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OpenGovIntelligence

Fostering Innovation and Creativity in Europe through Public Administration Modernization towards Supplying and Exploiting Linked Open Statistical Data

Deliverable 2.1

OpenGovIntelligence framework – first release

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Abstract:	This document summarizes the results of T2.1 (OpenGovIntelligence Framework) and proposes the first version of a framework for transforming the traditional public service production process to a lean and agile process of data-driven service co-creation. We believe that open data drives a shift towards a new conception of public services which can be initiated and co-created by anyone, the public sector as well as citizens and businesses. In order to support this shift, we put forward a lean and agile process for data-driven co-creation, and define the core elements of this new service ecosystem.
Keyword List:	public services, public value, co-production, co-creation, innovation, linked data, agile development, lean development

Consortium

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Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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List of Abbreviations

The following table presents the acronyms used in the deliverable in alphabetical order.

Abbreviation	Description
API	Application Programming Interface
LOSD	Linked Open Statistical Data
OGD	Open Government Data
RDF	Resource Description Framework
URI	Uniform Resource Identifier
WP	Work Package

Executive Summary

The deliverable "OpenGovIntelligence Framework – First Release" (D2.1) represents the first step towards designing a new conceptual framework for public service co-creation driven by the exploitation of linked open statistical data (LOSD). The framework makes use of the work conducted in WP1 by incorporating the results of the investigation of appropriate data infrastructure architectures and the study of the technical, organisational, legal, political and user-related challenges. The framework assists the work of the OpenGovIntelligence (OGI) pilots (WP4) in opening up and exploiting LOSD in a way that facilitates the co-creation of innovative data-driven public services.

The core content of this innovation is a new vision of public services, which are driven by the goal of generating public value through innovative uses of data, and which are produced in a user-centric manner through co-creation between public administrations, citizens and businesses. The framework proposes to learn from lean and agile service development models that have become the norm in the private sector but not yet so in the public sector. At the same time, to account for the complexity of the public sector context, the framework also considers the variety of factors, actors and processes that affect the shift to data-driven public service co-creation, including stakeholders, enablers and barriers at different levels, and supporting strategies and policies.

The framework takes a holistic view on LOSD-driven public service innovation looking at three sides of innovation: first the content (what is a data-driven/LOSD-driven public service, what role does co-creation play in developing this service, what are the core components of the data and service architecture), then the context in which innovation takes place (what factors drive or constrain this innovation, who are the actors) and finally the process of innovation (what steps and how should be taken in order to realize a (new) LOSD-driven public service).

Building on recent developments influencing the **content** of public services, a framework is proposed for data-driven public service co-creation, changing the traditional public service creation cycle and proposing many radical changes. In our view public service co-creation would mean that any actor, whether public or private, can take the lead in developing a new service to create public value, and any actor can take part in the co-creation of this service. In data-driven services, service co-creation largely revolves around different stakeholders providing or using data to add value to different phases of service creation.

The **context** section considers the broader environment of data-driven co-creation as an integral part of the public service innovation system. This includes data infrastructures for LOSD and data-driven public services, stakeholders involved in service co-creation, as well as contextual drivers and barriers. Most relevant context factors comprise open data and technology-related factors, stakeholder-related factors, legal and policy context, and organisational factors.

The basic elements of the **process** for data-driven public service creation and implementation are threefold: (1) public service development process based on a lean and agile approach, (2) processes

for opening data and exploiting data in public service creation and (3) co-creation process, i.e. process for feeding users' needs, data and feedback into service creation.

This results in a new agile co-creation public service model, where anyone can initiate, design, create and provide a new public service. Open data plays a catalytic role in this new model as it is the access to open data which allows for this new approach to be successful. Public service creation in a fast and agile manner decreases costs and improves efficiency.

An updated and final version of the framework will be elaborated based on the actual experience and lessons learned from the public service pilots and will form Deliverable D2.2 which is due in October 2017.

1   Introduction

1.1   Scope

This document constitutes the first release of the OpenGovIntelligence framework. The aim of Deliverable D2.1 is to propose an initial conceptual framework for public service co-creation driven by the exploitation of linked open statistical data (LOSD)[1]. More specifically, the framework is meant to assist the work of the OGI pilots (WP4) in opening up and exploiting LOSD in a way that facilitates the co-creation of innovative data-driven public services. To that end, this deliverable redefines the traditional processes used by public authorities for satisfying the needs of citizens and businesses, and suggests ways for adapting existing innovation strategies and policies to the real needs of society. This will be done by describing the data-driven public service innovation in terms of its content, context and process.

D2.1 offers an initial description of the LOSD-driven public service co-creation process at a general level. The framework makes use of the work conducted in WP1 by incorporating the results of the investigation of appropriate data infrastructure architectures and the study of the technical, organisational, legal, political and user-related challenges that affect the process of open data-driven co-creation of public services. While D2.1 only constitutes a preliminary sketch of the OGI framework, the final version of the framework will be substantially elaborated based on the actual experience and lessons learned from the pilots. The final framework will be published as deliverable D2.2 at the end of the second project year.

Figure 1. Relations to other WPs
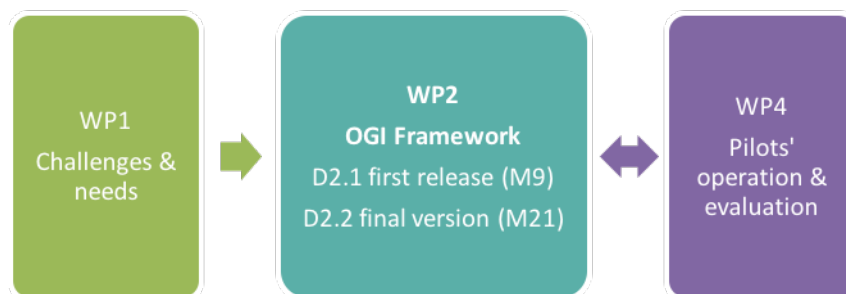
1.2   Audience

The primary audience for this document is the OGI consortium, in particular the organisations responsible for the pilot projects, and the European Commission (EC). The document might also be

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[1] Though this framework was built with LOSD service creation in mind, it is also a suitable framework for any other data-driven public service creation in general.

interesting to public and private organisations outside the project consortium and members of the general public who are interested in data-driven public service co-creation.

1.3 Structure

The deliverable consists of three main parts. Chapter 2 lists the objectives of this document and describes the overall approach to the framework creation. Chapter 3 describes the OGI framework and its components, outlining the content, context and process dimensions of data-driven public service co-creation. More specifically, Chapter 3 is divided into three main parts, where Section 3.1 defines the core concepts of the framework; Section 3.2 describes the context that affects the innovation content and process, including data infrastructure architectures, stakeholders, and innovation drivers and barriers that emanate from the broader environment; and Section 3.3 proposes a process for lean and agile data-driven public service co-creation. Finally, Chapter 4 draws some initial conclusions and suggests the next steps for the framework development.

2   Objective of the framework

The objective of the framework is to propose a user-centric LOSD innovation ecosystem based on a holistic approach to data-driven public service innovation. The framework describes the processes, policies, strategies, and data infrastructure architectures that specify a user-centric LOSD innovation ecosystem and help orchestrate the collaboration of society and public administration in the development and implementation of data-driven public services. This is done with the aim to propose general guidelines for public administrations, citizens and businesses for opening up and exploiting LOSD in a way that addresses the relevant challenges and facilitates the co-production of innovative data-driven services through the direct participation of citizens and businesses. More specifically, the framework aims to:

- specify improved business processes for feeding society's input (needs, data, feedback) and data reuse into service delivery (i.e. facilitating the co-production of services);
- define strategies and policies to support the involvement of society in the design and delivery of data-driven public services and opening public sector data;
- propose a data infrastructure architecture that will enable stakeholders to collaborate towards the production of innovative data-driven public services by exploiting Linked Open Data technologies and statistical datasets.

In order to comprehensively describe this LOSD-driven public service innovation ecosystem, the framework outlines a number of components that are part of this ecosystem, including processes for opening up data; processes to input society's needs, data and feedback; strategies and policies for innovation; data infrastructure architectures for LOSD; and contextual drivers and barriers.

2.1   Approach

The ambition of the OGI innovation framework is to propose an almost radical shift in the way public services are created. The framework therefore goes beyond traditional processes that are used by public authorities to satisfy the needs of citizens and businesses, and aims to redefine these processes to allow for a genuinely user-led and data-driven innovation. The framework builds on the Business Process Reengineering (BPR) approach in rethinking the process of public service production to facilitate the co-creation of data-driven and user-driven services. The framework views public service creation as an innovation process and in this regard also builds on innovation theories, looking at innovation strategies and the various drivers (e.g. technology, users) that can act as the source of this innovation. As a core innovation strategy, the framework proposes to learn from lean and agile service development models that have become the norm in the private sector but not yet so in the public sector. At the same time, to account for the complexity of the public sector context, the framework also considers the variety of factors, actors and processes that affect the shift to data-driven public service co-creation, including stakeholders, enablers and barriers at different levels, and supporting strategies and policies.

2.2   A vision for public services summary

In 2013 the EU released a report titled "A vision for public services" in which the ideas of open government and co-created public services remain the core focus throughout the report. Some of the main points and claims of the report can be summarized as follows:

- "Open government empowers users to directly participate in their own service design, creation or selection. It leads to more user friendly – personalised, pro-active and location-based – services."
- "Open participation and open engagement allow legitimate actors to engage in the activities of government in order to enhance public value":
- "Open decisions can empower users to participate in policy-making, which can eventually be embedded within wider governance changes across all public sector activities, processes and structures"
- "Open data and information lead to more transparency, accountability as well as trust in administrations"
- There are four main drivers of open government: citizen-driven issues, technology-driven issues, economic-cost driven issues, and public policy trends. All four of these drivers help to promote "greater interaction between institutions, citizens, and public and private organizations"

What can be seen is that the terms participation, engagement, empowerment, transparency, and accountability are commonly used throughout the report and are directly associated with the benefits of an open government which uses data to co-create or co produce services with its citizens. However, there must also be some understanding of how these terms should be understood, and some common definitions follow here.

