WP4 INTERLINK Platform

D4.1- List and description of the socio-technical requirements

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V0.2	01.06.2021	First draft made available to partners leading technical workpackages WP3, WP4, WP5	Document filled with content elaborated within project activities carried out in Task 4.1 in collaboration with WP2, WP3 and WP5	FBK
V0.3	10.06.2021	Second draft shared with project partners	Revision of the first draft, improvements and additional requirements added to sections: 5.2, 6.3, 6.4.1, 6.1 , 6.2, 6.3, 6.4.2 .	FBK, DEUSTO, TREETK
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Glossary

ENTRY	DEFINITION
INTERLINKERs	Common building blocks, provided as software tools or in the form of knowledge offered digitally, that represent interoperable, re-usable, EU-compliant, standardized functionality for the co-production of public services
Public Service	Services that are publicly available and are provided by the government or on behalf of the government's residence in the interest of its citizens. In INTERLINK we focus not only on the software services (i.e., the services delivered digitally) but also the services that rely on digital technologies.

ACRONYMS

ABBREVIATED	EXTENDED
CSC	Unified State and Municipal Customer Service Centres
G2C	Government to Citizen
G2G	Government to Government
MEF	Ministry of Economy and Finance - Italy
PA	Public Administration
VARAM	Ministry of Environmental Protection and Regional Development - Latvia
ZGZ	Zaragoza, capital city of the Zaragoza province - Spain

Table of contents

List of figures

List of tables

Executive summary

D4.1. is the first output of Task 4.1. (M1-M24) that is meant to provide a first list of high level socio-technical requirements that will be used to (i) guide the functional specification of the set of INTERLINKERs that will be described in D3.1. "Identification and specification of INTERLINKERs" (M10), (ii) bootstrap the INTERLINK reference architecture model and specification that will be documented in D4.2 "Reference architecture model and specification" (M12), and (iii) inform the preparation of the plans for the execution of the use cases that will be detailed in D5.1 "Use-case plans and guidelines v1" (M12) .

This deliverable integrates i) socio-technical requirements empirically elicited through end-users involvement with ii) requirements related to the principles and guidelines of the new collaborative governance model emerging in WP2 and with iii) technical requirements and constraints related to the implementation of the platform and the INTERLINKERs. This document includes the description of the iterative process followed to acquire the socio-technical requirements which was conducted in synergy with other WPs, in particular:

- *WP2: Task 2.1. Preliminary governance model*. Even if the preliminary governance model is foreseen at M16 (with deliverable D2.1), in the early stages of project development an initial model has been outlined to drive the elicitation of requirements. The model emerged from literature analysis on co-production processes and from a comparative analysis of successful and unsuccessful cases of co-production. The draft governance model has allowed to identify the major steps of a collaborative endeavor between Public Administrations, third private parties and citizens for the co-design and the co-delivery of services, as well as the collaboration aspects that should be supported by technology (Misikangas et al. 2021).
- *WP3: Task 3.1. analysis and specification of INTERLINKERs*. This task concentrates on the specification of a set of common (digital and non-digital) building blocks to support the co-production of effective, participatory and sustainable public services. Understanding the different types of required INTERLINKERs has been a mandatory prerequisite to identify the functional and non-functional requirements for their implementation.
- *WP5: Task 5.2 Use-case requirements, planning and KPI definition*. This task coordinates the understanding, planning, deployment, operation, monitoring and evaluation of the three use cases that will pilot the usage of the INTERLINK platform. It has been therefore essential to examine the potential user journeys of different stakeholders with the platform.

This Deliverable provides an **initial overarching view of the high-level technical and non-technical aspects** that should be carefully taken into account in developing the INTERLINK platform. **The description of the requirements will be further detailed and refined as the research work progresses and will be additionally documented in other following deliverables**, in particular:

- Functional requirements for INTERLINKERs will be refined in D3.1 (M10), as the discussion progresses on the possibility to reuse / wrap / develop from scratch the different building blocks.
- Technical requirements pertaining to the system platform will be specified in D4.2 together with the reference architecture model and specification (M12).
- User requirements related to the refinement of the use cases, including objectives and background will be included in D5.1 (M12).

Moreover, the socio-technical requirements described in D4.1. will provide input for the dissemination activities developed in WP7, that aim at engaging stakeholders across different Countries to disseminate the know-how produced in INTERLINK and to foster the replication of similar experiences in other contexts.

The present deliverable D4.1 is also complementary to (i) D6.1 (M6) which describes the requirements and constraints related to the Data Management implemented in INTERLINK, (ii) D6.4 (M12) which focuses on legal requirements, and (iii) D6.5 (M16) which addresses requirements for EU privacy compliance.

1. Introduction

This deliverable describes the socio-technical requirements for the design and development of the INTERLINK platform to be developed in WP4 and for the implementation of the set of INTERLINKERs which are at the core of WP3. This is one of the first technical deliverables of the project and is aimed at providing an initial overarching view of how a collaborative governance model shall be supported by the proposed INTERLINK Platform.

1.1 Approach

A requirement can be defined as a demand or need related to what the system should do and the process of requirements elicitation should start with understanding and documenting the wishes of the stakeholders and the flow of user processes (Khan, 2014). The elicitation of INTERLINK requirements integrated different perspectives and input coming from the different WPs of the INTERLINK project, namely:

1. **Top-down requirements**: principles and guidelines of the new collaborative governance model defined in WP2 pertain to this category and are essential to understand the steps of the co-production of new public services.
2. **Bottom-up requirements**: the stakeholders' perspectives have been empirically elicited through the involvement of the three PAs partners of INTERLINK, namely the Italian Ministry of Economy and Finance (MEF), the Latvian Ministry of Regional Development (VARAM) and the City of Zaragoza (ZGZ). The three use cases partners have been involved to elicit specific requirements related to the different public services to be developed and validated in each PAs. This work has been conducted in synergy with WP5 (T5.2 Use-case requirements, planning and KPI definition).
3. **Transversal user requirements**: these requirements refer to the characteristics that a digital solution should satisfy in order to be useful, acceptable and accessible by end-users, considering different types of users, such as PAs, private entities, citizens.
4. **Transversal technical requirements**: technical requirements refer to all those features that the INTERLINK platform should implement and the constraints it should satisfy to be interoperable and compliant with EU-regulations. The knowledge has been collected leveraging the technical know-how and experience of partners in the consortium, taking into account best practices and guidelines emerged from literature analysis on eGovernment platforms and related European projects. Specific requirements address the issue of ensuring that the INTERLINK Platform can be easily adapted and used by different PAs and with a cross-sector and cross-border dimension.

Figure 1 shows how the different perspectives complement each other and the synergy between the different WPs that allowed synthesizing the overall vision for the INTERLINK platform. Three interdisciplinary working teams were created to collaboratively elaborate the different perspectives: a group working on governance models (*Gov Team*, involving partners RU, CNS, DEUSTO, FBK, TREETK), a group working on IT aspects (*IT team*, involving partners TREETK, DEUSTO, FBK, DEDA, CNS), a group

dissecting the analysis of the use cases (*User Team*, involving partners DEUSTO, FBK, DEDA, ZGZ, MEF, VARAM). These work teams are complementary to the work coordinated by UCLOUVAIN on legal and ethical requirements.

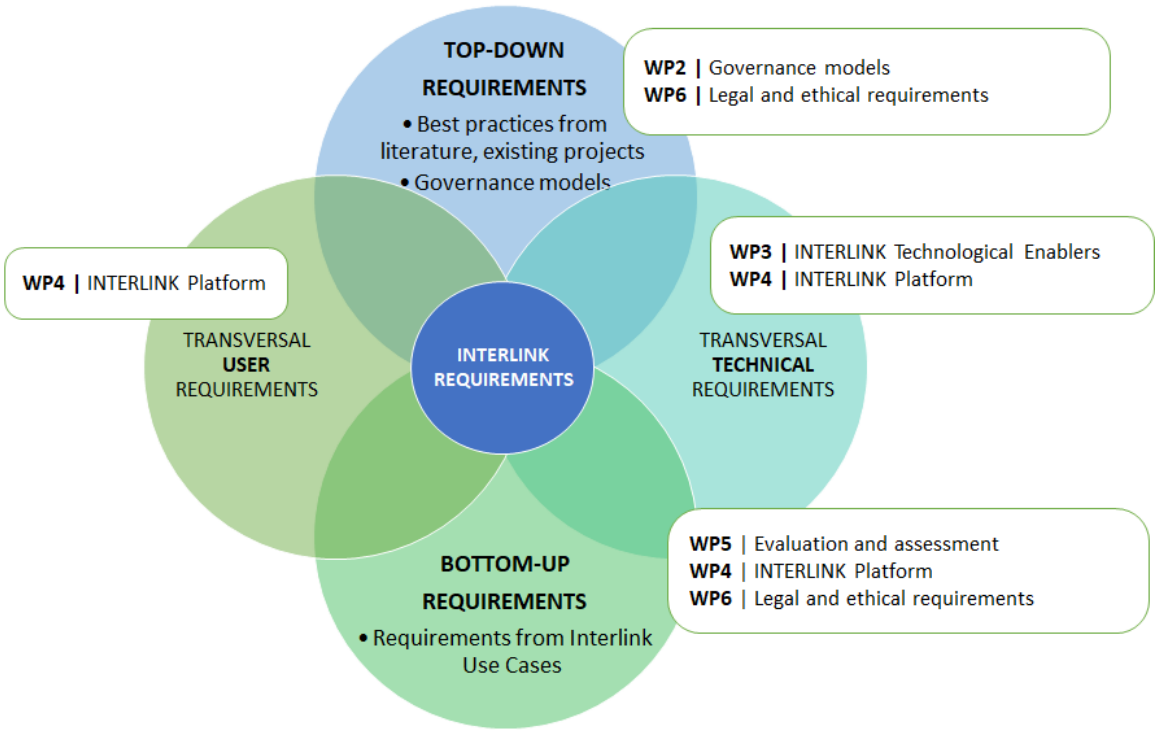


Figure 1. The elicitation of INTERLINK requirements integrated different perspectives and input coming from the different WPs

D4.1. is the first output of Task 4.1. on Socio-technical Requirements and it is meant to provide a first list of high-level requirements that will be used to (i) guide the functional specification of the set of INTERLINKERs that will be described in D3.1. "Identification and specification of INTERLINKERs" (M10), (ii) bootstrap the INTERLINK reference architecture model and specification that will be documented in D4.2 "Reference architecture model and specification" (M12), and (iii) inform the preparation of the plans for the execution of the use cases that will be detailed in D5.1 "Use-case plans and guidelines v1" (M12).

