



Roadmap for Future Research Directions Gap Analysis and Research Needs

WORK IN PROGRESS

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1 Methodology

1.1 Methodology for Gap Analysis

The Big Policy Canvas Gap analysis is focusing on the gaps that hinder the rapid and effective uptake of data-driven policy-making, policy-modelling and policy-implementation solutions and approaches. The gaps are identified by comparing the needs of public administrations identified in WP3 and the potential to be covered through the exploitation of existing Methods, Tools, Technologies and Applications, that is, the assets, identified in WP4.

Gaps are the mismatch between what currently can be provided in this universe through the use of the existing assets, and what are the current needs in terms of information, organisation, strategy, legal and technology according the current conceptual, societal and technological trends.

We look for gaps in existing assets to fulfil the needs and advance in the policy making through the use of (big) data for the evidence-based policy-making. Firstly, we need to identify the gaps from the needs collected in WP3, D3.3, and the assets collected in WP4, D4.2. Needs require some functionalities to be fulfilled, so we have identified those functionalities and subsequently to which extent the associated assets support those functionalities according the trends that foment those needs.

1.1.1 Process for Gap Identification

For the identification of the gaps we follow the methodology described below. The main inputs for the gaps identification are the description of need and Assets found in the Big Policy Canvas Knowledge Base.

Step 1: Selection of needs from the KB¹ is based on those with high priority, according the prioritisation performed in the assessment framework, updated in D3.3, and those with big data potential, according to the big data potential relevance assessed as well in D3.3, as the project is focused in the policy development through the use of (big) data evidence.

Step 2: After the needs are selected, each one is broken down into the functionalities that form that need. For example, from the description of need N-S-1, *Development of domain specific target and indicator systems*, two main functionalities that are required from the Need description:

“Already the political economist and sociologist Max Weber once has pointed out that decision makers need to ensure the rationality of their decisions, by trying to balance out the best relation of means and ends.

Consequently, policy makers need to clarify the targets that they want to reach through certain political programmes and norms. In fact, the executive bodies need quite precise targets, since they are responsible for the adoption and implementation of political and legal solutions and need to translate political solutions in concrete activities. If public administrations want to monitor political targets, they need to set up a management control system, as it is already quite common in the private sector. Nevertheless, since it is not possible to score success from insulated financial ratios (See also Need:

¹ Big Policy Canvas, Knowledge Base, <https://www.bigpolicycanvas.eu/community/kb>, retrieved March 2019

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Link between impact, quality, performance measurements and financial information), the public sector needs to observe much more complex systems in consideration of public interests.

In a conducted interview with a public administration representative on the regional ministerial level in the youth welfare policy domain, the interviewee confirmed that there is a lack of clearly formulated goals on the political level. The interviewee further mentioned that without clear goals on a political level, executive bodies are incapable to derive operationalised goals and indicators.

A second problem he mentioned is that targets, if they are formulated, should be well balanced among each other, since it is important in the implementation phase to know which targets have priority to set up a strategic planning. For example, it is difficult to implement child day care availability for everybody and best trained childcare workers at the same time.

To sum up, policy domain specific targets and indicator systems are especially relevant in the formulation, and implementation phase, but are also relevant in the monitoring and evaluation phase, since it is impossible to monitor and evaluate political targets and their derived indicators in a performance measurement system without targets.”

Error! Reference source not found. presents the gap identification methodology.

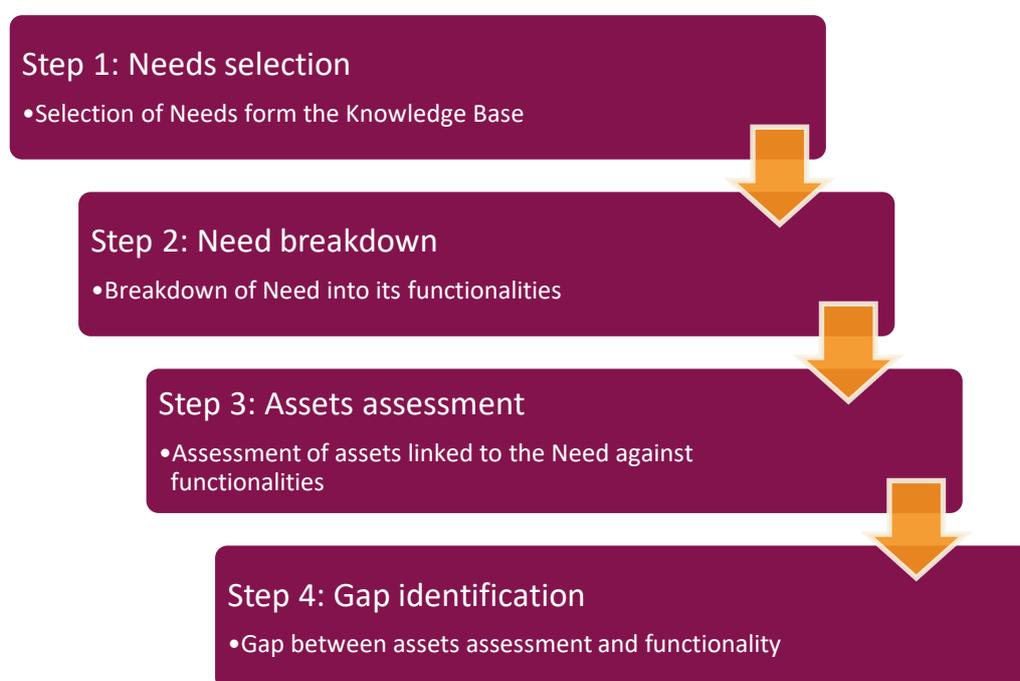


Figure 1 - Methodology for gap identification

So, from the two parts of the text highlighted above we have concluded that the following functionalities are required:

- F1: Management control system to monitor political targets based on multiple indicators (impact, quality, performance measurements and financial information).
- F2: Definition of clear goals in policy building with balanced targets.

Typically, one or two functionalities are found for each need.

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Step 3: Once the needs functionalities are defined, we assess each asset linked to the need against the functionalities extracted. This is performed with a table with the functionalities in the x axis, and the assets in the y axis, as in the example in Table 1 below. At the end we have a set of assessments for each functionality from each asset.

