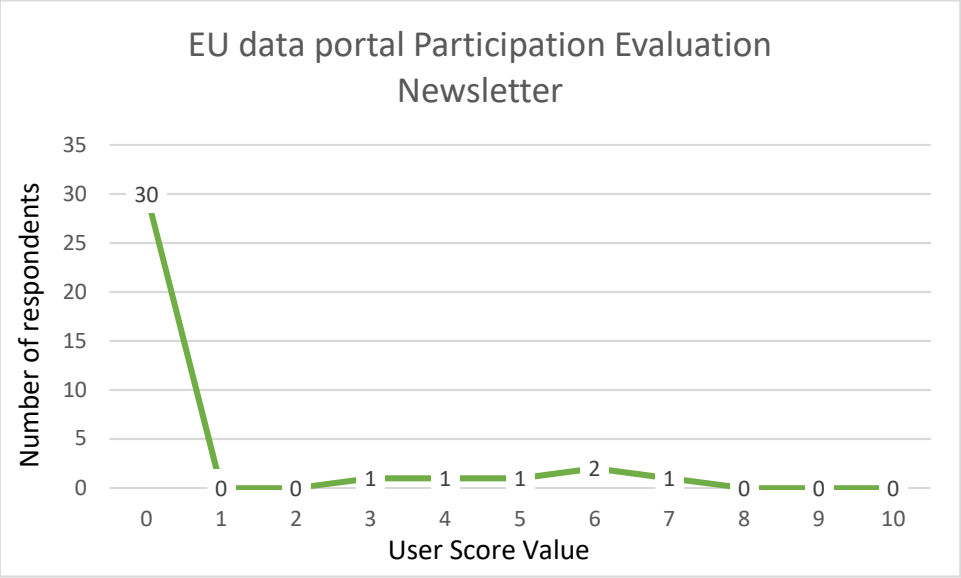
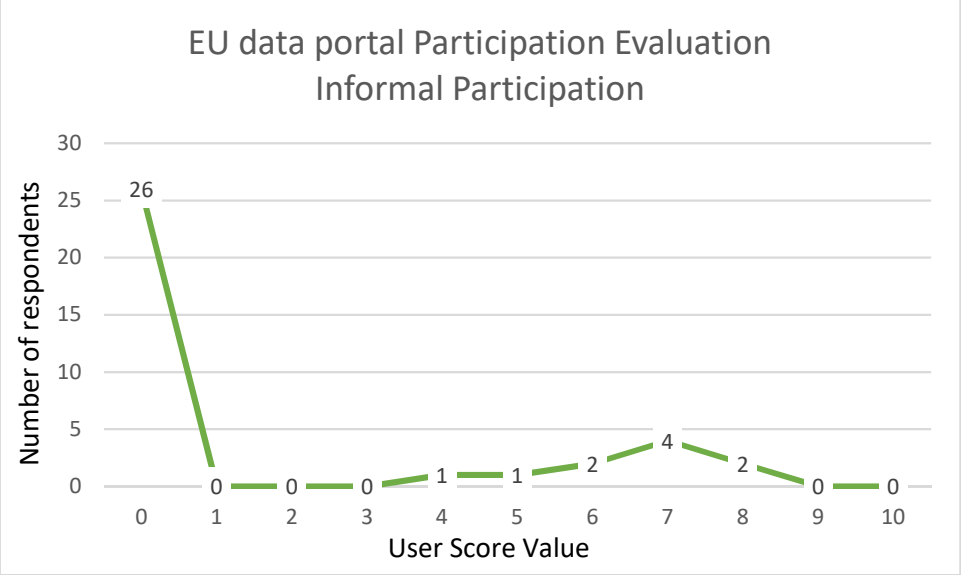
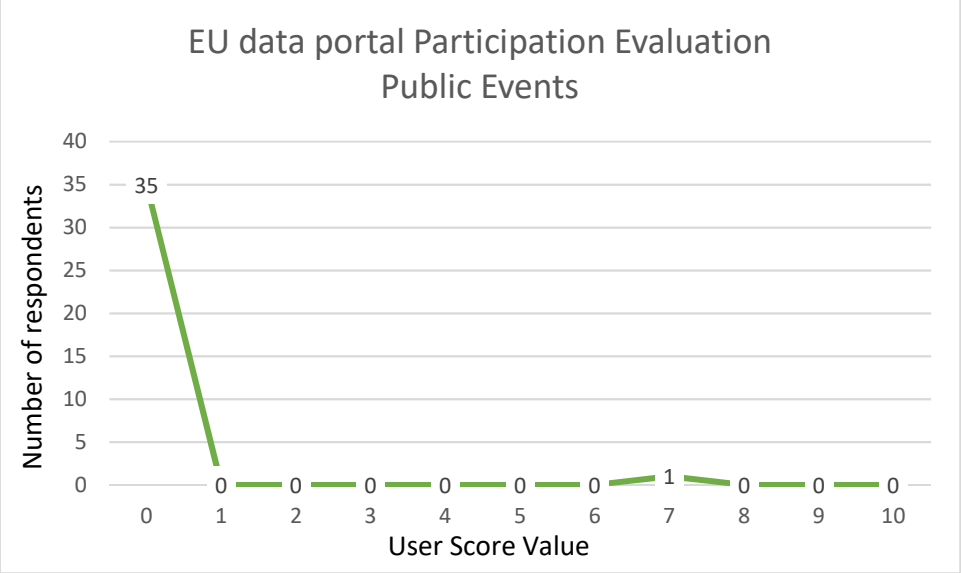
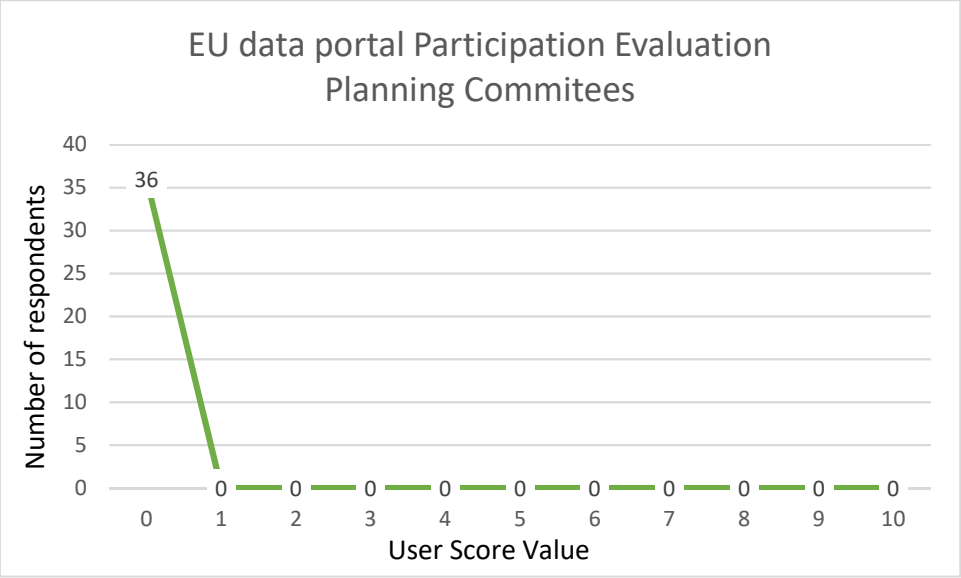
0
1
2
3
4
5
6
7
8
9
10