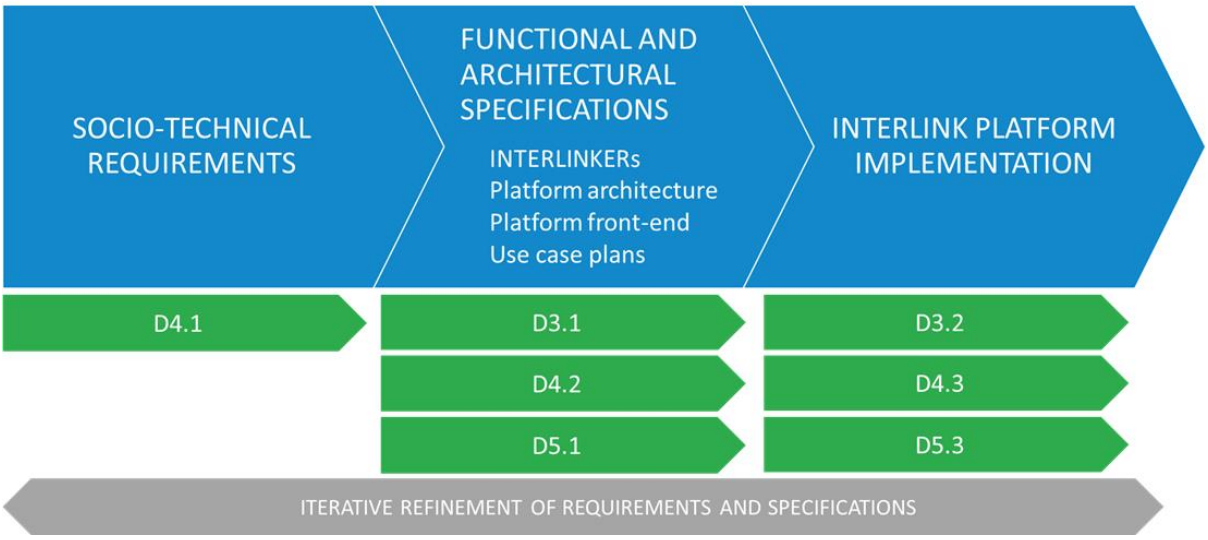


Figure 2. Cascade relationship between Task 4.1 / D4.1. and other deliverables in WP3, WP4 and WP5.

1.2 Schema for requirements description

INTERLINK leverages the know-how and results acquired by previous EU and national projects (for example SIMPATICO[1], WELIVE[2], FAMILIES_SHARE[3], CITADEL[4]) to make sure the open government platform envisaged by INTERLINK complies with consolidated standards, guarantees interoperability and reusability, and adopts a validated user-centred approach to elicit socio-technical requirements.

There is no unique schema adopted by previous projects for requirements descriptions. For example, the SIMPATICO and WELIVE projects focus on technical requirements for the system architecture and adopt a description schema that relies on the Volere methodology[5] (Robertson 2006), although introducing some simplification (Simpatico-D5.1; WeLive-D1.5). FAMILIES_SHARE and CITADEL use instead a more informal description format to summarise the extracted user requirements (Families_Share-D1.1; Citadel-D3.5).

For the description of the INTERLINK requirements, we have taken as a reference model the Volere methodology, in particular, the Volere Requirements Specification Template. However, not all the elements and description fields of the Volere template have been selected as appropriate to fit with the project goals at M6, as a lean description structure was preferred at this stage, with further details to be added as the technical work progresses.

First of all, the Volere methodology introduces a useful classification of the requirements that helps characterize them (Robertson and Robertson 2007). For the INTERLINK objectives the following types are relevant:

[1] https://simpatico-project.com/
[2] https://www.welive.eu/
[3] https://families-share.eu/
[4] https://www.citadel-h2020.eu/
[5] https://www.volere.org/

- **Functional requirements** are the fundamental or essential subject matter of the product. They describe what the system has to do or what processing actions it is to take.
- **Non-functional requirements** are the properties that the functions must have, and that must be compliant with the ISO-25010 standard metrics for evaluating Product Quality[6], such as:
    - Look and Feel Requirements
    - Usability and Humanity Requirements
    - Performance Requirements: Reliability, Scalability
    - Operational and Environmental Requirements and Standards
    - Maintainability and Support Requirements
    - Security and Privacy Requirements
    - Cultural and Political Requirements
    - Legal Requirements
    - Architectural Requirements: Modularity, Configurability
- **Project constraints** are restrictions on the product due to the budget or the time available to build the product. For the INTERLINK project the following main constraints are envisaged:
    - Due to the fixed duration of the Project, the deliverables will include a fixed set of INTERLINKER modules (in case of SW modules), a platform for co-production of public services and public service execution platforms for the pilot testing of the 3 basic use cases of the Project (VARAM, MEF and ZGZ);
    - The public service co-production platform and the catalogue of INTERLINKERs need to be properly designed and developed to guarantee they are open to possible future extensions;
    - Since, in case of a new INTERLINKER being a SW module, the creation of it may imply a non-trivial SW development and platform integration work, then, in general (except for the 3 mentioned pilot cases) we leave outside the scope of the current Project the creation of new SW INTERLINKERs and their integration into platform versions executing the corresponding new public services (see Section 5.2 Specific technical requirements for the INTERLINK platform for more details). Nonetheless, to guarantee the extensibility of the system, the Project will support and experiment with the publication of new INTERLINKERs in the catalogue within the considered pilot cases.
- **Design constraints** impose restrictions on how the product must be designed. For example, the need for the graphical user interface to be responsive on different digital devices, e.g. following the Progressive Web Apps (PWA) approach[7].
- **Project drivers** are the business-related forces.

For the purposes of this deliverable, the following fields have been included in the requirements description template:

- *id*: this is a unique identifier that can be used to quickly refer to the requirement

[6] https://iso25000.com/index.php/en/iso-25000-standards/iso-25010
[7] https://web.dev/progressive-web-apps/

- *name*: this is a title that concisely describes what the requirement is about
- *requirement type*: this fields describes whether the requirement is functional or non-functional; in case of non-functional requirements the specific type will be indicated according to the Volere classification
- *description*: this is a precise explanation of what is required
- *motivation/rationale*: this provides a justification for the requirement. It is very important to trace where the requirement comes from and why it is important for the INTERLINK project
- *fit criterion*: this field contains an explanation of a measurable method for evaluating whether the requirement has been successfully met by the INTERLINK platform
- *author*: this field records the person or the team who described the requirement. This is important for traceability of the requirements collection process and to facilitate the collaborative process of requirement refinement
- *revision*: this field is useful to record whether the initial specification of a requirement was modified and the reasons behind the update.

Additional fields will be considered for inclusion during the following stages of project development. For example, fields like expected *input* and *output* of a certain software component, *difficulty of implementation*, *priority*, *actors* involved in the use of the component, *dependencies* with other components will be relevant in deliverable D3.1 which will collect functional specifications for INTERLINKERs.

1.3 Document structure

This document is organized in two main parts: **the first part (sections 1-5) describes the context and the rationale for the high-level requirements for the INTERLINK platform; the second part (Section 6. List** of socio-technical requirement descriptions **presents the actual list of descriptive tables for the requirements**.
More specifically, the first part of the report is aimed at describing the process of requirements elicitation that was performed during the first six months of the project development considering different perspectives and types of requirements: top-down requirements, bottom-up requirements, transversal user requirements and transversal technical requirements. For top-down requirements, the report summarizes (i) the preliminary results related to the governance model under development in WP2 and (ii) the know-how consolidated in previous governance projects and research studies. This knowledge is used to distill implications for the INTERLINK platform to support the co-production process. For bottom-up requirements the deliverable reports about the implications that have emerged from the analysis of the three use cases. A brief summary is reported of the process followed for the exploration of prototypical stakeholder profiles, user scenarios, and potential user journeys that map concrete user needs with potential platform functionalities. For transversal user requirements, consolidated standards and recommendations for usability, acceptability and usefulness, trust and privacy are reviewed and translated into practical implications for the INTERLINK platform development. For transversal technological requirements the deliverable reviews common characteristics of Digital Government architectures that have emerged from previous studies and projects on Digital Government and that are endorsed by the EU regulations and recommendations.

The second part of the deliverable is conceived as a more technical inventory, to be used as a reference guide by project partners to inform development decisions and perform regular evaluation measurements.
A set of appendices complete the deliverable with materials that were produced during T4.1 activities and may be of interest to other Governance projects exploring how to support co-production.

2. Top-down requirements from governance model

One of the main goals of INTERLINK is to develop a new collaborative governance model based on partnerships between public administrations, citizens and companies. In particular, INTERLINK aims at developing a platform that, following the new governance model defined in WP2 will facilitate co-production processes between PAs and private stakeholders, and will provide tools to monitor service customization and delivery. A main requirement for the Project is hence to design a collaboration platform with a simple and user friendly front-end that enables an agile customization process of public services, offering at the same time tools and methods to the PA to make sure the customized service complies with EU regulations and directives (e.g. eIDAS, GDPR). In this deliverable we describe the first governance model defined in WP2 and discuss/define related requirements that will impact on the design and implementation of the INTERLINK platform.

2.1 Co-production process

Co-production is a practice in the delivery of public services in which citizens are involved in the creation of public policies and services. It is contrasted with a transaction based method of service delivery in which citizens consume public services which are conceived of and provided by governments (Brandsen 2006). Co-production is very different from traditional models of service provision because it fundamentally alters the relationship between service providers and users; it emphasises people as active agents, not passive beneficiaries; and, in large part because of this alternative process, it tends to lead towards better, more preventative outcomes in the long-term.
There are different types of co-production and co-creation. A classification can be done according to two factors, as suggested by Brandsen and Honingh (2016) and summarized in Table 1:

- the level of *citizens engagement* in the process and the *phases* in which they are involved: only in the implementation or in both the design and implementation of the service;
- the *proximity* of the tasks that citizens perform with respect to the core activities of the organization: the service co-produced with citizens can be complementary to the organization's core activities or can be part of its core activities.

Table 1. Four types of co-production defined by Brandsen and Honingh (2016).

	Implementation	Design and implementation
Complementary (Non core activities)	Citizens are engaged in the implementation, but not the design, of a complementary task.	Citizens are engaged in co-production, but in tasks that are complementary to the core process rather than part of it.

	Example: students assisting the university in organizing welcome days and parents helping prepare school plays. These activities do not directly contribute to the core activity of teaching, and the participants usually do not have the opportunity to design or redesign the events.	*Example*: when parents help plan and organize extracurricular activities such as school excursions or design and plant a school garden. These activities are part of the professional organization's mission, but they do not directly involve citizens in the core activities of teaching.
Non complementary (Core activites)	Citizens are actively engaged in the implementation, but not in the design, of a service that is at the core of the organization. *Example*: children's education in which students follow strictly defined lessons, yet their input is still crucial to effective learning, and enforced services.	Citizens are involved in producing core services of an organization and directly involved in both the design and implementation of the service provided to them. *Example*: postgraduate training modules in which entrants, together with instructors, define their own learning objectives and activities; participative building projects in which (future) tenants of a housing cooperative work with architects and builders in the design, construction, and maintenance of their homes.