Table 1 - Table for assessment of assets against Needs functionalities

Functionalities	F1: Functionality 1	F2: Functionality 2
Assets		
Asset 1	Assessment Asset 1 against Functionality 1	Assessment Asset 1 against Functionality 2
Asset ..	Assessment Asset .. against Functionality 1	Assessment Asset .. against Functionality 2
Assent N	Assessment Asset 2 against Functionality 1	Assessment Asset 2 against Functionality 2

Step 4: The gap is then extracted from the maximum level of compliancy of the assets against a given functionality. The space between this level of compliancy and the requirement of the functionality is identified as the gap for that functionality, so at least one gap is identified for each functionality. One issue found during the assets functionality compliance assessment is that the description in the Knowledge Base² is quite limited for many of them, so at the end it is required to go through the description of the asset found in the corresponding website linked to it. This poses a homogeneity issue, as usually there is not the same level of detail, or even the same approach in the assets' description.

² Big Policy Canvas, Knowledge Base, <https://www.bigpolicycanvas.eu/community/kb>, retrieved March 2019

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2 Identification of Gaps and Research Needs

2.1 Step 1: Needs Selection

In the Knowledge Base³ there are 28 Needs identified, from those, 12 are of High Priority, and 11 of them have big data potential. After we apply the selection of Needs with High Priority and big data potential from the Knowledge Base filters we end-up with the Needs listed in Table 2.

Table 2 - Needs selected for Gap analysis

Reference	Priority	Type	Name
N-S-1	High	Strategical	Development of domain specific target and indicator systems
N-S-2	High	Strategical	Involvement of the public and citizens, as well as the development of citizen-centred policy making
N-S-4	High	Strategical	Strengthen citizens' trust in public administration
N-S-9	High	Strategical	Cross-linked information exchange
N-O-7	High	Organisational	Standardisation of processes
N-T-1	High	Technical	Cope with the production of huge volumes of data
N-T-3	High	Technical	Ensuring data security taking into account the protection of citizens' privacy
N-T-4	High	Technical	Establishment of a comprehensive technical infrastructure and IT architecture
N-I-1	High	Informational	Link between impact, quality, performance measurements and financial information
N-I-3	High	Informational	Ensure availability of (real-time) information and knowledge
N-I-4	High	Informational	Comprehensive knowledge and information management

From the eleven Needs, four are of strategical type, one organisational, three technical and three informational.

2.2 Step 1 to Step 4: Need Breakdown, Asset Assessment and Gap Identification

This set of steps is performed for each Need individually. Each Need is broken down into its functionalities, the assets are assessed against those functionalities, and the gap is identified for each functionality. For each Need, a table is shown with the text of the Need, the first *functionality* and its corresponding *gap* below, and below a second set of *functionality-gap* in case there is one. Tables with the assessment of the assets against the functionalities are available in **Error! Reference source not found.**

Table 3 - Gap identification for N-S-1, Development of domain specific target and indicator systems

N-S-1	Development of domain specific target and indicator systems
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³ Big Policy Canvas, Knowledge Base, <https://www.bigpolicycanvas.eu/community/kb>, retrieved March 2019

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<p>Already the political economist and sociologist Max Weber once has pointed out that decision makers need to ensure the rationality of their decisions, by trying to balance out the best relation of means and ends (Weber 1980). Consequently, policy makers need to clarify the targets that they want to reach through certain political programmes and norms. In fact, the executive bodies need quite precise targets, since they are responsible for the adoption and implementation of political and legal solutions and need to translate political solutions in concrete activities. If public administrations want to monitor political targets, they need to set up a management control system, as it is already quite common in the private sector. Nevertheless, since it is not possible to score success from insulated financial ratios (See also Need: Link between impact, quality, performance measurements and financial information), the public sector needs to observe much more complex systems in consideration of public interests (Budäus and Buchholtz 1997). In a conducted interview with a public administration representative on the regional ministerial level in the youth welfare policy domain, the interviewee confirmed that there is a lack of clearly formulated goals on the political level. The interviewee further mentioned that without clear goals on a political level, executive bodies are incapable to derive operationalised goals and indicators. A second problem he mentioned is that targets, if they are formulated, should be well balanced among each other, since it is important in the implementation phase to know which targets have priority to set up a strategic planning. For example, it is difficult to implement child day care availability for everybody and best trained childcare workers at the same time. To sum up, policy domain specific targets and indicator systems are especially relevant in the formulation, and implementation phase, but are also relevant in the monitoring and evaluation phase, since it is impossible to monitor and evaluate political targets and their derived indicators in a performance measurement system without targets.</p>	
Functionality N-S-1.F1	Management control system to monitor political targets based on multiple indicators (impact, quality, performance measurements and financial information).
Gap N-S-1.F1.G1	Lack of an approach to develop socio-technical control systems tailored to specific domains and its specific KPIs. So far, tailor-made systems or assessment frameworks have been developed. A methodology to build such standardized and modular systems is required.
Functionality N-S-1.F2	Definition of clear goals in policy building with balanced targets.
Gap N-S-1.F2.G2	Each domain requires proven approaches to define the goals and balanced targets to monitor the application of policies.

Table 4 - Gap identification for N-S-2, Involvement of the public and citizens, as well as the development of citizen-centred policy making

N-S-2	Involvement of the public and citizens, as well as the development of citizen-centred policy making
<p>Concerning the public, a close cooperation between public administration and citizens seems essential. Through participative democracy and public involvement, a new relationship between the citizens and the administrations can be established. The publicity becomes a valued partner to identify problems, discover new thinking and propose solutions. This can be seen as a profit for public administrations, because the experiences of the citizens can be contributed into the administration and help to improve, for example, its policy making. As the main customer of public administration, the wishes and needs of the citizens (customer satisfaction) should be involved in policy making and be automatically transferred into administrative needs. It is of big interest what the customer is thinking and what the customer wants. This can lead to improvement of efficiency and effectiveness. The changed living environment of the customers (internet, online shopping, 24-hour availability of products) raises the expectations towards the administration, which must meet these demands. Engaging the public can help to rebuild the trust of citizen and consequently lead to a stronger citizens' satisfaction (Thomas 2013).</p>	

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Functionality N-S-2.F1	Participative democracy.
Gap N-S-2.F1.G1	Realistic participation is very limited, mainly through games and simulations or comment and suggestion tools. There are some tools that provide support to participative democracy but there is a lack of real experiences where direct democracy is applied, and when found it is very limited in its scope. Conclusion, there are no experiences that really exploit the full potential of participative democracy.
Functionality N-S-2.F2	Improvement of efficiency and effectiveness by transferring to PAs the experiences, wishes and needs of the citizens into administrative needs in the policy making process.
Gap N-S-2.F2.G2	Tools and applications are mainly devoted to idea collection and scoring or problem and idea reporting mainly for environment in urban areas. So specific transfer of needs (all kind) to PAs is lacking. It is not a problem of tools availability, but of political willingness to really involve citizens in development of citizen-centred policy making.