- **Participation** – Service end-users play an active role in service creation.
- **Engagement** – Service users or those who wish for a new service to be created are interacting with those who will provide the service.
- **Empowerment** – Having the ability and the incentive to participate in the political process (European Commission, 2013: A vision for public services)
- **Transparency** – Service users are able to be involved in most aspects of the service creation process, and understand how the service is being created.
- **Accountability** – The service provider is working directly with end-users encompassing the obligation to report, explain and be answerable for resulting consequences.

Ultimately the point of this section is to demonstrate that the idea behind our framework is not necessarily new, but it represents an advancement of ideas which have already been presented. This framework is the next step forwards for the future of public service creation.

3   OGI framework: key elements

The framework takes a holistic view on LOSD-driven public service innovation following a content-context-process (CCP) approach (see Pettigrew 1985, Symons 1991). This means we are looking at three sides of innovation: first the content (what is a data-driven/LOSD-driven public service, what role does co-creation play in developing this service, what are the core components of the data and service architecture), then the context in which innovation takes place (what factors drive or constrain this innovation, who are the actors) and finally the process of innovation (what steps and how should be taken in order to realize a (new) LOSD-driven public service).

Together, these different elements constitute our proposal for a user-centric LOSD innovation ecosystem, which has a twofold aim: 1) to offer a conceptual framework for understanding and discussing LOSD-driven public service innovation, and 2) to provide some practical guidelines for facilitating the use of LOSD and co-creation approaches in public service production.

The core content of this innovation is a new vision of public services which are driven by the goal of generating public value through innovative uses of data, and which are produced in a user-centric manner in co-creation between public administrations, citizens and businesses. Moreover, this vision differs from the traditional public service development approaches in that it proposes to start from releasing the service as a minimum viable product (MVP), i.e. at its most basic and functional form, and developing it into a full-fledged service step by step, with extensive input from end users and relevant stakeholders. Key concepts of the OGI framework content will be discussed in section 3.1.

Naturally, the opportunities and constraints to this kind of innovation are heavily influenced by the context in which the innovation process takes place. As the co-creation of data-driven public services is in essence a complex and multi-layered concept, relevant enablers and constraints emanate from several sources, such as 1) the shape and maturity of existing data infrastructures; 2) different kinds of drivers and barriers that are related to the context of public sector organisations and public service provision, and 3) the interests, perceptions, needs, capabilities and actions of the stakeholders who participate in or have the power to affect the innovation process. The context dimension of the framework will be elaborated in Section 3.2 of this document.

Finally, the content and context dimensions come together and are addressed through the innovation process. We will argue that the traditional mode of public service creation is no longer compatible with the current demands for user-centric, personalized and adaptable services and the technological opportunities of the digital era. We therefore propose an innovation process based on lean and agile service development methods, which put a large emphasis on stakeholder participation, a continuous cycle of input and feedback, and a constant improvement of services through a number of fast iterations and releases. The innovation process will be described in more detail in Section 3.3.

3.1 Content: LOSD-driven public services

3.1.1 Traditional public services and recent developments

A public service can be understood as a service which is offered to the general public with the express purpose of developing public value; public value can be understood as the total societal value that is shared by all actors in society which is the result of all resource allocation decisions (European Commission, 2013). Traditionally, public services have been initiated, designed, and provided by public administrators. In this traditional system public administrators act as a "broker" between society and the political system, they attempt to feed society's needs to the relevant political bodies who, in turn, produce and provide their understanding (correct or incorrect) of the corresponding public service to meet those societal needs (Peristeras and Tarabanis, 2008). The traditional policy cycle, depicted by Figure 3, follows a plan-design-deliver-evaluate cycle. It is also important to note that traditionally during this lifecycle society is only involved as the receiver of the service whereas the public administrators are the ones leading and steering this cycle in a top-down way.
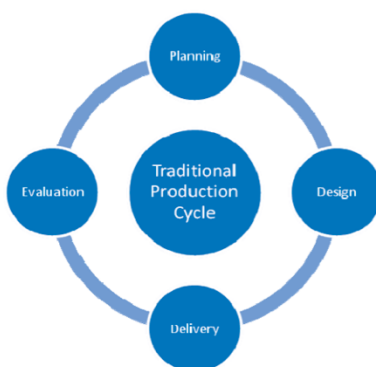

Figure 2. Traditional public service lifecycle[2]

Today we are starting to see some examples of public services which are beginning to move and drift away from this traditional top-down approach. In these recent developments public services are being created and delivered due to private initiatives. In these new services governmental agencies may be acting as partners with NGOs or citizens and they are beginning or working towards the ability to "co-create" a new service. In the examples of public service co-creation which are witnessed today, private entities are involved only under the supervision of public administrators and only when they are allowed to act as partners through relevant governmental policies being in place. So, the service production process is still owned and dictated by public administrations and the traditional public service lifecycle is not seeing a large or radical shift.

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[2] Source: Pollitt et al. 2006.

Another recent development is the movement towards the exploitation of data. In the public sector efforts are being made to exploit the large quantity of data which currently exists in governmental databases to help increase the efficiency of public service production. Public services which are built upon the exploitation of data in this manner at any point in the traditional public service lifecycle are termed **data-driven public services**. As with the trend seen in the change towards co-produced public services, data-driven public services are not causing a large radical shift in the traditional public service lifecycle and the process is still being run by public administrators in a top-down fashion.

3.1.2 OGI approach to public services

In the previous section the current state of public service creation was discussed, in this section the OpenGovIntelligence approach will be defined. In the OGI approach, a combination of recent trends is utilized and the idea of a "**co-created data-driven public service**" model is proposed. It is important to note that this new approach is not merely a combination of these new recent trends, but it represents a radical shift in the traditional model.
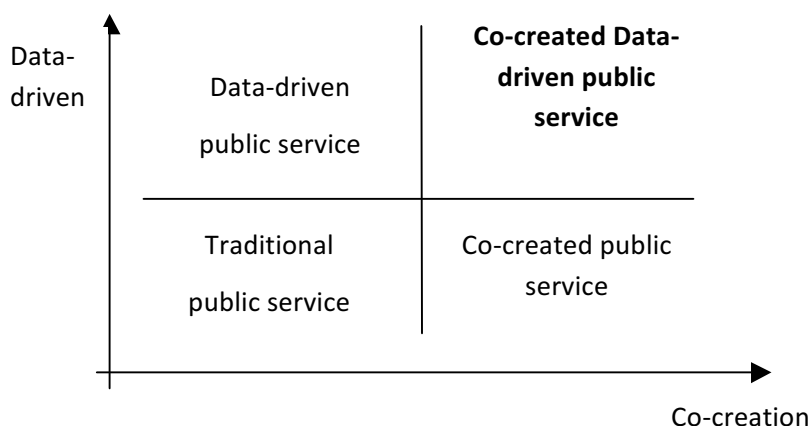
Figure 3. OpenGovIntelligence: Data-driven public service co-creation[3]

3.1.2.1 Public service co-creation

A collaborative approach to public service production has emerged as an important way to innovate public services which traditionally have been provided by public administrations in a top-down manner. The engagement of users in the service production process is seen as a way of increasing efficiency and effectiveness by aligning services to users' needs and interests. At the same time, engaging stakeholders such as citizens, businesses and researchers in the design and delivery of public services is seen to foster the openness and transparency of public administration (EU eGovernment Action Plan 2016-2020).

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[3] Source: Authors.

This direct participation of citizens, businesses, voluntary organisations, researchers and other stakeholders in various stages of public service production has become termed 'co-production'. This concept has its roots both in public management and service management theory and is closely related to the idea of 'co-creation' (Osborne et al., 2016). While these two concepts are often used interchangeably in literature, the concept of co-creation is more often associated with creating value for service users and the public (see, for example, Bovaird and Loeffler, 2012; Osborne et al., 2016; Voorberg et al., 2014). As public value is central to the definition of public services proposed by OpenGovIntelligence, the term co-creation rather than co-production will hereinafter be used to refer to collaborative public service creation.

Co-creation and co-production cover a range of more specific concepts which reflect the different stages and types of stakeholder involvement, including co-design, co-decision, co-implementation, co-evaluation, etc. (Pollitt et al., 2006; OECD, 2011). The core idea is that stakeholders can make valuable contributions throughout the whole cycle of service creation, for example as explorers who discover problems and needs, as ideators and co-initiators of solutions, as co-designers of services, or as co-implementers and diffusers of service innovations (Nambisan and Nambisan, 2013).

However, the spread of digital technologies and concepts such as open data and open government seem to be driving an ongoing paradigm shift towards thinking of citizens and other non-state actors not only as contributors to public services initiated by the public sector, but as actors that can take the lead in providing services for the public good. According to this new thinking, ICTs and open access to data can facilitate a collaborative production of electronic public services by anyone, including government, citizens, NGOs, private companies and individual civil servants, regardless of the role that the government plays in this process (EC, 2013, p. 6).