INTERLINK ambition is to define a new governance model for public-civic partnerships, building on top of existing approaches and best practices, and further develop them with a set of digital building blocks, called "INTERLINKERs", that will implement the defined governance model and standardize the basic functionalities needed to enable private actors to cooperate in the delivery of a service (organization, communication, scheduling, monitoring, etc.). The main challenge is to develop a new governance model that combines elements of a "top-down" approach, in which the public administration provides high-quality, open, interoperable procedures that other parties can then adopt and re-use, and a "bottom-up" approach in which citizens and private actors co-produce services (Misikangas et al. 2021).

2.2 Stakeholders and end-users of INTERLINK platform

The terms "user" and "stakeholder" are often confused in project management as well as in co-design. For the sake of this document, we propose to use the term "stakeholder" to denote "anyone who could impact or be impacted by the project" (following the PMBok©). On the other hand, "users" refer to specific types of stakeholders defined by their relations to the system that is going to be designed: primary users, are those who actually use the system on a regular base; secondary users, those who may occasionally use the system or who use it through an intermediary; and tertiary users are those who will be affected by the use of the system or make decisions about its purchase (Abras, et al., 2004). For the design and development of the INTERLINK platform both stakeholders and end-users perspective should be considered.

The goal of INTERLINK is to support a co-production team composed by heterogeneous actors (e.g. PAs, private entities, citizens, NGOs) in creating a new or customizing an already existing service, leveraging on the collaboration of different actors, each bringing specific needs in relation to the service and competences. Possible participants of the co-production team can be divided into four main groups (according to the Quadruple Helix approach[8] for innovation) 1) *public authorities*, 2) *citizens*, 3) *businesses and private non-profit organisations* and 4) *research organisations* as shown in the figure below (Figure 3). They can be divided further into sub-groups that each have different motivational factors to join the work.

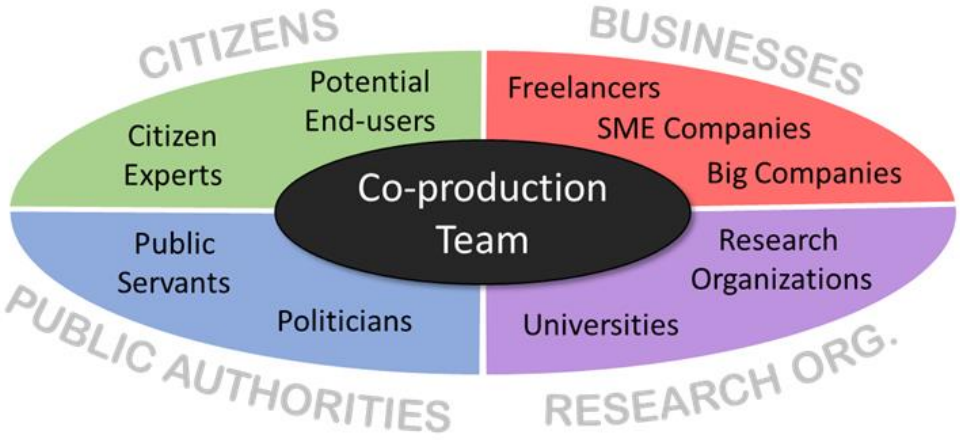


Figure 3. Stakeholders involved in the co-production process. (Misikangas et al. 2021)

A preliminary analysis of the co-production of public services conducted in WP2 has identified the following sub-groups that could participate in the co-production process, analyzing for each of the target groups motivations that can drive their engagement in co-production (Misikangas et al. 2021). It is worth noting that in INTERLINK these sub-groups might be end-users of the platform, playing an active role in creating and managing co-production teams and projects though the INTERLINK digital platform or participating in the team activities.

1. **Public authorities**
    - National and local PAS, Public servants
    - Politicians whose constituents/voters include end-users of the service.

    Motivations to participate: deliver more acceptable and adopted stakeholder-driven public services; solving a common problem/need or improving an existing solution, helping a specific group of people in everyday life, helping public servants to fulfill their daily duties, allowing citizens to participate in governance related tasks, improving communication between public servants and citizens, improving acceptance and adoption of new services.

[8] Florian Schütz, Marie Lena Heidingsfelder, Martina Schraudner, Co-shaping the Future in Quadruple Helix Innovation Systems: Uncovering Public Preferences toward Participatory Research and Innovation, She Ji: The Journal of Design, Economics, and Innovation, Volume 5, Issue 2, 2019, Pages 128-146, ISSN 2405-8726, https://doi.org/10.1016/j.sheji.2019.04.002.

2. **Citizens**
    - Potential end-users who would benefit from the co-produced service directly as an end-user and/or want to help in creating a service which they believe to be useful. They contribute experiential knowledge which is valuable in (re-)designing a service. These can be individual or organised in groups (associations).
    - Expert citizens who enjoy participating in co-creation projects and have the relevant skills to take on a more specialist role (knowledge activists).

    Motivations to participate: contribute to the improvement of a service addressed to them, based and customized on their needs and priorities; use the co-produced service personally or for family members; receive benefits when others use it, e.g. simplified duties for public servants or for service deliverers; get rewards for their participation (e.g. bonuses, social coin); learn by doing; advertise personal skills (e.g. to find a job), social acceptance/reputation.

3. **Private businesses and non-profit organisations**
    - SME who are looking for new business opportunities and ways to utilize their skills and technology.
    - Freelancers who are looking for new customers and ways to demonstrate the benefits of their services.
    - Large companies who are looking for new customer relationships (with involved PA or companies), investment opportunities or ways to improve their brand or corporate image.
    - Private non-profit organisations (e.g. foundations, charities) who are willing to support the service.

    Motivations to participate: short- or long-term revenue to business, funding, new business partnerships, intellectual properties that could be licensed, revenue sharing opportunities, improved corporate image, proof-of-concept for a new technology or service, opportunity to learn or practice skills needed in other business

4. **Research organisations**
    - Universities and other research organisations who support the service as part of their research mission.

    Motivations to participate: new research projects, academic publications, enlarge own network, funding for research and innovation projects.

It is important to pay attention to the role of these different groups of stakeholders within the INTERLINK project. To achieve the project objectives, it is necessary to understand the individual actors potentially affected and envisioned by the system and project results, identify their needs and motivations to participate and, finally, recognize synergies among them.

2.3 ICT-enabled co-production

ICTs have the potential to reshape existing models and frameworks, therefore ICTs are strategic assets for the success of co-production in the public sector (Paletti 2016). ICT can encourage co-production processes in different ways, for instance facilitating new

connections within the community, establishing relationships that were not possible before by overcoming problems of geographical dispersion of users, finally, through ICT, citizens can reinvent how public services are delivered according to their own perspective and needs (Paletti 2016).
However, a number of barriers prevent PAs, companies and citizens from fully exploiting the potential of ICT to co-produce and co-deliver services. Following Garcia et al. (2019), we describe some of them below, identifying lessons learned and requirements useful for the development of INTERLINK platform:

Table 2. Barriers identified by Garcia et al. 2019 with practical implication for INTERLINK platform

BARRIERS	IMPLICATIONS FOR INTERLINK
Barriers related to governments and PAs adoption of ICT for co-production	
Financial capacity Shortage of finance is a common barrier to a government's promotion of ICT-enabled coproduction, and financial impediments to the deployment of ICTs in co-production are reported as lower where governments or public agencies opt to use low-cost ICTs.	INTERLINK should provide guidance on sustainability issues, and on how to select the most appropriate ICTs considering different aspects: ICT maintenance costs, regulatory framework.
Technical capacity The lack of infrastructures and skilled workforce shortages constitute a barrier to ICT-enabled co-production. Furthermore, the lack of planning for the day-to-day ICT use may lead to the failure of ICT-enabled co-production initiatives.	INTERLINK should provide clear and easy ways to access information about co-production processes, explaining the different expertises needed to carry out an ICT-enabled co-production process. Besides, guidance on how ICT can be exploited throughout the whole co-production process might be provided (e.g., practical recommendations, best practices, risks related to potential technical failures, etc)
Legal issues The complexity of legal regulations can prevent governments from taking up ICTs to co-produce and can cause significant delays in the deployment of solutions. Besides, when regulatory frameworks are very complex, "governments may require the participation of external agents or experts, increasing the operating costs and time required to implement ICT-enabled co-production projects".	INTERLINK should provide a clear regulatory framework that promotes deployment of ICTs to facilitate co-production.
Cultural barriers Negative perceptions and fears may exist on the part of government staff about ICTs: ICTs are seen to risk changing their routines or because staff members fear new technologies may undermine their roles. Government staff may perceive ICTs as potentially controlling and intrusive, introducing too much rigidity to the organization.	INTERLINK should provide flexible and adaptable solutions that do not introduce additional bureaucracy to processes.
Barriers related to citizens adoption of ICT for co-production	

Technical Skills A lack of technical skills, along with a negative attitude toward ICTs, tends to reduce the participation of citizens in ICT-enabled co-production. Difficulties in understanding the terms and conditions associated with certain ICTs.	INTERLINK should promote bottom-up processes and ICT training as measures to encourage citizens participation. Besides, INTERLINK should ensure high usability and acceptability of the solutions deployed.
Cultural factors A lack of trust in the government tends to reduce the participation of citizens in ICT/enabled co-production; furthermore, citizens might fear that ICTs may invade their privacy.	INTERLINK should ensure transparency of collaborative processes and deploy privacy-preserving solutions.

Other barriers identified by Sorrentino (2018) are related to the often informal and experimental nature of most co-production initiatives "and in the difficult scaling up and dissemination of the experiences. The latter indicates that most co-production arrangements are context-dependent" (Sorrentino 2018).
Howlett and Ramesh (2017) pointed out that three interconnected sets of resources and capabilities are required to carry out successful co-production initiatives:

- analytical (to ensure technically sound policy action)
- operational (to mobilize and deploy means, to carry out coordinated actions, and engage policy networks, communities and individuals);
- political (to ensure political legitimacy and two-way communication with non-state actors).

According to Sorrentino (2018) this means to rely on effective administrative structures, processes and coordination. This also stresses the importance of the information systems and ICT platforms to achieve coordinated and consistent functions.