Table 5 - Gap identification for N-S-4, Strengthen citizens' trust in public administration

N-S-4	Strengthen citizens' trust in public administration		
To improve public administration's image, it is important to rebuild the trust in it. The citizens' cooperation seems essential to achieve public purposes. The lack of trust can make the formulation and implementation of policies more difficult or even impossible. Relevant factors that influence citizens' trust is the administrations' integrity, as well as its performance. Transparency and public participation can be helpful possibilities to increase the trust in government and administration (Grimmelikhuijsen et al. 2013, Wang and Van Wart 2007, Olabe 2017). The need has not been validated in the qualitative interviews, but seems to have relevance for the public sector due to the findings of the desk research. This need is a key in the policy formulation phase, because only with the trust of the population, problems can be understood consequently right and the necessary policies can be developed.			
Functionality N-S-4.F1	Citizens' cooperation.		
Gap N-S-4.F1.G1	The citizens' acceptance of public participation offers often falls short of expectations because participation requires time and other resources (technical, logistic, educational). There are educational games at the citizens disposal but not sufficiently promoted or not accessible for all audiences.		
Gap N-S-4.F1.G2	Appropriate legislation at the Member States level which can better integrate public consultation, as policy-making is more based on expert inputs in detriment of non-expert knowledge coming from other parts of society. Therefore, there is a need to change institutional and organizational culture and a shift of mindset from civil servants, policy makers, politicians, researchers but also from citizens and civil society.		
Functionality N-S-4.F2	Transparency		
Gap N-S-4.F2.G3	Citizens tend to refrain from engaging in participation procedures because it is not clear for them what will happen with their contributions and because trust in political bodies is lacking (sometimes it is not always the interests of the most concerned that become accepted but often the interests of the best organized). The issue of representativeness needs to be preserved through a mix of tools and methods that ensures a good variety of viewpoints. This can be reinforced by more transparency about the use and influence of citizens' feedback, thus avoiding concerns about potential conflict of interests or biased collection of inputs.		

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Table 6 - Gap identification for N-S-9, Cross-linked information exchange

N-S-9	Cross-linked information exchange
	Public sector organisations are mainly knowledge-intensive organisations, and to exploit their knowledge, effective knowledge sharing among the different departments is required. There can be great advantages if information is not only used in the own administration but is shared between hierarchies, different policy areas and levels of government. Including findings from other disciplines in respective monitoring systems (e.g. education, social, youth, and work) can create synergy and learning effects, which in turn leads to a share of benefits. In the interview with the division head in the policy domain “Youth and Welfare” on regional level, it became clear, that the information exchange is a big issue in German administrations. Due to the federal structure, the data belongs to different players and cannot be easily matched. Analyses and comparisons are made more difficult, whereby valuable information is lost. Especially in the agenda setting and implementation phase, cross-linked information exchange can bring valuable improvements.
Functionality N-S-9.F1	Share information among hierarchies, different policy areas and levels of government, creating synergies.
Gap N-S-9.F1.G1	While there are a lot of initiatives to share public open data for citizens / businesses, there is a gap in sharing information internally (also closed data) between different public administrations. Interoperability is often lacking and most of the times political will. Also, ignorance about the availability and benefits of sharing data in the administration. The publication of open data is usually considered more a duty (additional workload perception) than an opportunity, and possible reuse is more focused to private companies than own administration.
Gap N-S-9.F1.G2	There is a lack of alignment with the interests of re-users, due to a lack of communication between suppliers and users. The data published has not always the necessary quality, it is not updated frequently or there is no homogeneity between different countries, and this makes reuse inefficient and costly.
Gap N-S-9.F1.G3	Intellectual property rights and the diversity of licences makes information sharing and reuse more difficult.
Gap N-S-9.F1.G4	Sharing information can lead to an eventual improvement, but there is a huge trade-off between the opportunity to improve and to reveal that processes are implemented in a non-optimal manner (fear of criticism). Sharing of process knowledge has the potential to greatly improve the organization but is connected with a high degree of self-exposure and risk.
Gap N-S-9.F1.G5	Lack of altruistic culture and conservative pattern of behaviour in public administration.

Gap identification for N-O-7, Standardisation of processes

N-O-7	Standardisation of processes
	Standards require a certain legal basis and binding specifications. At the same time, they must be also accepted by the target group. If standards are enforced, they offer the advantage of planning and investment protection. This provides a good basis for further digitisation of processes (Grosso and Heck 2009). As an example, interviewed employees of the administration referred to a nationwide same process for which there are different procedures in all municipalities. In addition, the media interruption between the administration and external partners was criticised. Standards can optimise these processes, increase the efficiency and save time.
Functionality N-O-7.F1	Legal basis & specifications.

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Gap N-O-7.F1.G1	Initiatives are dispersed and often only tackling a specific aspect of a policy domain, sometimes too generic. Following these standards is not usually mandatory.
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Table 7 - Gap identification for N-T-1, Cope with the production of huge volumes of data

N-T-1	Cope with the production of huge volumes of data
Probably one of the biggest needs for administration is to keep up with the technical innovation. To cope with the production of huge volumes of data is a technical problem as well as a big challenge for the staff. On the one hand, there should be established technical infrastructure for new policies and the increasing number of data, on the other hand, the staff needs to be trained and able to manage data and produce “good” data. The interviewed division head in the policy domain “Youth and Welfare” on regional level stressed the importance of having enough staff that is able to handle data. To cope with the technical challenges, it is important that public administration is technical modernised and updated, which in turn requires financial investments. The automation of standardised processes could save a lot of time and resources (OECD 2013).	
Functionality N-T-1.F1	Technical infrastructure to support new policies and increasing amount of data.
Gap N-T-1.F1.G1	Some infrastructures have been deployed (like BDTI or MapR) and some specific tools are available as well, solving specific problems in the scope of public administrations. What it likes to be missing to further develop these capabilities in the public administrations is a tool set of infrastructures and tools and filling the gap between them and the real needs of public administrations, so these tools can be adapted to solve each specific problem.
Functionality N-T-1.F2	Staff training to be able manage and produce “good” data.
Gap N-T-1.F2.G2	Technical training is usually available for technical staff. It looks like public administrations management still has to be aware of the potential of using these infrastructures and tools to support policy making, while at the same time incorporating data scientists to PA staff.