One of the challenges and preconditions of this new collaborative model of service creation is the need to fundamentally redefine the traditional roles of public and private actors in the process. As suggested by Hartley et al. (2013, p. 827), collaborative innovation requires politicians to redefine their role from "political sovereigns who have all the power and responsibility" to ones setting the agenda through dialogue with a number of relevant actors, and it requires public managers to redefine their role from being experts-technocrats to "meta-governors" who orchestrate collaborative arenas that involve a range of innovators. At the same time, private companies and voluntary organizations need to become "responsible partners in the production of innovative solutions for public value" rather than promoters of their own interests; and citizens need to be seen as "co-creators and co-producers rather than solely as clients, customers, or regulatees" (*ibid*).

However, this could also be seen as just the first step in the full transformation towards a new kind of public services. According to a more radical vision, the changing roles may well lead to a complete blurring of boundaries between politicians, civil servants, experts, consumers, citizens, etc., in the public service production process, and eventually a blurring of the boundaries between private and public services (EC, 2013). Therefore, public service co-creation would mean that any actor, whether public or private, can take the lead in developing a new service to create public value, and any actor can take part in the co-creation of this service.

3.1.2.2 Data-driven public services

A study by IBM (2013) revealed that only 50 percent of managers made even half of their decisions based upon data and analytics. The reason for so many decisions being made without analysis is that the data and analytical capabilities are just not available. Data-driven government is about solving that problem. In short, a data-driven government is one where, for all critical decisions, actionable information is available when and where needed (IBM, 2015).

However, data alone does not translate to data-driven government. An individual data element has little value beyond its applicability to its citizen, business or other subject. The higher value comes, not from the individual data elements themselves, but from using all the data to obtain insightful or actionable information and have it available when and where it is needed (IBM, 2015). By opening up government data to citizens, public institutions become more transparent and accountable to the people they serve. By encouraging available and shareable data, governments can help promote innovative, citizen-centric public services (OECD, 2016). Opening up governmental data also provides the opportunity to involve innovators from inside and outside governments to create innovative ways to tackle new and existing problems. This has the potential to increase public sector efficiency and effectiveness. Moreover, Open Government Data (OGD) can help countries improve development programmes and track progress, prevent corruption and improve aid effectiveness (UN, 2016).

Linked Data has been introduced as a promising paradigm for opening up data because it facilitates the integration of datasets across the Web. The term Linked Data refers to data published on the Web in such a way that (i) it is machine readable, (ii) its meaning is explicitly defined, (iii) it is linked to other external datasets, and (iv) can in turn be linked to from external datasets (Bizer et al., 2009). In contrast to the full-fledged Semantic Web vision, Linked Data is mainly about publishing structured data in RDF using URIs rather than focusing on the ontological level or inferencing (Hausenblas, 2009). Linked Data requires the identification of entities with URI references that can be dereferenced over the HTTP protocol into RDF data that describes the identified entity. In addition Linked Data include the creation of typed links between URI references, so that one can discover more data (Berners-Lee, 2006). The specification of the Linked Data principles resulted in the emergence of the Web of Linked Data, which currently comprises more than 1000 datasets in various domains (Schmachtenberg, 2014).

3.1.2.3 Data-driven public service co-creation

In the context of data-driven services, service co-creation largely revolves around different stakeholders providing or using data to add value to different phases of service creation. For instance, in the problem discovery and needs identification phase, citizens can contribute their data to notify the government about problems in their neighbourhood such as potholes or graffiti (see Text Box 1 for current examples of citizen data contributions).

Current Examples

FixMyStreet: FixMyStreet (www.fixmystreet.com) is an application allowing citizens to report street problems (like graffiti, fly tipping, broken paving slabs, or street lighting) to the local councils who are responsible for fixing them. Through the FixMyStreet application citizens pinpoint the spatial location of the problem on the map, can add a description and photo, and updates can also be posted e.g. by the responsible council until the problem is finally resolved. FixMyStreet is a classic example of how citizens can contribute to enhance the services offered by local government.

StreetBump: Street Bump (www.streetbump.org/) is a crowd-sourcing mobile application that helps improve the condition of local streets. Utilizing the mobile phone's accelerometer and GPS, the Street Bump application automatically detects and records "bumps" on the City map while the user is driving. If three or more bumps occur at the same location, the city will then inspect the obstacle and assign it to a queue for short-term repair or record its location to assist with long-term repair planning. Thus, Street Bump provides governments with real-time information to fix problems and plan long term investments, and citizens are effortlessly being co-creators of an added-value public service.

Text Box 1: Current examples of services using user provided data

Citizens with more advanced data skills can also mine and analyze open data to explore patterns or discover problems (Nambisan amd Nambisan, 2013). As a simple example, residents of an area could scan data provided in waste collection plans and report problems to improve the collection schedule or locations (Scherer et al., 2015). In the ideation and initiation phase, data can inform the development of ideas for solutions. In the service design phase, citizens with proper ICT skills can be connected to data providers to develop data mashups or apps to address problems and needs (Nambisan and Nambisan, 2013). Services can be co-implemented with citizens by having citizens contribute user data to enhance data-based services. Finally, citizens can also be involved in monitoring services through providing feedback and reporting data to point to problems in service provision (Scherer et al., 2015).

The proposed approach represents a large shift in how a data-driven public service could be created, puts a large emphasis on citizen involvement in the process, and, ultimately, represents a much needed upgrade to the current understanding of public service creation. Only then can it result in more user-friendly and effective public services, improve the quality of decision-making, promote greater trust in public institutions and thus enhance public value (Coats and Passmore, 2008). This approach, driven by opening up and sharing assets – making data, services and decisions open – enables collaboration and increases bottom-up, participative forms of service design, production and delivery (open governance framework) (EC, 2013).

Having in mind the traditional approaches to service delivery, data-driven public service co-creation means innovations such as the following:

- Any actor, even individual citizens, can be actively involved in the co-creation of public services;
- Public services can utilize not only governmental data but also citizen data, business data and social data;
- The public service creation lifecycle will be transformed, a discussion of this transformation will take place in section 3.3
- Public services can be created independently from the governmental policy making process;
- The public service production process can be owned by any actor not just public administrations.
- Consequently, the traditional top-down public service delivery model is revised with all actors (public administration, businesses, NGOs, individual citizens, etc.) undertaking any of the data provider, service provider or service consumer roles.

3.1.3 The OGI architecture

3.1.3.1 Introduction

To support the aforementioned approach to **co-created data-driven public services**, the OpenGovIntelligence framework developed a proposed data infrastructure architecture for LOSD and data-driven public services. The purpose of the architecture is to enable stakeholders to collaborate towards the production of innovative data-driven public services by exploiting Linked Open Data technologies and statistical datasets. Moreover, the OGI architecture will guide the pilot partner implementations, as well as the other future implementations of the OGI software in other projects.

The OGI architecture is presented in Figure 4. It is organised as follows:

- Five Architectural Layers: (i) Data Provision, (ii) Data Platform, (iii) Process Layer, (iv) Service Design, and (v) Service Provision.
- An additional layer, Management, that enables cross-layers functionalities
- Each layer has a set of components that performs tasks specific to that layer.

More details on layers' description and interaction are provided in the following sections.

3.1.3.2 Layers description

Data Provision

The Data Provision Layer implements fundamental functionalities needed to create qualitative LOD and thus support the execution and scalability of the Service Design. The Data Provision services RDF creation, schema, code lists, vocabularies and metadata management services in order to enable the extensibility and scalability and assure the data quality of the proposed OpenGovIntelligence approach.
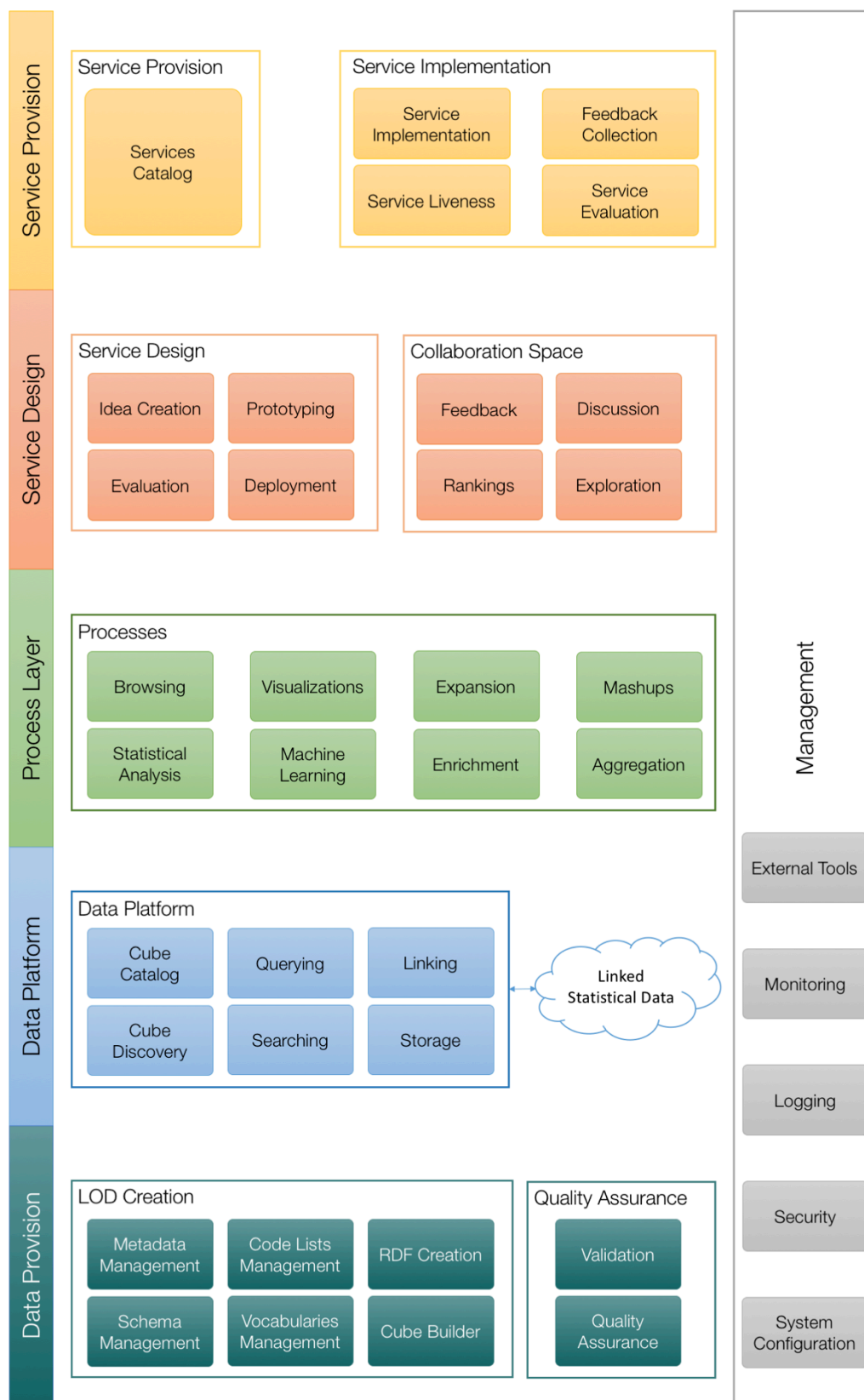
Figure 4. OGI Architecture