2.4 Outline of INTERLINK Governance Model

The first draft of the Governance Model delivered as a first input in WP2 (and that will be described in detail in D2.1.) proposes a new collaborative governance model, based on a partnership between private actors (citizens and companies) and public administration. The model focuses on the different **phases** of the co-production process, identifying two main phases of the process that are further specified in sub-phases:

- **co-design phase**: co-design concerns activities that incorporate "the experience of users and their communities" into the creation, planning, or arrangements of public services" (Bovaird and Loeffler, 2012). In this phase the co-production team is created and starts working together to define the service to be co-produced. The co-design phase entails two sub-phases:
  - Engagement
  - Design
- **co-delivery phase**: co-delivery is a joint effort by public authorities and stakeholders to provide and improve public services (Alford, 2014; Nabatchi et.al., 2017) where the service is implemented and delivered in a sustainable manner. The co-delivery phase entails two sub-phases:
  - Implementation
  - Sustainability

For each of these sub-phases, the model identifies:

- the specific **objectives** that the co-production team should pursue
- the **questions** that the co-production team should answer to progress to the next phase of the process
- the **tasks**, i.e. the specific activities that the team might perform to answer the questions (e.g. identify stakeholders groups);
- an **evaluation strategy** to check and monitor whether the co-production team is ready to proceed to the next phase. A "Go/no-go" decision structure includes an assessment of the current co-production team and an assessment of how the service is developing (see Figure 4). It guides the team in periodically evaluating the state of the service production according to a set of parameters that guarantee that the service is feasible, that resources and skills are available, and that a plan is in place to make the service sustainable. In this perspective, proceeding along the co-production process, and therefore to progress from a phase (e.g. "Design") to another phase (e.g. "Implementation") requires that a common understanding has been reached among stakeholders engaged in the process and that the ongoing service co-production has enough potential to justify further development.

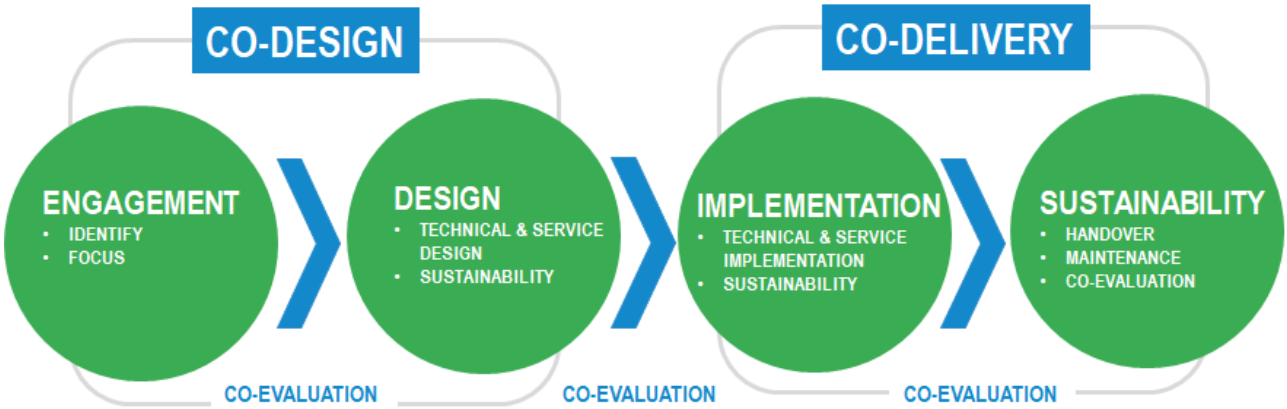


Figure 4. Overview of the INTERLINK Public Service co-production process

In Table 3 below the different phases with related objectives, questions and tasks are summarized, as elaborated in the preliminary activities in WP2 (Misikangas et al. 2021):

Table 3. Describes the different phases with related objectives, questions and tasks to carry out a successful co-production process.

PHASE	OBJECTIVE	QUESTIONS	TASKS
ENGAGEMENT	**Identify**	- Which stakeholders should be involved?	Identification of stakeholder groups; Contacting representatives
	Focus	- What is the problem? - By what criteria should a solution be evaluated?	Determining a format for structuring stakeholder engagement

Go / no-go* *Internal assessment to check and monitor whether the co-production team is ready to proceed to the next phase.	**Co-evaluation**	Is there a clear and accepted concept that can be developed?	Acceptance, technical feasibility, business and sustainability
	Team formation	- Who should be on the team(s) in the next phase? - What support do they need?	Skills/expertise analysis
DESIGN	**Technical design**	-What are the technical requirements? - Are the expertise and resources sufficient to launch the service?	Functionality specification, User interface design, Functional, environmental, performance, scalability and other technical requirements
	Service design	- What are the economic and social requirements? - Are the expertise and resources sufficient to launch the service?	Customer journey map, Service architecture design, Informed consent procedure Service workflow, deployment and operational instructions, customization guidelines, etc"
	Sustainability	- What are the sources of funding/support necessary? - What are the incentives?	Co-business plan, Policy plan / grant agreement
Go/ no-go	**Co-evaluation**	- Do the funders / stakeholders support the final design?	Implementation feasibility analysis Implementation viability analysis
	Team formation	- Who should be on the team in the next phase?	Skills/expertise analysis
IMPLEMENTATION* *In case the implementation of the new public service involves software development or integration, some stages of the implementation may also rely on the work of IT companies external to the co-production team and on execution platforms external to the collaborative production process	**Technical implementation**	- Is the environment / infrastructure for implementing the design in place? - Who owns the data?	Software architecture design, Software development, Execution environment, Databases, Integration with external services, Ownership of data agreement
	Service implementation	- Is the organisational / regulatory environment for the service in place?	Legal check; Quality assurance
	Sustainability	- Are the conditions foreseen in the sustainability plan in place?	Business plan / Exploitation plan / License / Pricing model

Go / no-go	**Co-evaluation**	- Is it working as planned? - Does the design need to be adapted?	Usability / acceptance / ease of use evaluation
	Team formation	- Who will maintain the service from here on?	Task distribution; Contracts /regulation; Data management, archiving
SUSTAINABILITY	**Handover**	- Are ownership and responsibilities clearly arranged?	Data management IPR contract Installation & operation instructions
	Maintenance	- Who is in charge of the maintenance? How will we keep this service running?	Maintenance workload and costs analysis User support and feedback
	Co-evaluation	- Is it still working? - Should the service be re-designed or terminated?	Monitoring (ongoing evaluation) and KPIs assessment Periodic evaluations with stakeholders and end users

2.5 Implications for INTERLINK

A number of considerations can be drawn from this initial analysis (a more detailed description of the INTERLINK governance model will be included in D2.1. Preliminary governance model - M16).

- *Raise awareness about the different types of co-production and co-business models*. Co-production is a broad concept: the spectrum of public service delivery is defined by a number of variables (Linders 2012), in particular i) the *level of citizens participation*, ii) the *spectrum of government-citizen relationships*, iii) the *type of service*, iv) *sustainability models*.
- *Support users in managing a co-production process*. There may be different co-production paths according to different government models and types of services. The INTERLINK platform should provide guidance to different types of co-production arrangements that might benefit from different resources and types of support. For instance, co-producing an ICT-based service requires different tools, expertise and a different organization of the collaborative work than to co-produce a more traditional service (e.g. set-up a new educational program). A step-by-step guided co-production flow management process should be integrated in the INTERLINK platform to support actors in coping with the different challenges of a co-production process and use the most appropriate resources and INTERLINKERs (defined in T3.1) at the different stages of the process. Support should also be provided to select the most appropriate INTERLINKERs according to specific phases and needs.
- *Consider the heterogeneity of actors involved:* The INTERLINK platform will be used by different users with different ICT skills, backgrounds, competences in relation to eGovernance and, finally, with different motivations to participate in a co-production process. INTERLINK should guide users in:

a. understanding which skills are needed in the different phases of the process
b. defining which are the related roles and responsibilities and make them transparent to other members
c. supporting the network of stakeholders in sharing knowledge and open discussion
d. defining the most appropriate incentives to encourage the participation of different target groups (e.g. citizens).

- *Support actors to reflect and to systematically co-evaluate the joint effort*. A number of barriers exist that prevent ICT-enabled co-production processes to succeed such as the lack of analytical, operational and political resources and capability that are required to carry out successful co-production initiatives (Howlett and Ramesh, 2017). INTERLINK should provide PAs and other actors guidance to evaluate and monitor the availability of needed resources and, on the other side, should provide guidance on finding adequate support and appropriate resources to cope with the challenges related to co-production. In particular, INTERLINK could support PAs and other stakeholders in analyzing the needed resources for carrying out a co-production process, encouraging the co-production team in reflecting and assessing under what conditions and constraints the initiative is likely to succeed or fail.
- *From the technical point of view, the support to the theoretical co-production process of public services described above requires two different types of platforms*: 1) a platform that guides stakeholders through the collaborative steps of engagement, design, implementation of non-software enablers and registration of new software enablers into the catalogue of INTERLINKERs, sustainability (*co-production platform*) and 2) a platform that supports the actual execution of the digital services involved in the co-created public services (*software execution platform*). This distinction is important as it emerged from the preliminary analysis of the cases studies performed in WP5 that some PAs might wish to execute all the digital services offered to their citizens on their servers (like in the case of VARAM) or in connection with other existing software components (like in the case of MEF) or by using other components available on the market. Therefore, the software execution platform for the co-produced public services is not unique and might require bespoke actions of software development and integration. The INTERLINK project will fully address the design and implementation of the co-production platform and will pilot test software execution platforms for the three project case studies, as a proof of concept of the execution of co-produced public services.

3. Bottom-up requirements from use cases

One of the main goals of INTERLINK, is to customise, deploy, operate, and evaluate the INTERLINK solution on three real use-cases in three different EU countries: the Italian Ministry of Economy and Finance (MEF), the Latvian Ministry of Regional Development (VARAM) and the City of Zaragoza (ZGZ).
The elicitation of bottom-up requirements has been conducted with the goal of incorporating the needs and expectations of the three Public Administrations into the design of the INTERLINK platform. The work has been carried out in synergy with work

conducted as part of WP5, that has the goal of specifying the proof-of-concept experiments to be executed in the three PAs. To elicit the specific requirements of the three use cases, as well as to identify INTERLINKERs to be included in the INTERLINKER catalogue (T3.1.), an iterative process has been followed to refine the understanding of use cases specificities and needs. As shown in Figure 5, the process started from use cases specification and exploited methodological approaches like scenarios, personas and user journey to elicit requirements. Requirements collected in T4.1. will be further elaborated to specify front-end features (T4.2) and the INTERLINKERs catalogue (T3.1.).

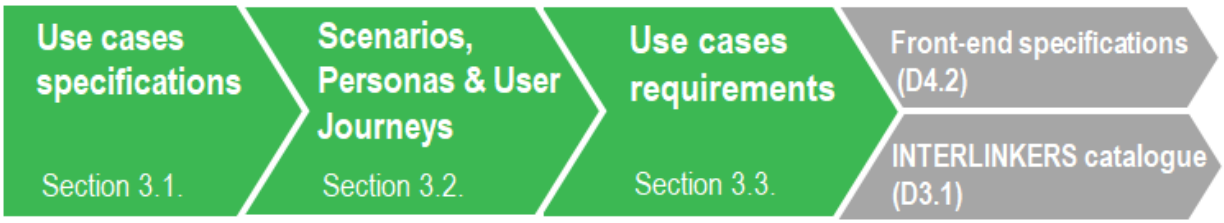


Figure 5. The process followed to collect bottom-up requirements from the three use cases (MEF, VARAM, ZGZ)

A scenario-based design approach (Carroll, 2000; Rosson and Carroll, 2002), enriched with the use of personas (Cooper 2007) has been adopted to foster an active participation of stakeholders and end-users in the definition of requirements. Scenario-based design (Rosson and Carroll, 2002) consists in presenting and discussing stories that represent a specific problem or technology in use with different purposes (Bødker, 2000), namely, 1) *identify needs and problems*; 2) *present and situate potential solutions*; 3) *illustrate and discuss alternative solutions*. A scenario can be defined as a sequence of interactions that happens under certain conditions, a brief user story explaining who is using the system and what they are trying to accomplish.