Table 8 - Gap identification for N-T-3, Ensuring data security taking into account the protection of citizens’ privacy

N-T-3	Ensuring data security taking into account the protection of citizens’ privacy
Concerns about insufficient security and privacy are ubiquitous when it comes to the use of new technical possibilities - especially in public management (OECD 2017a). Besides the advantages and potentials, digitisation is associated with some technical and non-technical obstacles. Data protection and information security management can help to preserve trust in government ⁴ . Public administrations have to guarantee citizens’ informational self-determination, protect their sensitive personal data against unwarranted access and avoid unintended consequences (for example AI bias and identity theft). Additionally, it is necessary to ensure information security to managing sensitive information including people, processes and information systems. In this context an interviewee mentioned, that it is not even possible for them to send encrypted emails at present time.	
Functionality N-T-3.F1	Data protection, complying with GDPR standards for gathering, processing and storing personal data.
Gap N-T-3.F1.G1	How organizations obtain and use consent. Many individuals do not hold a digital footprint, so organizations need to be able to provide consent and consent management in hard copy as well as online.
Functionality N-T-3.F2	Information security management systems manage sensitive information so that it remains secure. It includes people, processes and IT systems by applying a risk management process.

⁴ Website of the EU General Data Protection Regulation (GDPR), <https://www.eugdpr.org/>, retrieved February 7, 2018.

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Gap N-T-3.F2.G2	To find a balance between the need for high security standards while ensuring enough openness to new innovation.
Gap N-T-3.F2.G3	The removal of explicit personal information from the citizens' data collected may not fully protect privacy, as combining multiple datasets may lead to the re-identification of individuals.

Table 9 - Gap identification for N-T-4, Establishment of a comprehensive technical infrastructure and IT architecture

N-T-4	Establishment of a comprehensive technical infrastructure and IT architecture
<p>All interviewees stated that there is room for improvement in the technical infrastructure. The used technical infrastructure is partly outdated and does not meet current requirements, a fact that consequently increases administrative costs and leads to unnecessary bureaucracy. In addition, the lack of good infrastructure makes digitalisation difficult. In concrete terms, interface problems must be solved and harmonised. Concrete requirements that have been addressed in the various interviews are a comprehensive data infrastructure component, centralised records management and the ability to work mobile. This technical need is particularly related to the policy implementation and formulation but is also relevant in the other stages.</p>	
Functionality N-T-4.F1	IT infrastructures are the backbone of a system of services that Public Administrations use and provide to citizens. They must be reliable, secure and economically sustainable.
Gap N-T-4.F1.G1	Decisions over the IT infrastructure are usually left to the initiative of each administration and undertaken without a shared vision, coordination or planning.
Gap N-T-4.F1.G2	IT Infrastructure managed with insufficient or fragmented resources in terms of budget but also skills, as acquisition of talent with specific capabilities to the different technical roles, is not fomented.
Gap N-T-4.F1.G3	Lack of technical capacity in policy processes and public administration own inability to understand technical data.

Table 10 - Gap identification for N-I-1, Link between impact, quality, performance measurements and financial information

N-I-1	Link between impact, quality, performance measurements and financial information
<p>For making administrations not only more efficient but also more effective, activities and their costs should be closely linked to strategic outcomes and broader policy objectives. A monitoring with restricted focus on financial aspects in order to assess success of public services and political programmes is not enough. To reach a holistic view on success, it is more important to consider financial ratios interlinked with quality data, impact measurements and other performance indicators. For this reason, a strategic management system requires the integration of both financial and nonfinancial performance information. (Kaplan and Noerton 1992). This need was also validated by the focus group (policy domain “Social security”). As an example, one interviewee argued that there are missing linked information between the granted aid deliveries and the qualitative implementation by the institutions or care providers. Linking performance and outcome measurements to financial information provides information that is more relevant to decision makers (Pollanen 2016). The need is especially relevant in monitoring and evaluation, but also in the agenda setting and formulation stage. We were asking a PhD candidate with the thematic priority on digitalisation in the public sector in an interview, which experiences he gained during his work on use cases in the context of smart cities. He answered, that he was deeply shocked by the fact how low the information level of public administrations is, regarding their main tasks, services and societal outcomes. This leads to the point, that public administrations, before they want to link financial and nonfinancial information, quite generally first need to collect the relevant data (see also Need: <u>Ensure availability of (real-time) information and knowledge</u>), which can be integrated in a holistic interlinked monitoring system.</p>	

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Functionality N-I-1.F1	Strategic management system integrating both, financial and nonfinancial performance information. Financial ratios linked with quality data, impact measurement and other performance indicators.
Gap N-I-1.F1.G1	Although some specific challenges are presented from the public sector due to the variety of services, this is a usual procedure in the private sector. This requires the interlink of financial and non-financial indicators in a system to have an integral view of the performance and the financial effort required. It is likely to require a change in the mindset in the public administrations to set-up these procedures, as there are already tools and methods available to perform this.