Data Platform

The nature of the data handled by OpenGovIntelligence (i.e. Linked Data, aggregated cubes etc.) is fragmented since they are not stored and curated in a central point but they are distributed to

remote repositories and usually made accessible through SPARQL endpoints. The Data Platform Layer is responsible for the data storage and provides catalogue which allows a user to search for aggregated cubes over many distributed repositories (i.e. based on their metadata).

Process Layer

The Process Layer allows an end user to interact with the system. It involves a set of existing tools that can be adopted/expanded to:

- create visualization of statistical data,
- identify and link compatible disparate data sets that could be processed together,
- identify correlations between different measures of the cubes,
- perform OLAP operations on linked data cubes,
- perform statistical analyses on linked data cubes.

Service Design

The Service Design Layer implements the main functionalities offered by OpenGovIntelligence and enable the co-design of data-driven public services:

- Service Design

  Supports Idea Creation, Prototyping, Evaluation and Deployment of the designed service by providing set of tools and templates. Stakeholders with proper ICT skills can be connected to data sources in order to design new services (i.e. dashboards or apps) that attempts to address public service needs.

- Collaboration space

  Enables and facilitates the collaboration between the stakeholders that participate in the co-design of the public services by providing collaboration environment that allow the designers of the services to brainstorm in sessions, chat, share assets and so on.

Service Provision

The Service Provision layer implements the co-provision of the public services that were previously co-designed in the Service Design layer. It provides services catalogue, service monitoring, evaluation and collection of the feedback.

Management

The Management Layer provides cross-platform functionalities (i.e. APIs) and it is responsible for overall security. Moreover it enables configuration of the platform, system monitoring and events logging as well as provides administrative provisions to a group of administrators.

3.1.3.3 Layers interaction

The OGI Architecture identifies five architectural layers and one support layer in order to outline scalable, reusable, modular and extendable infrastructure for publishing and exploiting Linked Open Statistical Data.

Raw data is processed and transformed to Linked Data cubes by the Data Provision Layer. It is achieved by using conceptual models and set of components for validation that ensures output quality. After that, produced data is transferred to the Data Platform Layer, which is responsible for storage and allows cubes discovery in the service design process. The end user can interact with the system by accessing the Process Layer. The user is able to process the data on he/she is interest and use functionalities and computational capabilities required to create the services, such as data querying, aggregations, visualizations, and so on. Created assets (i.e. widgets) are used in the Service Design Layer, which enables stakeholders to play an active role in open data sharing and public service design and delivery. The Service Design Layer allows idea creation based on the available assets, prototype it and evaluate it in a collaborative environment. The final element of the architecture is Service Provision which enables the implementation of the designed service and provides a set of tools for monitoring, evaluation and its management. The whole process is supported by the Management Layer which facilitates smooth interaction between components across all other layers of the architecture.

3.2 Context: actors and infrastructures, drivers and barriers

Service theory is increasingly focusing on the concept of service systems, understanding services as open systems where the production of a service is a "product of a complex series of, often iterative interactions, between the service user, the service organization and its managers and staff, the physical environment of the service, other organizations and staff supporting the service process, and the broader societal locus of the service" (Radnor et al., 2014, p. 406). Similarly, public sector innovation and e-government innovation theories emphasize the importance of the technological, social, organisational, administrative, cultural and political context as a source of drivers and barriers to technological innovations in the public sector (see, for example, Angelopoulos et al., 2010; Hartley et al., 2013). The OGI framework thus considers the broader environment of data-driven co-creation as an integral part of the public service innovation system. This includes data infrastructures for LOSD and data-driven public services, stakeholders involved in service co-creation, as well as contextual drivers and barriers. Based on the study of drivers and barriers to open data-driven public

service innovation, which we conducted among selected stakeholders in OGI pilot countries as part of WP1[4], we can conclude that relevant context factors comprise open data and technology-related factors, stakeholder-related factors, legal and policy context, and organisational factors.

3.2.1 Technological, LOSD, and data infrastructures for data-driven public services

The purpose of this section is to outline the needed open data infrastructures which would allow for the co-creation of a data driven public service. An Open Data Infrastructure can be understood as being synonymous with an Open Data Portal (Zuiderwijk et al., 2013). These Open Data portals should allow for data to be found, opened, used, and created. There are also numerous sub-dimensions within the Open Data Infrastructure definition and understanding, these have been outlined in greater detail in section 8.2.4 of OGI D1.1. Open Data Infrastructures should support all aspects of the Open Data lifecycle which is described in section 3.3.2 of this deliverable. So, any infrastructure which is in place to support Open Data provision must be able to support the creation of data, it must be able to disseminate the data, the data must be able to maintained, and there must also be the legal and technical requirements in place to allow for all these steps to take place. The following sections of 3.2 will describe how stakeholders, legal environment, policies, and organizational factors all influence the Open Data Infrastructure.

3.2.1.1 ICT Tools for co-creation

Currently there are many ICT tools for co-creation which are freely available online and allow for development or management of ideas. In this section seven different potential tools which may assist in the co-creation of a new data-driven service are presented. These tools may well be useful for public service co-creation in that they can be easily and quickly adopted by public authorities or organizations without needing any additional funding or technological capacity. The tools selected had the offered functionality examined as well as their potential to be utilized in data-driven public service co-creation.

Tools for developing ideas

1. **Flockdraw**

Flockdraw (http://flockdraw.com) is a web application providing an online whiteboard-based drawing tool where unlimited people can collaboratively draw in real time on the same canvas. In drawning section users can choose between different colours, shapes and text. Beside the drawing feature, Flockdraw also offers chat functionality.

2. **Kune, web application**

Kune (http://kune.ourproject.org) is an open source web application focusing on real time collaboration. With Kune users can create online group spaces for the creation of collaborative

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[4] The details of the study are summarized in OpenGovIntelligence Deliverable 1.1

documents, for interaction and sharing of content, and for setting up virtual meetings. Additional features include polls and mind-maps (see also http://kune.ourproject.org/screenshots/).

3. Mind42

Mind42 (https://mind42.com) is an online mind mapping application. Users can create mind maps, meaning they can easily organize their information in a visual way. Mind-maps are private by default and there is the option to share them with other users.

4. XWiki, wiki software

XWiki (http://www.xwiki.org/xwiki/bin/view/Main/WebHome) is a second-generation wiki. Second generation wikis focus on structure and application creation like blogs, file managers, meetings, forums and tasks. XWiki can also be used as a first-generation wiki focusing on content creation with features relevant to page editing, version control, access rights, search and exports.

Tools for management

1. Freedcamp

Freedcamp (https://freedcamp.com) is a web application facilitating cooperation and management. Users can create to-do lists, tasks, events, calendars and milestones and share them among themselves.

2. Trello

Trello (https://trello.com) is an online application that provides unlimited boards, cards, lists and checklists. With Trello users can collaborate with unlimited members and attach files up to 10MB. Moreover, Trello can connect with Box, Drive and Dropbox.

3. Wiggio, online application

Wiggio (https://wiggio.com) is an online application that helps users create to-do lists, assign tasks, manage events, and share calendars. It also offers polling groups in real time, sharing files and host virtual meetings.

3.2.2 Stakeholders

The very idea of co-creation suggests the involvement of more than one stakeholder group in the creation of public services. The three broad groups often mentioned in the context of public service co-creation are public administrations, citizens/citizen organisations, and businesses. These in turn can consist of various different sub-groups with different needs, interests, skills and positions – and hence different roles – in the co-creation process. The OpenGovIntelligence model sees no limitations to the role that any of these groups can take in data-driven co-creation: all of them can act as initiators of new data-driven services, or as partners and co-creators of these services. This, however, not only presumes the existence of supporting infrastructures but also a favourable cultural environment for data sharing and cross-sectoral collaboration.