For the sake of clarity, we summarize here below the aim of the three INTERLINK use cases:

Ministry of Environmental Protection and Regional Development - Latvia - VARAM

The goal of the Latvian Ministry of Environmental Protection and Regional Development Customer Service Centers' use case is to test the sharing of service delivery with third parties to improve public services.

Zaragoza, capital of the Zaragoza province of the autonomous community of Aragón - Spain - ZGZ

Zaragoza will adopt the INTERLINK governance framework to widen Open Innovation within the city. The framework and set of enablers made available within INTERLINK will provide holistic support for sustainable Open Innovation in the co-creation and co-delivery of services.

Ministry of Economy and Finance - Italy - MEF

The Italian Ministry of Economy and Finance will leverage the INTERLINK platform and its components to co-create with local Public Administrations and other stakeholders a new module for Joint Strategic Planning to be used by central and local Public Bodies. The municipality of Reggio Emilia has already been involved in the project and will participate in the pilot studies.

To identify the specific requirements of the three use cases, an iterative process has been followed that started from the analysis of use cases specification to the final list of socio-technical requirements (Figure 5). We summarize the different phases of iteration in the following sections.

3.1 Use cases specification by stakeholders

Use cases description. The first activity involved gathering information on the use cases by means of a structured form that pilot owners were asked to complete. Pilot owners were asked to fill a tentative template (see Annex 1 - Use case template) with *use cases specification* and *scenarios*, to be further discussed and refined during the Project Kick-off meeting (online, 2-3 february 2021). The template was meant to collect information about the following aspects of the use case:

- Context and description: the context in which the INTERLINK solution might be exploited and the stakeholders potentially interested in the solution
- Actual organization of the service (if applicable)
- Limits/challenge of the actual service/initiatives
- Hypothetical desired scenario in which the INTERLINK solution might support actors involved in co-produce a service
- Key Actors and roles: the type of actors involved in the co-production of the service and expected roles
- Related initiatives, projects and available resources ; link to other relevant documents
- Desired platform features

To refine the template descriptions, bi-lateral calls were organized with pilot owners to improve our understanding about use cases specificities (2021-01-20 MEF; 2021-01-28 VARAM; 2021-02-01 ZGZ).

Brainstorming: An online collaborative session was organized during the Kick-off meeting with all the Project partners to discuss the three different use cases needs and specificities, to elaborate similarities and specificities. We exploited *Mural*[9] as a collaboration tool to map, for each use case: stakeholders involved, needs and desiderata, opportunities for INTERLINK and potential samples of INTERLINKERs (Figure 6). During the discussion, opportunities for the INTERLINK platform emerged. Pilot owners could listen and take inspiration from the other use case presentations and refine the reciprocal understanding about the opportunities offered by INTERLINK.

[9] https://www.mural.co/

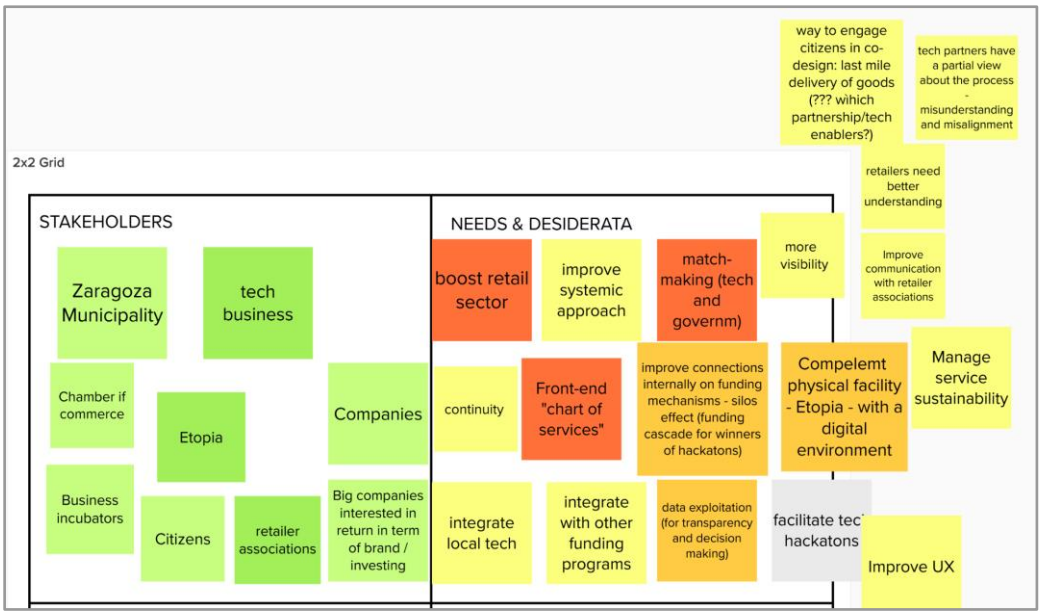


Figure 6. A snapshot of the Mural used to encourage discussion among partners on the three INTERLINK use cases (excerpt from discussion on Zaragoza use case).

Starting from inputs collected during the online brainstorming, an updated version of the use case template was produced that integrated: i) partners' input to the UC template that was circulated before the kick-off meeting, ii) bi-lateral meetings that took place before the kick-off , iii) partners' presentations and slides at the kick-off, iv) discussion output and comments that emerged during the brainstorming at the kick-off.
Moreover, a mapping of the three use cases was produced by FBK taking into account the INTERLINK conceptual architecture and the main phases of a co-production process, namely co-design and co-delivery (Figure 7). The mapping activity led to the identification of a number of open issues that were used as starting points for the second iteration, that was tackled exploiting scenarios and personas methodology.

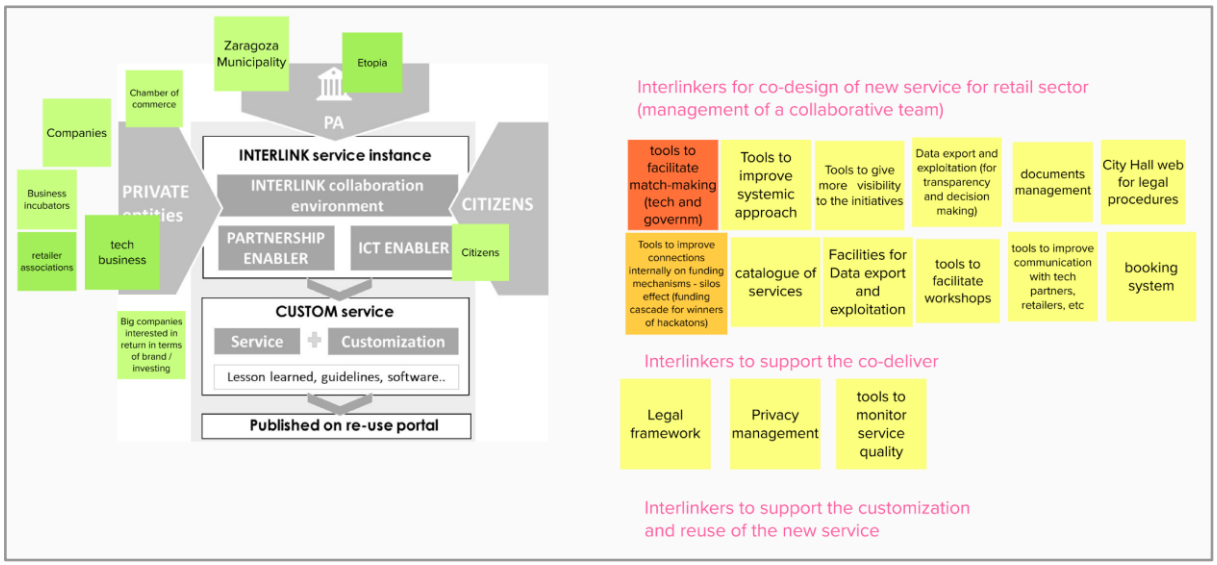


Figure 7. Mapping activity to refine use cases specificities in the different phases of the co-production process (excerpt from discussion on Zaragoza use case).

3.2 Personas, scenarios and user journeys

The goal of the second iteration was to define concrete *personas and scenarios* for each of the three use cases, in order to define the specific needs of Public Administrations in terms of INTERLINK platform functionalities and start defining a first set of INTERLINKERs (in synergy with T3.1.).
As a first step, pilots owners were asked to create *personas* relevant for their use case, and to define concrete scenarios in which the INTERLINK platform is used by these personas to carry out a co-production process for a specific service (See Templates in the Annex 2 - Template for Personas description).

Figure 8. An example of persona elaborated starting from data provided by pilot owners (example taken from VARAM use case).

User personas are representations of the platform's user base segments. They act as a benchmark for design and they encourage teams to reflect on users' needs and expectations and to design an optimal user experience. Personas are fictitious profiles based on the type of users who would be the main users of a solution, whose interactions are described in envisioning scenarios.
The template for personas description that was used in the preliminary phases of the project (see Annex 2 - Template for Personas description) is based on (Aoyama 2007; Ferreira et al. 2018; Nielsen 2019; Salminen et al. 2020). Pilot owners were asked to create at least one persona per Stakeholder group. The personas were used to define scenarios, hypothetical stories that describe concrete situations in which personas try to solve a problem using a given solution (see an example in Table 4).

Table 4. An extract of a scenario developed for the VARAM use case.

VARAM USER SCENARIO	
Personas involved in the scenario	**Ilze** - CSC employee, co-creator **Anna** - VARAM representative - co-creator, initiator of redesign/creation of a new service **Andris** - client, co-creator and final user **Katrina** - digital agent (librarian), co-creator
VARAM has the goal of improving service description forms available on the Latvian portal. Anna wants to engage relevant stakeholders, such as librarians, digital agents and NGOs representatives in the process. She would like to have an easy to access and use digital space that could be used also by users with limited digital skills and/or time. Through INTERLINK, all stakeholders access a common work space (online at home, at work or on the spot at the library) where an initial service description is created by Anna (VARAM). Anna instantiates the initial service description and defines the goal or task (e.g., "we want to improve existing description forms and make them simpler and easier to understand"). Then, Anna informs CSCs, librarians and NGOs about the instantiated service description and provides deadlines to provide their opinions. Local NGOs and CSCs, where possible, inform citizen groups and citizens that they can participate in co-creating a service. All stakeholders see the original service (its description) and provide their comments on changes/improvements. All users see all comments. Responsible authority, e.g., VARAM representative analyses and creates changes in service. Each change is rated or accepted/denied by other participants. If necessary, VARAM organizes online brainstormings with all users. Each author of the comments/suggestions receives a feedback - this can be personalized or there can be a universal response to all participants. After participants approve the new service (service description), it is considered finished and can be executed.	