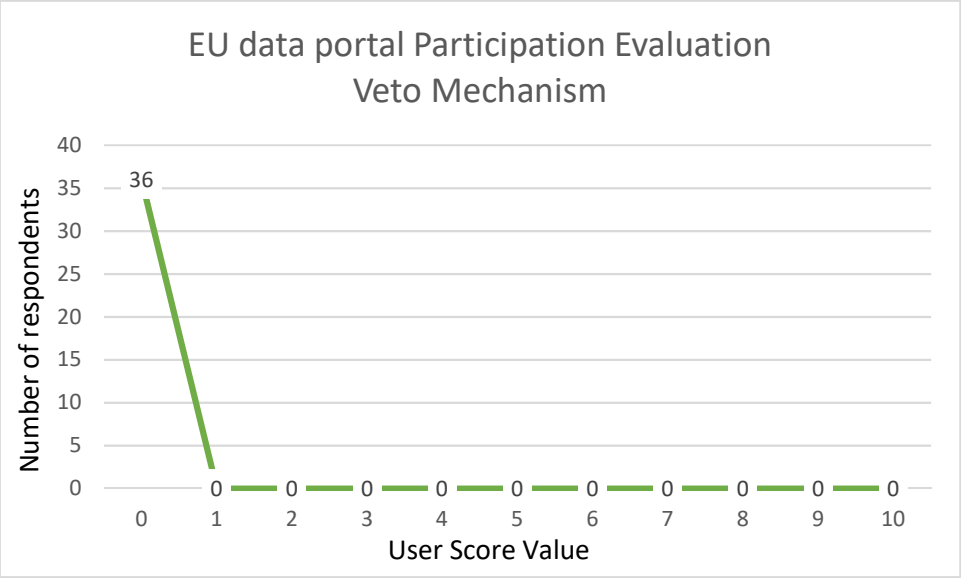
10.3.6 About Participation in EU Data Portal








EU data portal Participation Evaluation
Planning Commitees
Number of respondents
40
35
30
25
20
15
10
5
0
36
0
0
0
0
0
0
0
0
0
0
0
1
2
3
4
5
6
7
8
9
10
User Score Value


EU data portal Participation Evaluation
Veto Mechanism
Number of respondents
40
35
30
25
20
15
10
5
0
36
0
0
0
0
0
0
0
0
0
0
0
1
2
3
4
5
6
7
8
9
10
User Score Value