Stakeholders' interests, values, perceptions and capabilities have been found to play a crucial role in co-creation. As often suggested in literature and confirmed in the OGI stakeholder survey, stakeholders can be both the key driver as well as a major barrier to open data-driven public service co-creation. For example, diverging stakeholder agendas and views can be an important barrier to e-government innovation unless careful attention is paid to reconciling the needs of different stakeholders from the outset (Angelopoulos et al., 2010, Rochet et al., 2012). This is particularly important for collaborative and participatory democratic innovations (see, for example, Council of Europe 2009). The OGI survey of drivers and barriers found that some of the biggest barriers to open data-driven innovation come from stakeholders' perceptions and attitudes. Since open data is often perceived as lacking tangible benefits while costing a lot, there is resistance in many organisations to making their data open. Similarly, the benefits of co-creation are not well understood, which manifests in the administrators' lack of openness to the idea of co-creation. This is further complicated by a widespread lack of necessary skills to open up data and make use of open data in innovative ways among all stakeholder groups.

On the other hand, stakeholders' beliefs, priorities, preferences, skills and actions can act as a powerful driver of open data innovation – in fact these were among the most frequently mentioned in the OGI survey. The major drivers of open data innovation seem to be:

- A more widespread perception of open data as a source of value in terms of improved services, better information, transparency, participation, and economic opportunities. Among other means, this value can be demonstrated and communicated by prototyping and disseminating concrete applications to showcase open data solutions, ways of interactive data visualisation, etc.
- Visionary and open-data-enthusiastic policy-makers and administrators who act as innovation champions. Here, the role of senior managers and political leaders is particularly important to achieve buy-in among lower ranks of civil servants;
- On the citizens' side, vocal grassroots groups who express demand for open data are an important force, as well as individual innovators who are often driven by personal frustration with the low quality of existing services and use open data to develop new services that better meet user needs;
- Capacity-building to develop the necessary skills, knowledge and abilities of different stakeholder groups to work with open data. This could be done by offering specialized training programs on open data and digital skills, publishing concrete handbooks that explain open data, and sharing best practices.

3.2.3 Legal environment

Open data innovation is also constrained by legal issues around Intellectual Property Rights, personal data protection, security, data sharing and choosing appropriate licences. For example, personal data protection regulations sometimes prevent the government from releasing datasets that would otherwise be interesting for service innovators. Although this problem can generally be overcome by data aggregation into larger statistical datasets, this is not always a solution if the data concerns very

small groups of people. According to the stakeholder survey, privacy-related concerns in fact seem to have two layers: one is connected to the actual regulations and the other with the way they are perceived and interpreted by public sector organisations. The misunderstandings that some public officials might have about privacy and identity-related information might also impel them to be overly cautious about publishing any data rather than figuring out ways to publish data without privacy violation risks. Similarly, limited awareness about existing data licences can be a barrier to making data open and reusable.

Also, the traditional waterfall software development method applied largely today is fully supported by the current acquisition paradigm of government contracting (Mergel, 2016). Current acquisition activities are generally geared towards efficiency in public money spending as a first priority. However, there is a growing awareness among policy-makers around the world that public procurement has a potential to drive and spur innovation, referred to as public procurement of innovation, and this is needed for the acquisition and sustainability of LOSD based and/or co-created public services.

Various barriers influence public procurement of innovation. The contemporary public procurement culture is deeply rooted into the short-term efficiency idea, which is further reinforced by the prevalent accountability mechanisms employed in public sector. For civil servants there is little to be gained from successfully implementing a risky project, whereas failure to do so almost always leads to direct or indirect penalties. Also, low public management capacity is an issue, related to designing and using proper performance criteria, building and nurturing effective cooperation and interaction mechanisms between procurement stakeholders, etc. (see Lember et al., 2015 for more details).

Therefore, in order to support open data innovation, governments are encouraged to:

- Review data licensing and copyright regulations to ensure their compatibility with open data goals, public interest and new business models, and encourage a widespread adoption of free software licences with minimal restrictions and maximum compatibility;
- Increase the awareness of public officials of personal data protection regulations and ways to publish data without compromising privacy;
- Introduce a national-level legal obligation for government institutions to make public sector data open by default. According to the survey, this could exert a much-needed pressure and motivation for public organisations to publish open data;
- Qualify public grant submissions and public tenders against open data or oblige open data publication as part of public procurement and funding schemes.

3.2.4 Policies

Based on the results of WP1, the existing policy framework at the EU level and the six pilot countries is mostly not a barrier as such. However, policies are seen to hold a considerable potential to further drive open data innovation – a potential which still needs to be unlocked. For example, although the surveyed stakeholders were generally satisfied with the European open data policy, in particular the Directive on the re-use of public sector information (PSI Directive), they suggested that more could

be done to enforce the directive at the Member State level, and potentially even update the directive to force states to make all government information public free of charge. Another critical driver is seen in a holistic approach to open data policies which would regard open data as part of a broader open government policy, and would involve a combination of legal, policy and technical measures. According to the suggestions of the survey respondents, the following policy measures could be helpful in fostering open data-driven innovation and co-creation:

- Strengthening and enforcing the PSI Directive;
- Introduction of "open by default" policies;
- Data standardisation and open standards policies, which should be tackled at a cross-border rather than national level;
- Implementation of the "API first" policy to increase the reliability of data and facilitate the reuse of open government data by external stakeholders;
- Benchmarks with other countries;
- A comprehensive, systematic and strategic political approach to open data and open government, which includes:
  - making open data part of a broader openness and transparency policy;
  - making sure this policy is well integrated with the current state of the art and future trends in technology;
  - combining regulatory and policy measures with supportive technical infrastructures (e.g. open data portals), hands-on guidelines, dissemination of case studies and best practices, and funding schemes to support the publication of open data.
- Support and funding to different forms of collaboration (cross-border, cross-sectoral, inter-organisational) to enable learning, facilitate the adoption of common methodologies, and enhance cooperation between data producers and data users.

3.2.5 Organisational and administrative factors

The organisational context of public sector organisations is a frequently cited factor in e-government innovation and public sector innovation more broadly. For example, rigid organisational structures, organisational inertia, organisational silos, lack of collaboration, lack of incentives for innovation, risk avoidance, lacking innovation capabilities, lack of innovation leadership, resource constraints are often seen as barriers to innovation (see, for example De Vries et al., 2016; European Commission, 2013; Nasi et al., 2015). At the same time, a favourable organisational context can also drive innovation – some of the important drivers are ICT literacy, slack resources, active innovation leadership, strong political support, inter-institutional collaboration, etc. (Nasi et al., 2015). In the case of collaborative innovations, additional factors become important, such as the openness of the organisational culture towards citizen input (Freeman and Quirke, 2013) as opposed to politicians' and administrators' reluctance to lose status and control (Bovaird and Loeffler, 2012). Therefore, the prospects for a successful co-creation of public services depends both on organizational structures and routines as well as organizational culture.

The OGI stakeholder survey highlighted the importance of the organizational context: the main barriers to open data-driven co-creation are seen in incompatible organisational routines and processes; lack of feedback loops between government and citizens; lack of openness to the idea of open data and open processes, lack of trust and innovative culture; lack of political priority; lack of adequate resources. In addition to that, open data innovation is also hindered by existing proprietary business models and the fact that many public organisations make part of their revenue by selling key data. Based on the survey, the key drivers for open data-driven co-creation that would be needed at the organisational level include:

- Remodelling the existing processes for public service production to integrate co-creation;
- Sufficient funding for publishing open data;
- Development of new business models that make use of open data;
- Supportive organizational culture and innovation leadership;
- Capable change management;
- Capacity-building in digital skills, open data, data management and co-creation;
- Creation of innovation teams around internal change-agents, who should be given sufficient freedom to experiment with open data in innovative ways.

3.3   Process: public service creation and implementation

Having defined the idea of a user-centric data-driven public service as well as the context in which these services are usually created, we will now outline the basic elements of the process that make it possible to collaboratively create these services. This process can be seen as consisting of several sub-processes, which will be described in the following sections:

1. A public service development process based on a lean and agile approach. One aspect of the newly proposed methodology is borrowed from the private sector, it is the idea of the minimum viable product, or MVP. For the purpose of our methodology we will assume that product can be understood as a new public service. So, what we have is this idea of a minimum viable public service. The idea behind the MVP is to get a service at its most basic and functional form out and released. Once the MVP has been developed and released it allows for the "lean cycle" to begin (Figure 5). The lean cycle of build-measure-learn allows for fast feedback into the service from citizens. So, a service is proposed and developed and released in its most basic form, then as this MVP is used it is possible to rapidly get an understanding of how citizens are responding to it and adapt and change at a rapid pace. Ultimately, this means that the public service will be cheaper to provide and it will be more in tune with the citizens' wants and needs.
2. Processes for opening data and exploiting data in public service creation.
3. Co-creation, i.e. process for feeding users' needs, data and feedback into service creation.
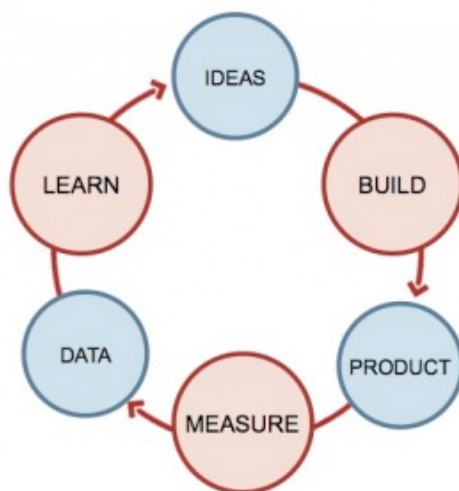
Figure 5. Lean Cycle[5]

3.3.1 Service innovation process

The service innovation strategy and process will borrow ideas from both lean and agile development, and will also incorporate some aspects of New Public Service methodology (Denhardt and Denhardt 2000). This new approach will allow for new public services to move towards the objective of using "citizen and user engagement as a source of innovation; and the implementation of new or significantly improved ways of providing public goods and services" (EC, 2013). In order to better understand how this new service innovation process will function, how it is innovative, and why it represents a change in the current framework for service provision it is important to provide a basic definition for the main qualities of the proposed framework.