After the completion of personas and scenarios, DEUSTO and FBK reviewed the material provided by pilot owners and organized bi-lateral calls to refine and close scenarios, personas and services to be delivered.

The material provided by use cases partners were worked out to reach a more comprehensive vision on the relations among the different actors engaged in the co-production process and to depict the use of the INTERLINK platform in the different phases of the process. In the figure below (Figure 9) the relationships among the different stakeholders and their possible interactions with the INTERLINK platform are represented for VARAM pilot. For each actor, the graph associates their roles and depicts the activities carried out in collaboration with other actors and the interaction with the INTERLINK collaborative environment and enablers, aka. INTERLINKERs.

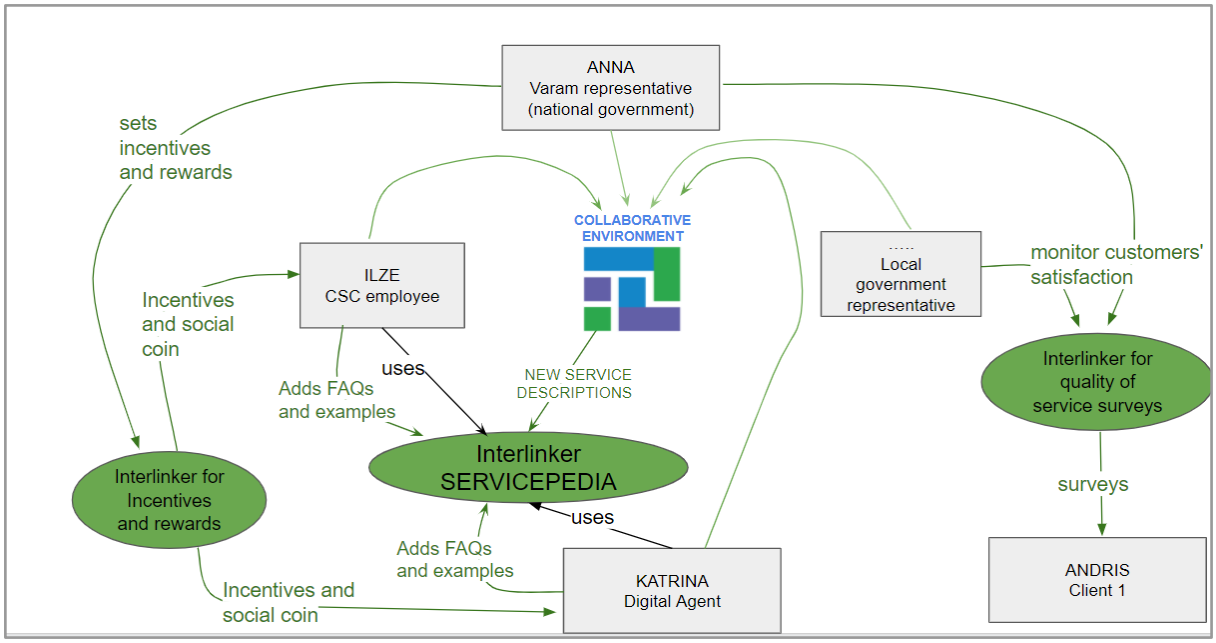


Figure 9. Relations between stakeholders and their interaction with the INTERLINK tools. Sample analysis for VARAM use case

Once the relationships among actors and collaborative activities were mapped, we could specify the technical features and components needed by actors in the main phases of the co-production process, distinguishing between engagement, design, implementation, sustainability. In Annex 3 a preliminary version of co-production scenarios for the three project use cases is provided.
Besides, user journeys were produced to hypothesize the type of interaction between users and the INTERLINK platform. See an example in Figure 10 below.

Figure 10. Sample user journey analysis for VARAM use case.

These more abstract representations led to the definition of a list of platform features and components accompanied with the identification of a first list of INTERLINKERs (detailed description of INTERLINKERs is part of T3.1. in WP3 and will be described in D3.1 - M10).

3.3 Use cases requirements

The three analyzed use cases highlight the heterogeneity of co-production processes envisaged, that differ by:

- objectives of PAs in relation to the INTERLINK platform
- actors involved in the co-production process
- level of participation of citizens and associations of citizens
- type of service to be co-produced
- resources needed to carry out the co-production process.

Next, we summarize the three use cases with related requirements as resulting from the iterative cycle previously described. A detailed description of use cases planning will be given in D5.1. while the specification of INTERLINKERs will be detailed in D3.1.

3.3.1 Latvian use case - VARAM

Ministry of Environmental Protection and Regional Development - Latvia (Acronym : VARAM)

Table 5. High-level requirements for the Latvian Use Case.

Goal	VARAM, the Ministry of Environmental Protection and Regional Development of the Republic of Latvia, has the goal to improve the service descriptions available on the Latvian State Portal (https://latvija.lv/EN), which is a portal that provides easy access to services delivered by state and local government institutions. The ambition is to make these descriptions more useful and accessible, since most of the citizens still rely on physical consultation of services through CSC (Unified State and Municipal Customer Service Centres)
Stakeholders	• VARAM: the Ministry of Environmental Protection and Regional Development of the Republic of Latvia • CSCs: Unified State and Municipal Customer Service Centres (CSCs) • Representatives of local governments • Digital agents: they have the goal of transmitting information to the public in a readily and comprehensible manner, including advice on the safe use of the Internet, and assisting the use of digital services • Non-governmental organisations • Citizens
Service(s) that will be co-produced	Through INTERLINK, the co-production team will improve service descriptions available on the Latvian portal. The improvement of these service descriptions are meant to facilitate citizens' access to public services available from the Latvian State Portal. The INTERLINK collaborative environment will be used by the network of stakeholders to define new richer service descriptions and new content will be created to better describe services.

High-level requirements	For the VARAM use case, a collaborative environment to engage stakeholders in the discussion and definition of new service descriptions should be deployed. Among the envisioned features are: discussion channels, feedback collection, documentation sharing, progress monitoring. A set of INTERLINKERs has been identified as key potential enablers: ● *Servicepedia*: INTERLINKER which allows the co-production team to annotate web documents with comments, questions, answers, terms which can be browsed, queried or even suggested to users when accessing different parts of a web document. The annotations can be voted, commented, extended by other users in a Wiki-like manner ● *Incentives and rewards*: Sustain participants engagement in the long-term and reward participation. ● *Quality of Service surveys*: Survey to monitor and assess the quality of service co-delivered ● *Partnership enablers*: regulatory framework, administrative and legal support, partnership tools to help stakeholders in identifying roles and responsibilities and guidelines to manage external agents participation in public services co-delivery.

3.3.2 Spanish use case - ZARAGOZA

Zaragoza, capital city of the Zaragoza province and of the autonomous community of Aragón - Spain (Acronym : ZGZ)

Table 6. High-level requirements for the Zaragoza Use Case.

Goal	Zaragoza and its center for Art and Technology (eTOPIA_), aims at promoting collaborative city-making facilities and programs and at improving the process of Open Innovation in the city. eTOPIA_ needs communication and co-creation tools so that the different stakeholders involved in the co-creation of new public services and initiatives (SMEs, startups, entrepreneurs, social collectives, citizens) can collaborate in particular in the co-development, co-maintenance and co-exploitation phases of the resulting new services.
Stakeholders	● Zaragoza (ZGZ) is the capital city of the Zaragoza province and of the autonomous community of Aragón ● eTOPIA_: an innovative centre for art & technology that includes both a) an Open Urban Lab, where a quadruple helix approach for innovation around Smart City & Government takes place, and b) a Terminal to incubate new companies. ● Citizens ● City Hall ● Academia ● Business (SMEs, Industry) ● Civic fabric (schools, neighborhood associations, etc) ● Artists-creators (visual, media, ...)
Service(s) that will be co-produced	Different types of co-produced services are envisaged for the Zaragoza Use Case, as resulting from the collaborative co-creation of activities exploiting eTOPIA_ facilities. An example scenario is the co-production through INTERLINK of a new school programme on Artificial Intelligence that a secondary school will co-design and co-deliver through teachers and students' engagement and by exploiting the resources and facilities of the eTOPIA_ center (facilities, equipment, mentorship).

High-level requirements	For the Zaragoza use case, a module is required to support heterogenous stakeholders (e.g. citizens, eTOPIA_ staff, PAs, private companies) in collaboratively defining new services, activities and initiatives offered from eTOPIA_ and for customizing existing services for specific uses. Specific INTERLINKERs that should be foreseen are: ● *Open & accessible service catalog*: Chart of services to make clear and transparent eTOPIA_'s offer in terms of: programs, facilities, equipement, mentorship. ● *Calendar*: to coordinate the team activities ● *Loyalty module*: to sustain participants' engagement in the long-term and reward participation.The loyalty module should be connected with the Zaragoza citizen card. ● *Resource management*: Module for the management of internal resources (places, equipement..). ● *Audience tracking and satisfaction module*: Module to track and follow up the engagement of eTOPIA_. Through this module satisfaction surveys about the services and activities launched by eTOPIA_ are administered (e.g. feedback on activities, programs, events, facilities.

3.3.3 Italian use case - MEF

Ministry of Economy and Finance - Italy (Acronym : MEF)

Table 7. High-level requirements for the MEF use case.