Table 11 - Gap identification for N-I-3, Ensure availability of (real-time) information and knowledge

N-I-3	Ensure availability of (real-time) information and knowledge	
	<p>Information is an asset that is constitutive to the effective and efficient supply of public services. To ensure that information meets the purposes for which it is intended, it must be accurate, accessible, valid, timely, complete and relevant (relevance especially means regional explicit information) (Hanger et al. 2013). In all the interviews that we conducted, it has become very clear and verified that information plays a very important role in policy making processes. According to the interviewed researcher in the field of administrative science, real-time data becomes relevant especially for the operative administration on the local level, for example, in the field of infrastructure. Information also plays an important role in economic policy. Up to now, current economic policy is based on very precise but outdated data. However, in such a dynamic environment, having up-to-date information is of great relevance. The interviewed division head in the policy domain "Youth and Welfare" emphasised that a good information situation, which means a certain amount of information in a good quality, is a precondition for further analyses and evaluations. In areas where there is already many data, initial success has been achieved. Nevertheless, there is still room for improvement here. However, it has been restricted that more than information is needed to positively change the policy process. Organisational conditions must be established to use this information adequately. For example, employees need to be able to understand and to use this information as well as to find creative solutions. This need seems to be closely connected with other needs, such as a comprehensive knowledge and information management, a deeper understanding IT potential and IT processes, and the establishment of a target-oriented personnel development.</p>	
Functionality N-I-3.F1	Availability of accurate, accessible, valid, timely complete and relevant information.	
Gap N-I-3.F1.G1	Regarding use cases, most of them goes from the most general to some specific areas, but not the most fundamental in terms of policy, like economics and taxes, social and welfare, that would have a real impact in the long term. Most of them just allow citizens to provide opinion or get information on secondary issues, or the information collected is just for accessory issues. They mostly provide the ability to manage limited impact areas. Most of the specific datasets and standards are generic catalogues, and the few specific are mostly about health-related issues, like food.	
Functionality N-I-3.F2	Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).	
Gap N-I-3.F2.G2	There is a wide range of casuistic, but this mostly depends on the application and the type of data or tools. In general, there are a lot of experiences, and the main challenge here is to provide valuable information to the right decision-level inside public bodies, and easy to understand and meaningful information to citizens.	

Table 12 - Gap identification for N-I-4, Comprehensive knowledge and information management

N-I-4	Comprehensive knowledge and information management						
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<p>Knowledge management affects the organisation's technical assets as well as the employees' willingness to share knowledge. Knowledge is an essential resource in public administrations and has to be stored in order to not get lost for the organisation. As a main reason for the loss of knowledge, participants of our focus group with a social political background named the retirement of employees. That is why it is important to build up a learning culture, to ensure and promote knowledge transfer within the organisation, as well as with relevant stakeholders (Hanger et al. 2013, OECD 2017b, Wige 2002).</p>	
<p>Functionality N-I-4.F1</p>	<p>Knowledge in the Public Sector should be collected, stored, shared and eventually destroyed.</p>
<p>Gap N-I-4.F1.G1</p>	<p>Rewards and learning & development processes in place in public administrations. The fear of not receiving recognition and accreditation from managers and colleagues can be the cause of retaining ownership. Besides, knowledge acquisition and high skilled and experienced staff is normally not a high priority.</p>
<p>Gap N-I-4.F1.G2</p>	<p>Sometimes IT infrastructure is old, so employees may lack the means and also the general skills of how to effectively share their knowledge.</p>
<p>Gap N-I-4.F1.G3</p>	<p>Lack of autonomy in the hierarchy and also lack of leadership and coordination, with a large number of professionals working in silos, which makes it difficult to share best practices.</p>
<p>Gap N-I-4.F1.G4</p>	<p>There is a lack of clear communication about the benefits and values of knowledge sharing.</p>
<p>Gap N-I-4.F1.G5</p>	<p>Some knowledge is hard to formalize as it is connected with the individual experience of a particular person.</p>
<p>Gap N-I-4.F1.G6</p>	<p>Insufficient capture, evaluation, feedback, communication and tolerance of past mistakes that would enhance information management in the public organizations.</p>
<p>Gap N-I-4.F1.G7</p>	<p>Loss of control over the location, distribution and use of knowledge due to the current facilities for generating, editing and storing documents. Public sector needs to break some mental schemes as they still think that power is in keeping it, rather than sharing it.</p>

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3 Annex I - Assets assessment against Needs functionalities (Step 3)

Table 13 - Asset assessment for N-S-1

Functionalities	F1: Management control system to monitor political targets based on multiple indicators	F2: Definition of clear goals in policy building with balanced targets
Assets		
African Highland Farmer – the Game	N/A	Gamification may help policy makers to understand better the impact of policies during policy making process and set appropriate clear and balanced targets
Aragon Open Data	Provides a structured access to data form the government that can feed control systems to monitor political targets	N/A
ENAP	Supports impact assessment to verify that the effects of a project correspond to sustainable development in accordance with the German legislation	N/A
GENIX	N/A	N/A
ISO	N/A	N/A
LEED	N/A	Provides green building rating system supporting policies in the scope of Energy and Environmental Design
Smart Start	Innovative techniques to analyse big data from a wide range of sources to achieve beneficial childhood experiences that allow children to grow up safely and child-friendly.	N/A

Table 14 - Asset assessment for N-S-2

Functionalities	F1: Participative democracy	F2: Improvement of efficiency and effectiveness by transferring to PAs the experiences, wishes and needs of the citizens into administrative needs in the policy making process
Assets		
Crowdsourcing Through Social Media-The Icelandic Constitution Case	Citizens can contribute directly to the drafting on the constitution	N/A
D-CENT	Provides tools for enabling democratic and participatory processes	N/A
EtherSport: Blockchain Sports Prediction Platform	N/A	N/A
EVOKE	N/A	Citizens can contribute with creative solutions to real life problems through a game
Fix My Street	N/A	Citizens reporting issues in the streets, so the city council can solve it

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Functionalities Assets	F1: Participative democracy	F2: Improvement of efficiency and effectiveness by transferring to PAs the experiences, wishes and needs of the citizens into administrative needs in the policy making process
Ideas for Bristol	N/A	Crowdsourcing site to involve citizens to provide ideas to reshape the city of Bristol
Improve the Neighborhood	N/A	Participation of citizens to report problems or provide ideas to improve the neighbourhood
Inflation Island	N/A	Educational game to check different inflation and deflation scenarios
LiquidFeedback	Tool to propose and vote ideas (digital assembly)	Tool to propose and vote ideas (civic participation)
Lisbon City Hall - Participatory Budgeting	Participatory platform to elaborate budget based on proposals	N/A
Madrid Participa	Participatory budgeting and public input and feedback on a variety of policy and issue areas	N/A
Maryland Budget Game	Game to make proposals on state budget adjustment	N/A
Regulations.gov	Citizens can provide comments on proposed regulations by the US federal administration	N/A
Smart Start	N/A	Collects inputs to improve childhood experiences in different social environments
Thousand Visions	Game to engage stakeholders to define transportation budget for the transportation of the future	N/A
UrbanSim	N/A	Simulation for supporting planning and analysis of urban development, transportation and land use.
Vancouver User Voice	N/A	Ideation process to collect ideas, votes and comments to make the city more environmentally responsible