Agile development – Agile development focuses on being able to adapt quickly to changes by following an 'agile' approach based on multiple sprints made up of four main stages: plan, build, test, release (Beck et al., 2001, Highsmith and Cockburn, 2001).

Lean Startup development – The idea of a lean startup was proposed by Eric Ries in his book "The Lean Startup", we will borrow one principle from this book which is the idea of the "build-measure-learn" cycle. It is stated that the build-measure-learn cycle is based on the idea that "the fundamental activity of a startup is to turn ideas into products, measure how customers respond, and then learn whether to pivot or persevere" (Ries, 2011). For the purpose of the OGI framework, we will substitute the term startup for service creators, and customers will be substituted by the word citizens or service users. So, what we have then is the idea that the "fundamental activity of

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[5] Source: https://leanstack.com/lean-analytics-the-one-metric-that-matters-and-other-provocations/

service creators providing a public service is to turn ideas into products, measure how service users respond, and then learn whether to pivot or persevere".

New Public Service – "A set of ideas about the role of public administration in the governance system that places citizens at the center" (Bernhardt and Bernhardt, 2000). The seven ideas included within the "New Public Service" are:

- Serve rather than steer
- The public interest is the aim, not the by-product
- Think strategically, act democratically
- Serve citizens, not customers
- Accountability isn't simple
- Value people, not just productivity
- Value citizenship and public service above entrepreneurship

When examining the aforementioned definitions, it is important to pick up the commonalities between these three different ideas: focus on the service user, be agile, develop quickly, listen to the service user, and be able to adapt to changing needs and wants quickly. In previous service provision approaches there was an overarching top-down ideology, that is to say the government was the service creator and the citizen was the service user. With this new approach the government and citizens are viewed as partners in public service creation, and there should be a focus on collaboration between the two parties (Vigoda, 2002). This new collaboration is unique in that it is now proposed that citizens can be both service user and service creator, this is no longer a top down approach: citizens, NGOs, local governments, and all other organizations can be both service users and service creators. This represents a radical shift in previous thoughts on service innovation and creation thus allowing for a better targeted public service which has been more efficiently developed.

The service innovation process can be summarized with the following points:

- The government and citizens should be partners at all stages from ideation to creation to implementation of the new data-driven public service.
- There should be an initial release of the public service at an early stage, or an 'MVP' of the public service, which allows for the lean cycle to be started as quickly as possible.
- The public service should be able to respond to user feedback from the initial launch.
- End-user input should be sought and utilized at all stages of the public service creation.

3.3.2 Processes for opening, linking and exploiting data

This section will focus on the OGI depiction of the Linked Open Statistical Data Lifecycle, described in more detail in OGI D1.1. The LOSD lifecycle has four main parts: data creation, data publishing, data usage, and data curation (see Figure 6). Each one of these parts is further made up of smaller steps (4 steps each in the case of data creation, data publishing, and data usage).
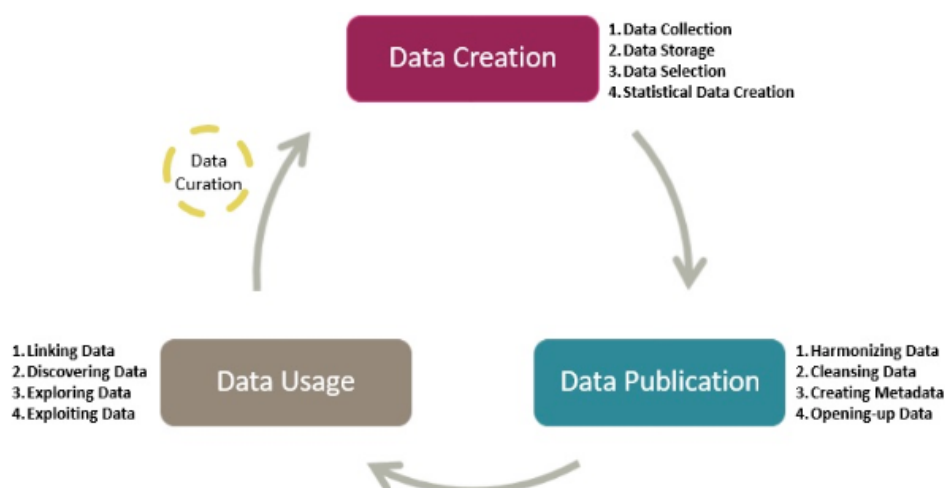
Figure 6. Linked Open Data Lifecycle[6]

Briefly, the LOSD lifecycle is made up of the following steps:

- Data Collection: Data from multiple sources is collected; data can be structured or unstructured.
- Data Storage: Data collected in previous step is stored in databases.
- Data Selection: Using the data which has been collected and stored, an analysis is conducted and data which is able to be published is selected.
- Statistical Data Creation: Statistical information on the selected data is generated at this stage.
- Harmonizing Data: Data is harmonized via international standards.
- Cleaning Data: Data is checked for errors and limitations.
- Creating Metadata: Metadata is created for the data.
- Opening up Data: Data is published via a dump or access is provided via an API.
- Linking Data: Datasets which have been opened and released may be linked together.
- Data Discovery: At this stage, users discover the datasets and take advantage/utilize them.
- Data Exploration: Data can be browsed or explored based on simple characteristics.
- Data Exploitation: More in-depth way to consume data, assumes that other data sets will be used and complex analysis will be carried out.
- Data Curation: In this stage the data is maintained so that it continues to be accessible to those who wish to utilize it.

We believe that this lifecycle provides an accurate description for the overall process of how data is created, discovered, published, and exploited. When talking about the exploitation of data, it is important to note that normally this requires advanced tools and data analytics abilities. So, to deal

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[6] Source: OpenGovIntelligence Deliverable 1.1.

with this user friendly GUI's (Graphical User Interface) may be created so that those who do not have much experience with data are better able to work and understand the presented data.

3.3.3 Processes for feeding society's feedback, needs and data into service creation

Society's feedback is a core aspect of the data driven public service. This feedback comes in many forms, but ultimately has one goal which is to improve the offered service. Feedback can be received in regards to the linked open statistical data which is being offered, the exploitation methods of the LOSD, and about the new services themselves. When looking at obtaining feedback from the end users, many different methods could be utilized. For this section we will focus on the most likely feedback forms for a data-driven public service which are feedback mechanisms built directly into the public service, social media, and user workshops.

When creating a new public service, it is important to make sure that the proper feedback mechanisms are in place. One way to do this is by allowing potential service users a direct way to become involved with the public service, that is to say, that they should be able to feel that they are able to participate in the creation or design of the public service. There are different ways to build this feedback mechanism into a public service. One of the easiest ways to do this is by allowing users to prove input into the service. For a data-driven public service users should be able to either upload their own data, suggest changes to datasets, or be able to directly participate in data creation for a service (this could be done via a phone app, sensors, etc.). Ultimately, the goal here is to make sure that service users have some direct role in the creation/design of a service and that they are able to continually provide feedback into the service which is valuable, listened to, and utilized. In the following paragraphs we will also discuss one semi-passive way for feedback generation and one active way. A successful process for feeding feedback into the new public service will likely utilize some combination of the proposed feedback mechanisms.

Social media allows for feedback to be received almost instantaneously. There are many ways which social media feedback could be implemented into the newly proposed data-driven public service creation methodology, but one way which stands out in terms of effectiveness is data mining. One aspect of data mining which may be useful is the idea of opinion mining or sentiment analysis. So, when there is an increase in usage of a newly created service, their tweets, Facebook posts, etc. could be followed and notifications could be received anytime a post related to the new public service was created. These posts could be automatically understood as positive or negative or neutral, from there further investigation could provide insight into what was good, what was bad, etc. In essence, social media allows for a large amount of users to provide real time feedback about a public service. Failing to take advantage of this feedback mechanism would be wasted potential, thus it is critical that a data-driven public service takes full advantage of all data which is available about the end users of our service so that it can provide as great a societal benefit as possible.

Another critical aspect of the feedback process is the inclusion of end-users in the creation of the new data-driven public service. One of the best ways to do this is through user-workshops. These user workshops are based on agile development, and the overall structure should be as follows:

- Introduction (describing the aim of the session)

- Silent ideation (silent individual ideation)
- Group discussion (group discussion of silently generated ideas)

This structure may be repeated as many times as needed for as many sessions which should be included at the workshop. User workshops structured in this way allow for all individuals to provide valuable input into the overall design and structure of the new public service. These user workshops should also be repeated throughout the lifecycle of the new data-driven public service. In terms of outcomes, these workshops should be able to produce a list of issues with the new service, a list of potential solutions, basic thoughts on the usability and functionality of the service, user stories, a list of user personas of individuals who could use the service, and any other information which may come out of the workshop organically. The information which comes out of these user workshops will allow for the government and citizens to work together and get a better understanding of what the service is, how it should function, and what the end goal should be. It truly is a necessary feedback step if the new data-driven public service is to place an emphasis on co-creation.

Building upon and extending the differentiation of co-creation in Voorberg et.al. (2014) Table 1 shows and explains how feedback can materialize, through what methods/tools, and discusses at what stage in the lean cycle they may be used/how they fit into the idea of "co-creation".