Goal	MEF is interested in strengthening its legitimacy by adopting a collaborative approach on service design and delivery, by directly involving external stakeholders in its business planning.
Stakeholders	● MEF Directorate's head of departments ● Head of Human Resource ● Municipality of Reggio Emilia ● Other local PA's ● MEF services operators (ex. NoiPA operators) ● Associations of citizens
Service(s) that will be co-produced	The co-production team will co-design a Participatory Strategic Planning Module (PSPM). After development by specialized IT personnel, the module will support Public Administrations in collaboratively defining Strategic Plans and share best practices in terms of strategic planning. The PSPM will be open to other public administrations and associations of citizens during both the planning and implementation phase of a Strategic Plan. Stakeholders will be able to contribute and provide feedback on strategic plans, as well as to vote action priorities and directly ask for questions. In this way, the initiating public administration can collect feedback and update the Plan taking into account external stakeholders' inputs. As a second functionality, the PSPM serves as a repository of good practices where MEF uploads strategic planning methodologies and approaches, to be freely downloaded by other public administrations and citizens' associations. After the end of the Project, the MEF will be adapting and re-using the consultation tool in-house for different transversal services provided by the MEF.
High-level requirements	MEF will leverage the INTERLINK collaborative environment to engage stakeholders such as the Municipality of Reggio Emilia and other PAs to co-design the Participatory Strategic Planning Module (PSPM). During the

	implementation phase, carried out under MEF supervision, some INTERLINKERs might be used, such as the Open Repository of Good Practices. At this stage of the project, the catalogue of INTERLINKERs has not been finalized; as a consequence, the choice of INTERLINKERs for the MEF use case is still ongoing. The following INTERLINKERs seem relevant at this point: ● *Open repository of Good Practices:* this module will be used to improve PAs' capacity with know-how. The metadata associated to the documents in this open repository will facilitate search and browsing of good practices according to different search dimensions (e.g. application domain, creator of the good practice, ...) ● *Problem exploration and co-design tools*. Guidelines, methods and templates to conduct interviews, surveys and task analysis; guidelines and templates to define personas, scenarios and user journeys. ● *Service Design specification tools.* Methods and templates to collect and share service design requirements. ● *Decision making features*: tools to support the network of stakeholders /the co-production team in collecting and sharing ideas about a service. Poll mechanisms might stimulate network members to form their opinions and vote on future strategies. ● *Quality of service monitoring*: survey to monitor and assess the quality of service co-delivered

The three use cases shed light on the variety of co-production processes that INTERLINK is asked to support. A recommendation is, therefore, that the INTERLINK platform should be able to adapt to different co-production arrangements and provide guidance to users on the most appropriate way to approach and manage the process considering different aspects:

- i) the *type of service* to be co-produced: since different types of services will be co-produced, INTERLINK should be able to provide guidance on the different resources and skills needed to co-produce the different services, considering, for instance that the design and deployment of an ICT-based service (such as in the case of MEF) requires different skills and resources with respect to co-produce a more traditional service (e.g. MEF vs ZGZ).
- ii) *Actors involved*: INTERLINK should be used by different users: National PAs (e.g. MEF and VARAM) as well as by citizens (e.g. ZGZ). This entails that the Interface should be flexible enough to be used by users that have previous experience in the co-production of services as well as by novice users with low familiarity with ICT and eGovernment concepts.
- iii) *Level of citizens participation and co-production stages in which they will be involved:* pilots differ also by the type of citizen engagement envisaged. Moreover, citizens are expected to contribute in different phases and with different goals.

For more details on the three use cases, the personas developed, the relationships between personas mediated by INTERLINK enablers, and envisaged steps of possible co-production scenarios as emerged from preliminary project activities see Annex 3 - Preliminary version of co-production scenarios for the three project use cases

4. Transversal user requirements

Transversal user requirements refer to the characteristics that a digital solution should satisfy in order to be useful and acceptable by end-users, considering different types of users, such as PAs, private companies, citizens with different skills and ICT expertise.

The adoption of a new technology is affected by a large number of factors: usability is an important factor, but other factors play a crucial role: accuracy, price, physical appearance, security, function, interoperability, and robustness are all independent factors affecting user acceptance (Kim 2014). Users' adoption of a new technology is particularly challenging in the case of innovative technologies, which typically exhibit some technical shortcomings. Moreover, different users will weigh criteria differently and might have different needs that are related to the final acceptability, and hence adoption, of a digital solution.

For the design and development of INTERLINK platform different criteria should be considered (usability, usefulness and acceptability, trust and credibility, privacy) that should be grounded on the diversity of users of the solution: PAs, private entities, citizens.

4.1 Usability

Usability is a key factor in users' engagement with e-government platforms and it refers to the ease of access and/or use of a product or website. The official ISO 9241-11 definition of usability is: "the extent to which a product can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use." A usable interface has three main outcomes:

- *Effectiveness*, which is the accuracy and completeness with which users achieve certain goals. Indicators of effectiveness include quality of solution and error rates.
- *Efficiency*, which is the relation between (1) the accuracy and completeness with which users achieve certain goals and (2) the resources expended in achieving them. Indicators of efficiency include task completion time and learning time.
- *Satisfaction*, which is the users' comfort with and positive attitudes towards the use of the system. Users' satisfaction can be measured by attitude rating scales.

Several principles for good usability have been proposed. We summarized usability principles developed by Nielsen and Molich (1990) in the following table:

Table 8. Principles for good usability developed by Nielsen and Molich (1990) .

USABILITY PRINCIPLES	DESCRIPTION
Visibility of system status	Users should always be informed of system operations with easy to understand and highly visible status displayed on the screen within a reasonable amount of time. For the INTERLINK project, in particular, this also means that if we support users throughout a complex process we should always support them in understanding where they are.

Match between system and the real world	Designers should endeavor to mirror the language and concepts users would find in the real world based on who their target users are. Presenting information in logical order and piggybacking on user's expectations derived from their real-world experiences will reduce cognitive strain and make systems easier to use.
User control and freedom	Offer users a digital space where backward steps are possible, including undoing and redoing previous actions.
Consistency and standards	Interface designers should ensure that both the graphic elements and terminology are maintained across similar platforms. For example, an icon that represents one category or concept should not represent a different concept when used on a different screen.
Error prevention	Whenever possible, design systems so that potential errors are kept to a minimum. Users do not like being called upon to detect and remedy problems, which may on occasion be beyond their level of expertise. Eliminating or flagging actions that may result in errors are two possible means of achieving error prevention.
Recognition rather than recall	Minimize cognitive load by maintaining task-relevant information within the display while users explore the interface. Human attention is limited and we are only capable of maintaining around five items in our short-term memory at one time. Due to the limitations of short-term memory, designers should ensure users can simply employ recognition instead of recalling information across parts of the dialogue. Recognizing something is always easier than recall because recognition involves perceiving cues that help us reach into our vast memory and allowing relevant information to surface. For example, we often find the format of multiple choice questions easier than short answer questions on a test because it only requires us to recognize the answer rather than recall it from our memory.
Flexibility and efficiency of use	With increased use comes the demand for fewer interactions that allow faster navigation. This can be achieved by using abbreviations, function keys, hidden commands and macro facilities. Users should be able to customize or tailor the interface to suit their needs so that frequent actions can be achieved through more convenient means.
Aesthetic and minimalist design	Help users recognize, diagnose and recover from errors. Designers should assume users are unable to understand technical terminology, therefore, error messages should almost always be expressed in plain language to ensure nothing gets lost in translation. Keep clutter to a minimum. All unnecessary information competes for the user's limited attentional resources, which could inhibit user's memory retrieval of relevant information. Therefore, the display must be reduced to only the necessary components for the current tasks, whilst providing clearly visible and unambiguous means of navigating to other content.
Help and documentation	Ideally, we want users to navigate the system without having to resort to documentation. However, depending on the type of solution, documentation may be necessary. When users require help, ensure it is easily located, specific to the task at hand and worded in a way that will guide them through the necessary steps towards a solution to the issue they are facing.

4.2 Acceptability and usefulness

Acceptability is a broader concept than usability, it is a high-level concept involving complex social, organizational, and financial aspects (Kim 2014). According to Shackel

(Shackel, 1991) users balance the following four factors when deciding to use a novel technology:

- *utility*: that is the match between user needs and functionality
- *usability*, that is the ability to utilize functionality in practice
- *likeability*: affective evaluation
- *costs*: both the financial costs and the social and organizational consequences of buying a product).

According to Hassenzhal (2005) both pragmatic and hedonic qualities of a product should be considered in the design of a new technology, their combination actually leads to positive or negative emotions and consequently guides the acceptance of the new technology. Hedonic qualities take into account the "pleasure of use" and emphasize stimulation, identification and evocation generated by the use of a system or a product. Other product features also play an important factor in the formation of user experience such as the individual characteristics of the user, the context of use and use over time to the interrelationship between user experience dimensions (Merčun 2017). Another important factor to consider is that the experience of the user with a product develops and changes over time: learnability, novelty, and pleasure may be crucial initially, but they do not necessarily motivate prolonged use. In the long term usability is valued more than hedonic features (Hassenzhal, 2005). Besides, these characteristics, and hence perceived usefulness and acceptability, strongly depend on the type of technology and its context of use: aesthetics and identification with a product may be the key components forming positive or negative user experience in some cases, while products that are more utilitarian in nature might be more dependent on the quality of interaction, perceived usefulness, and engagement.

Acceptance Model - developed by Davis (1989) - is one of the most popular research models to predict use and acceptance of information systems and technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably: i) perceived usefulness and ii) perceived ease of use.

- *Perceived usefulness* (PU) is the user's subjective probability that using a specific application system will enhance his or her job or life performance.
- *Perceived ease of use* (EOU) can be defined as the degree to which the prospective user expects the system to be free of effort.

Moreover, according to extensions of the TAM model (Venkatesh & Davis, 2000), attitude and intention to use are jointly influenced by perceived ease of use and perceived usefulness. In this perspective, attitudes as conceptualized by social psychology theory (Ajzen, 1991) have a mediating role not only on the behavioural intentions but also on the acceptance and on the continuous use of technology.

4.3 Trust and privacy

The INTERLINK platform will store and manage different types of data and this may raise issues of online privacy and security (see Deliverable D6.1). Trust and privacy are indeed key aspects that strongly impact on user acceptance of a system. Information privacy addresses the legitimate collection, use and disclosure of personal information, as well as "the interest an individual has in controlling, or at least significantly influencing the handling of data about themselves" (Lichtenstein et al. 2002). The INTERLINK platform should hence guarantee that data provided by users for the

legitimate functioning of the platform will be managed in a trusted way. Key aspects that should be considered in relation to privacy and security are taken from previous studies in the field (Cavoukian, 2012, Lichtenstein et al. 2002) and are summarized in the following table.

Table 9. Key aspects that should be considered in relation to privacy and security (Cavoukian, 2012, Lichtenstein et al. 2002).

Online Privacy Policy Guideline Category	Description
Awareness	The site/portal should facilitate user awareness on its online privacy policy (e.g. appropriate language, notification, collection, purpose for use, disclosure, third party involvement). Users should be aware of the type of private information that is required and the motivation behind the collection of specific data.
Data quality	Personal information should be maintained as complete, timely and accurate, by the company
Security	Personal information should be secured wherever possible (data transmission, cookies)
Information movement	Details of personal privacy provided in various states of information movement should be provided to the user (aggregation, transfer, personalization,..)
User identification	Use and disclosure of a user's site identifier as personally identifiable information (PII), anonymous, or pseudonymous, should be stated
Accountability	Company and user should be held accountable for actions
User access	Users should be able to access essential information related to their data and eventually modify their privacy setting. Users should have the opportunity to participate in their personal information protection, if necessary
Choice	The user should be given choices in respect to collection and use of personal information
Children's privacy	The policy should provide information regarding access by, and involvement of, children
Sensitive information	The way in which sensitive information (e.g. religion) is treated differently to other information should be explained

5. Transversal technical requirements

5.1 Requirements from the literature analysis and EU regulations

In the context of the Digital Government, some particular requirements must be taken into account, not only during the implementation phase but also at the early design or architecture modeling phases (Baheer et al. 2020). The Table below (see Table 10) summarizes a set of common characteristics of Digital Government architectures that have emerged from previous studies and projects on Digital Government. Most of these

requirements are explicitly endorsed by the EU regulations and recommendations, such as in particular EU eGovernment Action Plan 2016-2020 (EC 2016).