Table 15 - Asset assessment for N-S-4

Functionalities Assets	F1: Citizens' cooperation	F2: Transparency
Agora Voting	Secure and transparent digital voting based on blockchain technology	N/A
Aragon Open Data	N/A	Cross domain Open data from Aragon region (Spain)
BDVA labelled I-Spaces	N/A	i-Spaces are Trusted Data Incubators targeted to accelerate take up of data driven innovation in commercial sectors

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Functionalities	F1: Citizens' cooperation	F2: Transparency
Assets		
Crowdsourcing Through Social Media-The Icelandic Constitution Case	Citizens can contribute directly to the drafting on the constitution	N/A
D-CENT	N/A	Enables citizens to be informed and get real-time notifications about issues that matter to them
energie atlas	N/A	Information to the citizens and companies of the State of Bavaria in Germany in the domain of energy
Fix My Street	Citizens reporting issues in the streets, so the city council can solve it	N/A
Fraunhofer E-Health	N/A	N/A
GovTrack	N/A	Makes information about the United States Congress accessible, understandable, and actionable for public use
Ideas for Bristol	Involves the city's residents in the redevelopment of the city centre	N/A
Improve the Neighbourhood	Involves citizens in the improvement of their cities	N/A
Inflation Island	To participate in policy making, citizens should understand the concepts of the economy. This game shows how inflation affects the economy	N/A
It's Your Parliament	N/A	Unique overview of the votes cast in the European Parliament, where one can easily find and compare voting records of members of the European Parliament (MEPs) and political groups. It is also possible to make own comments and cast own votes
LiquidFeedback	Platform for proposition development and voting	N/A
Lisbon City Hall - Participatory Budgeting	Involves citizens in the improvement of their city, that can take part in budgeting process	N/A
Madrid Participa	Citizen forums and investments agreed between the City Council and the citizens	N/A
Maryland Budget Game	Game that allows users to develop their own proposals for balancing the state budget	N/A
OpenGov.gr	Open calls for the recruitment of public administration officials; Allows electronic deliberation exploring new ways to tackle modern public administration problems	N/A

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Functionalities Assets	F1: Citizens' cooperation	F2: Transparency
Regulations.gov	Makes it easy to submit a comment on proposed regulations and related documents	N/A
SeeClickFix	Enables users to report non-emergency issues in their communities	Community and local government responses are reported and tracked by users
Thousand Visions	To participate in policy making, citizens should understand the concepts of the economy. The game allows the player to determine the taxes, the projects and the priorities.	N/A
Vancouver User Voice	Ideation process to collect ideas, votes and comments to make the city more environmentally responsible	N/A
€CONOMIA - The Monetary Policy Game	To participate in policy making, citizens should understand the concepts of the economy. This game shows for example how key interest rate affects inflation	N/A

Table 16 - Asset assessment for N-S-9

Functionalities Assets	F1: Information sharing
Aragon Open Data	Open data from different policy domains and departments ready to be used
BehavePlus	Information sharing in US.Forest Service, that leads to a better understanding of fire behaviour
Blockcerts: An open Standard for Blockchain educational certificates	The citizen can share personal data (blockchain-based certificates about civic records, academic credentials, professional licenses, workforce development, etc.)
DCAT Application Profile for Data Portals in Europe (DCAT-AP)	Provides a common specification for describing public sector datasets in Europe to enable the exchange of descriptions of datasets among data portals
Enquete-Kommission "Internet und digitale Gesellschaft"	N/A
Europeana	Website that shares cultural heritage for enjoyment, education and research
Google Fusion Tables	Experimental data visualization web application to gather, visualize, and share data tables
IBM Watson	Makes sense of data to make better decisions
MAPR	Data platform that harnesses, manages, protects data, and powers the next generation of AI and analytics applications that are essential for data-driven transformation
POPVOX	Platform to exchange opinions on political initiatives. Dialogue between US Congress and trade and union organisations, as well as the general public on specific pieces of legislation

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Functionalities	F1: Information sharing
Assets	
SAHARA Smart analysis	A medical smart analysis platform for health care
Smart Start	Programme in The Netherlands that develops a data-driven and fact-based approach analysing big data from a wide range of sources to estimate the risk to the child's future well-being
UrbanSim	Simulation platform for supporting planning and analysis of urban development that makes use of shared open data of land use, transportation, the economy, and the environment
X-Road	A platform that allows the secure exchange of data in order to provide efficient public services. The tool can write to multiple databases, transmit large data sets and perform searches across several databases simultaneously. It gives a seamless service provision for citizens, given that once the data is updated, all other service providers will automatically also operate with up to date information

Table 17 - Asset assessment for N-O-7

Functionalities	F1: Legal basis & specifications
Assets	
Aragon Open Data	Ontology to organise all the information published by the Aragon Government
Correctional Offender Management Profiling for Alternative Sanctions (COMPAS)	Standardisation of data and process decision making to assess measures to rehabilitate prisoners and parolees
ISO	Non-governmental international organisation with membership from 164 national standards bodies
LEED	Provides green building rating system supporting policies in the scope of Energy and Environmental Design
OpenText	N/A
Polish E-Consultations	N/A
Smart City Reference Architecture German Institute for Standardization	DIN standard. Reference architecture Model Open Urban Platform (UOP) for Smart Cities
Solver BI360	N/A
The public safety assessment	Provides a neutral tool, evidence-based, to assess judges to decide whether to release or detain an arrested person awaiting a trial
Trackur	N/A

Table 18 - Asset assessment for N-T-1

Functionalities	F1: Technical infrastructure to support new policies and increasing amount of data	F2: Staff training to be able manage and produce "good" data
Assets		
Aragon Open Data	Availability and reuse of existing public open data, through ontology model and technical infrastructure	Standardised ontology makes it easier for staff and users to expose and reuse data