Co-creation type	Participant contribution	Methods	ICT tools and methods to collect
Co-initiation	Problem & needs identification	Open data mining by citizens Data analysis by skilled individuals	• R statistical analysis • TwitteR (R library for opinion mining and sentiment analysis) • Weka
	Idea generation for ways to solve problems (informed by data)	User workshops Community meetings Social Media Analysis	
Co-design	Input to service design	User workshops Focus groups Surveys UX and UI testing	• Survey • Questionnaire
Co-implementation	Uploading user data	User area for uploading data in service	• Web statistic (access, downloads, uploads, etc.) • Survey • Questionnaire • R statistical analysis • TwitteR (R library for opinion mining and sentiment analysis) • Weka
	Suggesting changes to data sets	Feedback channels integrated in service	
	Data creation for a service	Phone apps, sensors	
Co-evaluation	Providing feedback to service quality, usefulness, etc.	Social media mining for sentiment analysis Feedback forms integrated into service	• R statistical analysis • TwitteR (R library for opinion mining and sentiment analysis) • Weka
	Reporting data on service operation	Phone apps	

Table 1. Data-driven Co-Creation Stages, Methods and Tools[7]

3.3.4 Processes for transforming traditional public service model to agile co-creation model

The purpose of this section is to discuss the overall transformation process for public service creation. It will start with an initial discussion of the current process, continue on to a description of the agile process, will then present ideas about the new data-driven public service co-creation cycle,

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[7] Source: Authors.

and will end with a discussion of why this transformation process is important and what benefits it offers over traditional models.

In Figure 7 the traditional top-down or waterfall model is displayed. In the traditional waterfall model there is a fairly linear approach to development where the project requirements are all outlined at the beginning and the development happens late into the project design cycle. For the purpose of the framework, what is important to understand here is that in this traditional model the public administrators are steering and controlling the whole process with citizen input being occasionally sought, it is not a necessity either. So, what we have in the traditional model is a service which is slow, not easily adaptable, and one that may not have adequate ways at receiving feedback from the service user.
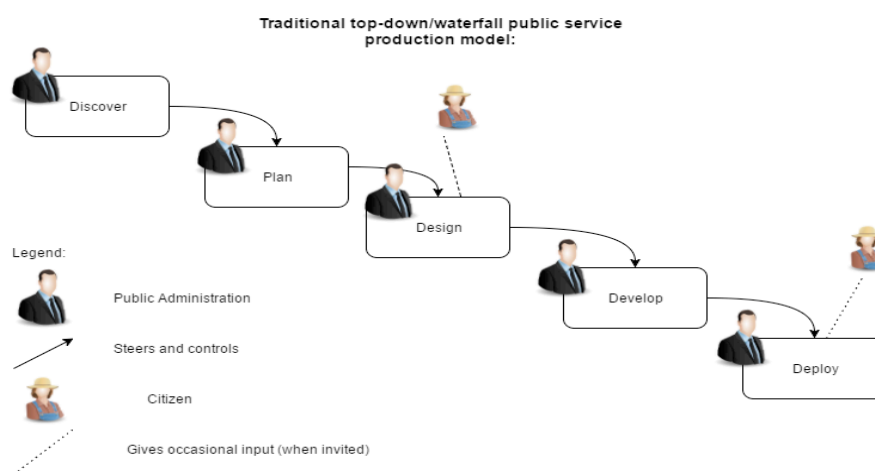

Figure 6. Traditional Waterfall Model[8]

A model which is currently advocated for in many software development projects is the "agile development" approach. Figure 8 demonstrates the traditional agile development approach. In this figure there are 4 main parts represented: discover, design, develop test. What is important to take from this image is that in agile development the process is iterative. In agile development the goal is to come up with some requirements or need, design the solution for this, test the solution, release it, and then start the cycle again. Due to agile developments' iterative and fast paced approach it is able to handle feedback from users and any unexpected changes which are made to the project.

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[8] Source: Authors.
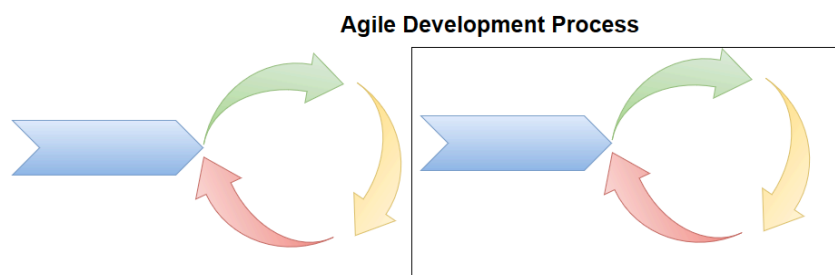
Agile Development Process

Figure 7. Agile Development Process[9]

Figure 9 is an example one cycle, or sprint, which is contained within the overall agile development process. As previously mentioned one cycle contains four steps of discover, design, develop, and test. In the agile sprint what should be noted is that input is sought from all different sources. In the traditional model the public administrators or government are steering and controlling the service creation and may seek input from citizens occasionally, in the agile model all parties related to the public service should have the ability to provide input.
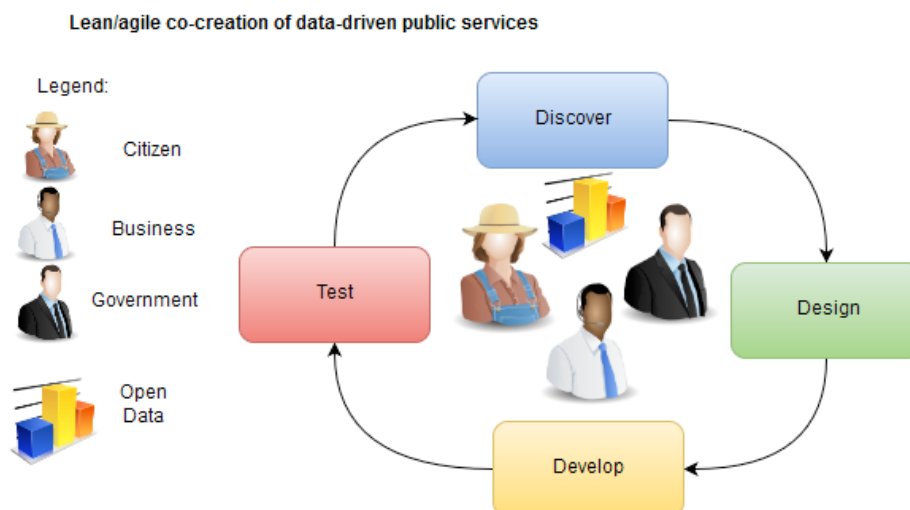

Figure 8. Extract of one sprint from Agile Development Process[10]

The new process for public service creation which is being proposed within this OGI framework is shown in Figure 10. However, it is important to also understand how the switch from agile development to agile co-development is being made. For this purpose, Table 2 presents a description of the different agile phases, the phases of co-creation, the stakeholders, and their motivation. The takeaway here is that for a new data-driven public service the initiators and the providers are asking the same questions and they will interact with each other in the same way. So, if one wants a new service or one wants to provide a new service it starts with this question of

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[9] Source: Authors.
[10] Source: Authors.

"What needs are not currently being met"? This question corresponds directly with the discover stage of agile development, and it maps directly to the idea of co-initiation. In order to merge the agile development model with the co-creation model proposed by (Pollitt et al., 2006), questions were developed for each stage of agile development which also encompassed the idea of the corresponding co-creation phase.

	Discover	Design	Develop	Test
Service Initiator/Service Provider	Co-Initiation	Co-Design	Co-Implementation	Co-Evaluation
Service Initiator/Service Provider Motivation	What needs are not currently being met?	How can we meet this need?	Is our need for X currently being met or improved?	Now that we have started to meet our need fort X, how can we keep our solution up to date?
Method for interaction	User workshops, Open Data mining, Community meetings, Social media	User workshops, UX and UI testing, Focus Groups, Surveys	Data mining, service usage analysis, user workshops, surveys,	User area for uploading data to service, service integrated feedback channels, tools for user generated service data

Table 2. Migration from Agile Development to Agile Co-Development[11]

Figure 10 represents a new agile co-creation public service model. In this model anyone can initiate, design, create a new public service and anyone can provide said public service. This is a huge leap from the traditional public service design models. It is also important to note that open data plays a catalytic role in this new model as it is the access to open data which allows for this new approach to be successful. Similar to agile development, this new proposed model would be organized into multiple iterative sprints of co-production.
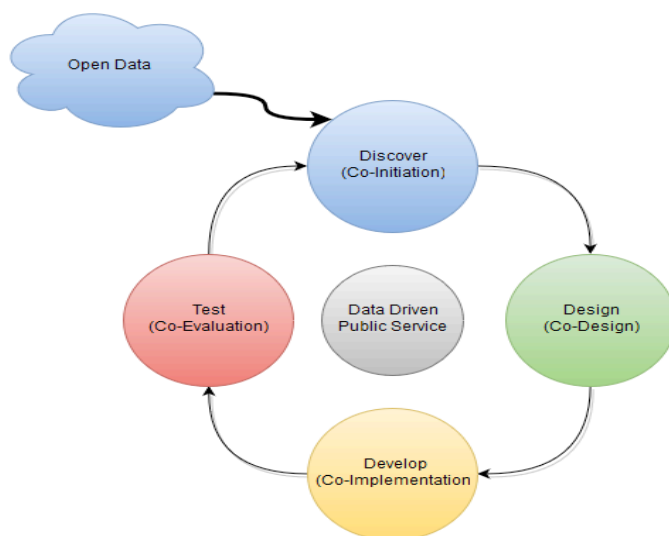
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[11] Source: Authors.