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Functionalities Assets	F1: Technical infrastructure to support new policies and increasing amount of data	F2: Staff training to be able manage and produce “good” data
Big Data Test Infrastructure (BDTI)	Connecting Europe Facility (CEF) component that provides a set of services to help public administrations explore and experiment with various data sources, software tools and methodologies	Provides support services and documentation to public administrations
Datawrapper	Easy data visualisation	For non-IT staff
FishstatJ	Provides data access to users for specific statistical data about fisheries	For non-IT staff
Galileo	Satellite system that provides increased accuracy in navigation, positioning and timing services	Embedded in smartphones and vehicle navigation systems
MapR	Platform that supports big data management and processing for governments with artificial intelligence and analytics, supporting different scenarios in the public sector competences	Training of staff is required
NodeXL	Tool to explore network graphs created from existing data and even from social network data streams	For advanced users with IT knowledge
OPEN ARTFISH	Smartphone app and database to collect data to know the status and trends of capture of fisheries	For end users
OpenRefine	OpenRefine can help to explore large data sets with ease, cleaning it; transforming it from one format into another; and extending it with web services and external data	For IT staff
SAKE Semantical analysis of complex events	N/A	N/A
Smart Start	Specific programme based on data analysis for supporting beneficial childhood experiences	N/A
Watson Super Computer Project	Supercomputer AI services	N/A

Table 19 - Asset assessment for N-T-3

Functionalities Assets	F1: Data protection	F2: Information security management
Aragon Open Data	N/A	Open data from different policy domains and departments ready to be used

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Functionalities	F1: Data protection	F2: Information security management
Assets		
ISO 27001	N/A	ISO/IEC 27001 is the best-known standard in the family providing requirements for an information security management system, helping organizations keep information assets secure
Smart Start	Programme in The Netherlands that develops a data-driven and fact-based approach analysing big data from a wide range of sources to estimate the risk to the child's future well-being	N/A

Table 20 - Asset assessment for N-T-4

Functionalities	F1:IT infrastructures must be reliable, secure and economically sustainable
Assets	
Big Data Test Infrastructure (BDTI)	Provides the infrastructure to help public administrations explore and experiment with various data sources, software tools and methodologies.
Blockcerts: An open Standard for Blockchain educational certificates	The citizen can share personal data (blockchain-based certificates about civic records, academic credentials, professional licenses, workforce development, etc.) in a reliable, secure and sustainable way
European Open Science Cloud	It functions as a virtual environment with open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines by federating existing scientific data infrastructures.
Interoperability Centre	Provides a unified infrastructure for the installation and use of online services through which operational data is exchanged between the Ministry of Finance and other public bodies in Greece
Italian Data Analytics Framework (DAF)	Big Data Platform to store in a unique repository the data of the PAs, implementing ingestion procedures to promote standardization and therefore interoperability among them
RapidMiner	Data science solutions
Weka	Machine learning algorithms for data mining tasks

Table 21 - Asset assessment for N-I-1

Functionalities	F1: Strategic management system integrating both, financial and nonfinancial performance information.
Assets	
Smart Start	Non-integrated financial and nonfinancial information in this solution
Solver BI360	Tool to make financial and operational reporting form data
The European Data Market Monitoring Tool	N/A
€CONOMIA - The Monetary Policy Game	A simulation game for monetary policy

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Table 22 - Asset assessment for N-I-3 - Use Case

Functionalities Assets	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
2050 Pathways Web Tool	Tool to collect citizens inputs for decarbonisation in UK towards 2050	Understandable
3D City Model	Open data Adelaide 3D city model to help visualise the City's future, particularly in relation to growth scenarios and land use planning	Easy to use and understand
African Highland Farmer – the Game	Simulation game for policymakers to raise awareness about policies impacts on farmers' decisions and farms production and economic results towards development of domain specific target and indicator systems	Easy to understand and use
Energieatlas Bayern	N/A	N/A
Global Pulse	Promote the use of big data for research and development with a network of innovation labs	Develop toolkits, applications and platforms to improve data-driven decision-making and support evaluation of promising solutions
Google ECO Projects	Information about Google projects and environmental impact	N/A
GovTrack	Provides open information about the US Congress activities	Helps US citizens to participate in their national legislature
In the Air	Visualisation project for microscopic and invisible agents of Madrid's air	Individual and collective awareness and decision-making support tool
It's Your Parliament	Information on votes cast per members and groups of the European Parliament	Information for public scrutiny
MASAR	Crowd control centre and tracking platform to help visitors plan their routes in Mecca and Medina	Specific control centre
OpenGov.gr	Greece Open government web. Open calls; Electronic deliberation on draft legislation or policy initiatives; Labs for new ideas and proposals from citizens	For citizens and policymakers collaboration on policy making
SeeClickFix	Reporting tool for non-emergencies in communities. Available interface for citizen and for officials	To be deployed by the municipality
Smart City - City Information Modelling Rotterdam	Integration of city information into a 3D model	Allows interoperability among city departments and potential development of new services for city development
Smart Construction Administration	Using sensors to perform maintenance of transport infrastructures, including information from user's smartphones	A collaborative infrastructure has to be set up and integrated with the public administration organisation
Smart Start	Use of big data analytics to achieve a well-being childhood	This must be supported by policy makers and the corresponding programs to achieve the objectives

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Functionalities	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Assets		
X-Road	Estonian e-government platform to provide services to citizens and internally	A new approach to modern e-government

Table 23 - Asset assessment for N-I-3 - Code list / Ontology / Taxonomy / Vocabulary/Standard

Functionalities	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Assets		
Agrovoc	Multilingual vocabulary for food and agriculture from FAO available as Linked Open Data	Can be browsed on-line, downloaded, and accessed through SPARQL and webservices
DCAT Application Profile for Data Portals in Europe (DCAT-AP)	Description of public sector datasets to enable cross-data portal search for data sets and make public sector data better searchable across borders and sectors	Has to be implemented in public datasets catalogues
FoodEx2	Standardised food classification and description system, facilitating comparison and data analysis	Specific for the food sector and public regulation
OECD Taxonomy of Economic Activities Based on R&D Intensity	Classification of industries according their percentage of R&D investment	Useful for policy makers