Figure 9. New Agile Co-Development Cycle[12]

The newly proposed model allows for a public service to be created in a fast and agile manner which decreases costs and improves efficiency. It also allows for input from parties at every stage of development so that the service can, truly, be co-produced. With this new model and the ability to access open data, any person or organization has the ability to become the initiator or provider of a new data-driven public service.

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[12] Source: Authors.

4   Conclusion

The increasing availability and accessibility of datasets along with tools for data analytics and exploitation have become a valuable driver of public service innovation. On the one hand, the provision of data through user-friendly interfaces can constitute the core of new services; on the other, the widespread availability of open data has the potential to 'democratize' public service production by making it possible for virtually anyone to initiate new services and engage in the co-creation of data-driven services.

The exploitation of this potential, however, requires a fundamental rethinking of the concept of public services, the ways in which these services are produced, and the roles of different actors in the process. This paper endorses the emerging vision of public services as services created by any actor (citizens, businesses, or the public sector) with the purpose of generating public value, regardless of the role the public administration in the provision of these services. Furthermore, we argue that the traditional top-down waterfall-like method of public service production no longer fits this changing vision and the increasing demand for needs-based, customized and responsive services. We therefore propose a new model for public service creation which builds on lean and agile production methods and allows to create new services faster, more efficiently and in a more collaborative way through a series of short iterations and constant improvement.

As such, this model is highly promising with respect to enabling a shift towards user-centric data-driven public services. However, it is important to look at service development as part of a broader ecosystem and acknowledge the existing drivers and barriers to this innovation at the level of organisations, legislation, stakeholders, policies and technical infrastructures. It is only by addressing some key barriers such as outdated intellectual property and data protection legislation, or incompatible processes in public sector organisations, that this new vision of data-driven service innovation can realize.

As the next step, the applicability of this framework will be tested in the six OpenGovIntelligence pilot projects. The outputs of the pilot tests will serve as an important learning process and inform the development of a second and final version of the framework. More specifically, the pilots will demonstrate whether and how this framework can be put to practice in six very different contexts; what real-life barriers might hinder the implementation of an agile and lean service development method; what problems and challenges might come up with regard to using linked open statistical data for service creation; and finally, what challenges emerge with regard to opening public service creation processes up to the general public and making co-creation an integral part of service development.

5 References

Angelopoulos, S., F. Kitsios, P. Kofakis, T. Papadopolous (2010) "Emerging Barriers in E-Government Implementation". In: Electronic Government, Proceedings of the 9th International Conference, EGOV 2010, eds. M. A. Wimmer, J.-L. Chappelet, M. Janssen, H.J. Scholl. Lausanne, Switzerland, August 29 - September 2, 2010, 216–225.

Berners-Lee, T. (2006) Design issues: Linked data. http://www.w3.org/DesignIssues/LinkedData.html

Bizer, C., Heath, T., Berners-Lee, T. (2009) Linked data - the story so far. International Journal on Semantic Web and Information Systems 5(3), 1–22

Bovaird. D., E. Loeffler (2012) "From Engagement to Co-production: The Contribution of Users and Communities to Outcomes and Public Value", *International Journal of Voluntary and Nonprofit Organizations*, Vol. 23, No. 4, 1119–38.

Coats, D., E. Passmore (2008) "Public value: The next steps in public service reform", The Work Foundation.

Council of Europe (2009) Electronic democracy (e-democracy). Recommendation CM/Rec(2009)1 adopted by the Committee of Ministers of the Council of Europe on 18 February 2009 and explanatory memorandum. Strasbourg: Council of Europe Publishing.

Denhardt, R. B., & Denhardt, J. V. (2000). The New Public Service: Serving Rather than Steering. *Public Administration Review*, *60*(6), 549–559. https://doi.org/10.1111/0033-3352.00117

De Vries, H., V. Bekkers, and L. Tummers (2016) "Innovation in the Public Sector: A Systematic Review and Future Research Agenda," *Public Administration*, Vol. 94, No. 1, 146–166.

DG-CONNECT, E. U. (2013). A vision for public services. *European Commission,"Public Services" Unit*

of Directorate-General for Communications Networks, Content and Technology (DG-CONNECT), 13.

European Commission (2013) "Powering European Public Sector Innovation: Towards a New Architecture. Report of the Expert Group on Public Sector Innovation," Directorate General for Research and Innovation, Innovation Union. European Commission, Brussels.

EU eGovernment Action Plan 2016-2020: Accelerating the digital transformation of government. Available at http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=15268.

Freeman, J., S. Quirke (2013)„Understanding E-Democracy: Government-Led Initiatives for Democratic Reform." *eJournal of eDemocracy and Open Government*, Vol. 5, No. 2, 141-154.

Hartley, J.; E. Sørensen, J. Torfing (2013). Collaborative innovation: A viable alternative to market-competition and organizational entrepreneurship. *Public Administration Review*, Vol. 73, No. 6, 821–830.

Hausenblas, M. (2009) Exploiting linked data to build web applications. IEEE Internet Computing, 13(4), 68-73

IBM (2013) Analytics: A blueprint for value," IBM Institute for Business Value. October 2013. http://ibm.co/18NKegY.

IBM (2015) "Data-driven government: Challenges and a path forward". White paper, https://public.dhe.ibm.com/common/ssi/ecm/gq/en/gqw03008usen/GQW03008USEN.PDF.

Highsmith, J., Consortium, C., & Cockburn, A. (2001). Development : The Business of Innovation, 120–122.

Mergel, I. (2016). Agile innovation management in government: A research agenda. *Government Information Quarterly*, *33*(3), 516–523. https://doi.org/10.1016/j.giq.2016.07.004

Nambisan. S., P. Nambisan (2013) "Engaging Citizens in Co-Creation in Public Services: Lessons Learned and Best Practices", IBM Center for The Business of Government, Collaborating Across Boundaries Series.

Nasi, G., M. Cucciniello, V. Mele, G. Valotti, R. Bazurli, H. de Vries, V. Bekkers, L. Tummers, M. Gascó, T. Ysa, C. Fernández, A. Albareda, A. Matei, C. Savulescu, C. Antonie, E.B. Balaceanu; J. Nemec, M, Svidroňová, B. Mikusova Merickova, M. Oviska, C. Mendes, M. Eymeri-Douzans, and E. Morette Monthubert (2015) "Determinants and Barriers of Adoption, Diffusion and Upscaling of ICT-driven Social Innovation in the Public Sector: A Comparatixve Study Across 6 EU Countries". LIPSE research report.

OECD (2011) Innovation in public service delivery. Context, Solutions and Challenges. Paris: OECD.

OECD (2011) *Together for Better Public Services: Partnering with Citizens and Civil Society*. *OECD Public Governance Reviews*. https://doi.org/10.1787/9789264118843-en

OECD (2014) Recommendation of the Council on Digital Government Strategies. Paris: OECD.

OECD (2016) Rebooting Public Service Delivery - How can Open Government Data help drive innovation? http://www.oecd.org/gov/digital-government/rebooting-public-service-delivery.htm.

Osborne, S.P., Z. Radnor, K. Strokosch (2016) "Co-Production and the Co-Creation of Value in Public Services: A suitable case for treatment?", *Public Management Review*, Vol. 18, No. 5, 639-653.

Peristeras V. and Tarabanis K. (2008) "The Governance Architecture Framework and Models". In Saha, P. (Ed.). *Advances in Government Enterprise Architecture*, Hershey, PA: IGI Global Information Science Reference.

Pettigrew, A. (1985) "The Awakening Giant: Continuity and Change in ICI". Oxford: Basil Blackwell.

Pollitt, C., G. Bouckaert, E. Loeffler (2007) "Making Quality Sustainable: Co-design, co-decide, co-produce, co-evaluate." Report by the Scientific Rapporteurs of the 4th Quality Conference, Ministry of Finance, Finland.

Pollitt, C., Bouckaert, G., & Löffler, E. (2006). Making Quality Sustainable : Co-Produce and Co-Evaluate the Quality Journey To 4Qc. *4QC Conference*.

Radnor, Z., S. P. Osborne, T. Kinder, J. Mutton (2014) "Operationalizing Co-Production in Public Services Delivery: The contribution of service blueprinting", *Public Management Review*, Vol. 16, No. 3, 402-423.

Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Crown Books.

Rochet, C., J. Peignot and A. Peneranda (2012) "Digitizing the Public Organization: Information System Architecture as a Key Competency to Foster Innovation Capabilities in Public Administration." *Halduskultuur – Administrative Culture*, Vol. 13, No. 1, 49-66.

Scherer, S., M. Wimmer, S. Strykowski (2015) "Social government: A concept supporting communities in co-creation and co-production of public services", In: dg.o '15 Proceedings of the 16th Annual International Conference on Digital Government Research, ACM New York, NY, USA, 204-209.

Symons, V.J. (1991) "A Review of Information Systems' Evaluation: Content, Context and Process". *European Journal of Information Systems*, Voli. 1, No 3, 205-212.

Vigoda, E. (2002). From Responsiveness to Collaboration: Governance, Citizens, and the Next Generation of Public Administration. *Public Administration Review*, *62*(5), 527–540. https://doi.org/10.1111/1540-6210.00235

Voorberg, W. H., V. J. J. M. Bekkers, L. G. Tummers (2014) "A Systematic Review of Co-Creation and Co-Production: Embarking on the social innovation journey", *Public Management Review*, Vol. 17, No. 9, 1333-1357.

Zuiderwijk, A., M. Janssen and K. Jeffery (2013). Towards an e-infrastructure to support the provision and use of open data. Conference for E-Democracy and Open Governement.