Table 24 - Asset assessment for N-I-3 - Application

Functionalities	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Assets		
ALERTS (Automated Land change Evaluation, Reporting, and Tracking System)	Near real-time land use and land-cover change detection for decision support evaluation, reporting and tracking system	Web based tool
BudgIt	Online information about budget and public finance with different views and levels of detail	Easy to visualise, but more detailed information can be accessed
Buienalarm	Accurate information for rain prediction	N/A
Cool Farm Tool Water	Crops' water needs based on user inputs and global datasets	Information centralised in an application
Diabetes Plus	Diabetes diary to annotate glucose readings, insulin doses and patient activity	Easy tool that can be managed by patients allowing to forward information to doctor

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Functionalities Assets	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Electronic Health Records	Improving healthcare delivery through the management of electronic health records for the health public sector	Protects the privacy of the patients
LiquidFeedback	Tool to propose and vote ideas (digital assembly)	Policy-makers can collect inputs from citizens
Meieraha	Estonian budget visualisation	Tool to help citizens understand the country budget
Opinion Crawl	Online sentiment analysis from web	Should be embedded in a wider topic analysis for public administrations
Opinion Space	Tool for the generation and exchange of new ideas about issues and policies	For citizens and policymakers
Runtastic Applications	Exercise and health apps for personal use	N/A
Workday	Enterprise cloud applications for enterprise management	Plan, manage and control organisations with this cloud-based solution
World in figures	Countries profiles and ranking indexes	Can be used as a data source for analysis

Table 25 - Asset assessment for N-I-3 - Tool

Functionalities Assets	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Infogram	Tool offering several charts and maps to visualise data	Useful to help understand data
Italian Data Analytics Framework (DAF)	Italian Government and Public Administration tool to support the diffusion of open data and to enable data-driven policies	Provides public and private access portals
MapR	Platform that supports big data management and processing for governments with artificial intelligence and analytics, supporting different scenarios in the public sector competences	Users require training to understand and use the platform
Open policy making toolkit	Guide for open policy making	For policy makers
Orange	Open source machine learning and data visualization. Interactive data analysis workflows with a large toolbox.	Tool for novice and expert. No need to have programming skills
Qlik	Generic tool that supports big data analytics and AI	To support decision makers with data analytics
Semantria	Cloud sentiment analysis tools, including social media and other sources	Should be embedded in a wider topic analysis for public administrations
Tableau Public	Analytics and visualisation tool	To support decision makers with data analytics

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Functionalities	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Assets		
Virtuose DE	Cloud-based video service platform for the analysis of traffic movements	To be integrated in public traffic control systems

Table 26 - Asset assessment for N-I-3 - Portal/Database/Data source

Functionalities	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Assets		
Copernicus	Earth satellite and sensor observation information for different domains available through different data services	Must be set up for each need. The Data and Information Access Services can provide tailored services for each need
Employment Ontario Geo Hub	Open data for employment Ontario	Provides the data and analytical tools
ESPON Database for policy makers	Regional indicators database	Focused towards Policy Makers, as well as towards scientists too
EU Open Data Portal	Provides access to an expanding range of data from the European Union (EU) institutions and other EU bodies	Data is organised by categories
EU Science Hub	Compilation of open databases and tools from projects	Organised by research area
EUMETSAT	Satellite climate and environmental data	Provides several data services
European Data Portal	Metadata catalogue from Public Sector Information data	Data is organised by categories
Europeana	Open database with digitised cultural contents from European archives, libraries and museums	Organised by collections, exhibitions and exploration tools
Galileo	Satellite system that provides increased accuracy in navigation, positioning and timing services	Embedded in smartphones and vehicle navigation systems
RASFF Database	Tool to get alerts on food. Publicly available	Easy to use, even for citizens
The CIARD Routemap to Information Nodes and Gateways (RING)	Directory of datasets and data services for agri-food sector	Mainly for agricultural information professionals and data scientists.

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Table 27 - Asset assessment for N-I-3 - Model

Functionalities Assets	F1: Availability of accurate, accessible, valid, timely complete and relevant information	F2: Organisational conditions established to use the information adequately (employees need to be able to understand and use the information as well as to find creative solutions).
Economic Simulation Library	N/A	N/A
GLEAM	Tool for simulation of human mobility and disease transmission based on real data	Simulation tool for public authorities and policy makers

Table 28 - Asset assessment for N-I-4

Functionalities Assets	F1: Knowledge in the Public Sector should be collected, stored, shared and eventually destroyed.
Big Data Test Infrastructure (BDTI)	Provides the infrastructure to help public administrations explore and experiment with various data sources, software tools and methodologies.
Digital Policy Model Canvas	Methodology that can help guide policymakers. It is a canvas approach that helps translate broad insights and understandings to the needs of a particular country. It also helps define the key issues at stake as well as metrics to evaluate success, and suggest avenues for possible iteration and improvement
European Data Portal	This portal harvests the metadata of Public Sector Information available on public data portals across European countries
OPEN ARTFISH	Toolkit for routine small-scale fisheries data collection. Its objective is to facilitate the implementation of cost-effective and sustainable routine data collection, storage and analysis of data, using the appropriate statistical procedures
Open policy making toolkit	Contains the tools and techniques needed to run through diagnosis, discovery and idea generation
OpenAIRE	Shifts scholarly communication towards openness and transparency and facilitate innovative ways to communicate and monitor research.
Qlik	Public sector organizations have tremendous amounts of siloed data. By combining all these data and making it easy for everyone to explore, Qlik delivers the valuable insights needed to efficiently improve services
Semantria	Business intelligence solution focused on drawing insights from unstructured text data
Smart Start	Programme in The Netherlands that develops a data-driven and fact-based approach analysing big data from a wide range of sources to estimate the risk to the child's future well-being
SmartRegio	Management Consultant for Smart Energy in rural regions. Provides statistics from social media platforms as well as individual data of little regions in terms of mobility, energy and so on
Tableau Public	It provides with speed, accuracy, transparency and ease of communication to the Government analytics
The OO Software	System that helps with backup of information and recovery
X-Road	A platform that allows the secure exchange of data in order to provide efficient public services. The tool can write to multiple databases, transmit large data sets and perform searches across several databases simultaneously. It gives a seamless service provision for citizens, given that once the data is updated, all other service providers will automatically also operate with up to date information

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