Table 10. A set of common characteristics of Digital Government architectures that have emerged from previous studies and projects on Digital Government (Baheer et al. 2020).

Characteristic	Description	References
Interoperability and integration	Interoperability and integration between data and applications and with various information systems	AlAbdali et al. 2019; Defriani and Resmi 2019, Helali 2011
Secure architecture	Having a secure architecture to ensure higher security of hardware and software to build trust with users	Helali et al. 2011; Cellary and Strykowski 2009; Sedek et al. 2011
Adaptability	Adaptability to changing requirements that can have technical, socioeconomic, legal, and/or political nature	Janssen (2007)
Flexibility	Flexible integration of architecture's components to better align business processes and technologies	Helali et al. 2011; Sedek et al. 2011 Janssen et al. (2003)
Reusability	Reusability of components to be used in more than one system	Mohamed et al. 2012; AlAbdali et al. 2019)
Resilience	Resilient to changes in the service environment	Yan and Guo (2010)
Compatibility	Compatibility of Digital Government architecture with the already existing infrastructures, such as legacy system and multiple public institutions integration in different environments	Helali et al. (2011)
Single Sign-On (SSO)	Providing citizens the Single Sign-On (SSO) service through a standard interface or a single window for all electronic services offered by the public sector	Drogkaris et al. 2010; Zeeshan Ali Ansari and Imran Khan 2008; Kaliontzoglou et al. 2005)
Traceability	Traceability of system operations performed by specific system users	Helali et al. (2011)
Usability	Usability i.e., providing functions that are required for better system performance	Helali et al. 2011; Cellary and Strykowski 2009
Cross-border	Cross-border characteristics i.e., providing Digital Government services in an international context and managerial settings in terms of G2C and G2G	Helali et al. (2011)
Scalability	Scalable to host a large number of digital services	Helali et al. 2011; Sedek et al. 2011
Legality	Providing Digital Government services according to relevant legislation and judiciary	Helali et al. (2011)

Cost-effective	The architecture should be implemented in a way that the deployment and operation resources are kept to a minimum	Helali et al. 2011; Sedek et al. 2011; Cellary and Strykowski 2009
Technological neutrality	The architecture must ensure that no components included in its definition advocate specific suppliers	Moreno et al. (2014).
Platform independence	The architecture is not dependent on particular technology platform implementation nor assumes a particular technology	Moreno et al. (2014)
Minimal learning curve	Giving limited training to government employees to implement or use the architecture	Helali et al. (2011)
Comprehensibility	The architecture should be well-defined, and understandable with strategic clarity by the Digital Government leaders	Agarwal et al. (2017)
Citizen-Centric	The Architecture must be designed in a way to support the strengthening of the relationship between citizens and the government	Moreno et al. (2014)

5.2 Specific technical requirements for the INTERLINK platform

One of the pivotal concepts of the INTERLINK project is the INTERLINK Platform which is supposed to serve (i) as an integration basis for a set of INTERLINKERs (common building blocks, provided as software tools or in the form of knowledge assets offered digitally, that exhibit interoperable, re-usable, EU-compliant, standardized functionality for the public service) and (ii) as a facility to bind together particular INTERLINKERs in order to implement functionality of particular public services out of those building blocks.

Requirements for the entire set of INTERLINKERs as well as design and interface specifications per each INTERLINKER in the catalogue are covered by WP3 in corresponding chapters of this and other project documents (See Section 6.3 Common requirements for INTERLINKERs and D3.1). In addition to that, there are several technical requirements which apply to INTERLINKERs from the Platform perspective. Among such requirements there are for example:

- Use of the same authentication mechanism between the Platform and each INTERLINKER integrated into the platform based on SSO (Single Sign On), Auth2 and OpenID technologies; external SaaS Software Services may either share the same authentication mechanism with the Platform or use their own implementation compliant with the project security requirements (for example, anonymized feedback collection may rely on Facebook, Twitter or other social network authentications if the survey is addressed to the general public rather than within the co-production team);
- Integrability into Platform: various levels of integration are envisaged, via REST API, custom API or integration at data level (more details below);
- Data management in compliance with GDPR and project standards;

- Compliance with EU regulations, FAIR and CEF principles.

Ongoing research work in WP3 and in WP5 related to the project pilots has identified the following "co-creation" processes within the lifecycle of a public service:

- **Co-production of a new public service from scratch**: a process which includes feasibility research, co-design, and possibly (depending on whether it is a SW module development or a digital asset) co-implementation stages. These stages are described in more details in Chapter 2.1 of this document.
- **Co-design and co-implementation of a particular INTERLINKER** (a building block needed for a particular public service) either in the form of a *pluggable* SW module or a digitalized asset (guidelines, training materials, reusable templates, etc). We should distinguish between co-production of (a) INTERLINKERS being digital assets and non-SW modules, (b) co-production of very use-case specific SW modules within the collaborative environment (using discussion boards, voting mechanisms, etc) and (c) possible co-production of INTERLINKERS which themselves are part of the collaborative environment (as when PAs and other stakeholders are involved to co-design new functionalities to extend the platform collaborative environment for an optimal support to governance models).
- **Co-production of a particular public service based on an existing service (reuse)**: a process which includes feasibility research, co-design including the investigation of existing public services, and an implementation phase that may involve different levels of reusability and complexity. The reuse may, in fact, may be as simple as the configuration of existing solutions to the new context, or to the need to swap some of the INTERLINKERS used in previous instances of the public service, or even more sophisticated changes to the original source code of some software modules to fit the new situation.
- **Co-delivery of a public service** in a sense of **co-execution** (collaborative operation of a public service) and *delivering* of its results to the users.

According to the "co-creation" processes described above, and depending on the use of particular INTERLINKERs in those different processes, we should distinguish between the following types of enablers, irrespective of the fact that they may have similar functionality or even same implementation:

- **Public service co-production INTERLINKERs**, i.e., the knowledge and digital solutions, including the functionalities of the collaborative environment, necessary to support and implement a particular public service co-production activity (e.g., discovery, engagement, design, etc.). These solutions are not part of the public service itself, but are used to support (organize and manage) its co-production.
- **Public service operational (co-execution) INTERLINKERs**, i.e., the digital solutions that are *adopted* by the co-production teams to be part of the public service implementation and operation. Public services will normally orchestrate one or many operational INTERLINKERs that aid them offering their business logic.
- **Platform tools:** a special set of SW modules whose functionalities are focused rather on internal platform processes such as user authentication, process flow management, platform front-end with graphical wizard GUI, etc. Such SW

modules can be also used during the public service execution process, but rather on platform side and not as building blocks selectable from a catalogue per public service.

From the technology perspective, all INTERLINKERs can be classified in the following way:

- *By type of their functionality*:
  - A kind of content / document management system (wiki-based web servers, document/file servers, etc)
  - A kind of resource management system (event management, reward management, etc)
  - A kind of customer relationship management system (discussion boards, feedback collection, voting, etc)
- *By type of their implementation and software licenses*:
  - Open-source software with freeware license, so we can copy and modify their source code;
  - 3rd party software which is non open-source code, with freeware or commercial license, so we can possibly run that SW as is but not modify it;
- *By availability of open API to integrate that SW*:
  - freeware and open-source software that can be integrated either via their existing API or by adding a necessary API to it;
  - 3rd-party software with an open API that can be integrated within the functionalities provided by that API.
  - 3rd party software which does not provide open API, so it can only be used as a remote cloud software service (SaaS) and can not be directly integrated into the INTERLINK platform. For this type of INTERLINKERs, users could be redirected to use the SW service on the SaaS web site or a frame in the INTERLINK portal front-end could be created to be taken over by the 3rd party software (integration at UI level).

Depending on these types of INTERLINKERs, particular blocks can be (or can not be) integrated into the INTERLINK platform to different extents:

- *Deeply integrated*: mostly for platform tools or custom SW modules, including building blocks used in the public service co-production process;
- *Intermediate or loose integration*: most of (re-usable) INTERLINKERs in the catalogue;
- *Not integrated*: those optional external software services (SaaS) which do not provide an open API for their integration. Such "external" INTERLINKERs may be only used under compliance with security and data protection policies. They may be considered as "integrated at human process" level, when users manually indicate in the INTERLINK platform workflow that the workflow step based on external software services has completed successfully.

Depending on type of integration into the platform, the architectural patterns to use could be

- *Microkernel architecture* (so that platform tools should be mostly integrated into platform core as kind of plugins)
- *Microservices architecture* (for non-platform tools kind of INTERLINKERs).

Based on the described above processes within a lifecycle of a public service, we may distinguish between the following two versions of INTERLINK Integration Platform:

- INTERLINK public service co-production platform and
- INTERLINK public service (co-) execution platform.

These two platform versions may have very similar architecture, workflow, list of SW modules (INTERLINKERs), and in cases of some relatively simple public services (with INTERLINKERs as either digital assets or same as co-production INTERLINKERs) they may almost coincide. But in general, for a relatively complex custom developed SW module, the amount of time and effort required to develop such an INTERLINKER and to integrate it into a public service execution platform may be significant. That's why, we consider the public service execution platform to be outside the scope of the current Project, except for the pilot testing for the 3 basic Project's use cases (VARAM, ZGZ and MEF).

One of the requirements to the INTERLINK platform is its openness for possible extensions in the future with new a priori unknown building blocks (SW modules) required for new a priori unknown public services. This implies, strictly speaking, a high level of uncertainty for possible efforts on SW development of a future INTERLINKER and on their integration into a corresponding version of public service execution platform. Thus, in a very general sense, some specific versions of public service execution platforms for particular complex future public service may be considered as separate projects or corresponding extensions of the current INTERLINK Project. In this sense, within the scope of the current Project, we will mostly assume the INTERLINK platform as being the platform for co-production of public services.

The major functional requirements for INTERLINK (public service co-production) platform are:

- To host a catalogue of INTERLINKERs (as building blocks for public services)
- To use co-production INTERLINKERs in the co-production process of public services
- To allow the configuration and binding together of public service operational INTERLINKERs during the public service co-production process
- To implement and manage processes within the co-production of public services
- To store newly created public service (digital objects) into a catalogue of public services for potential reuse
- To serve as architectural template for the public service execution platform as a possible extension of the public service co-production platform

The conceptual architecture of the public service co-production platform is shown in the Figure 11 below.

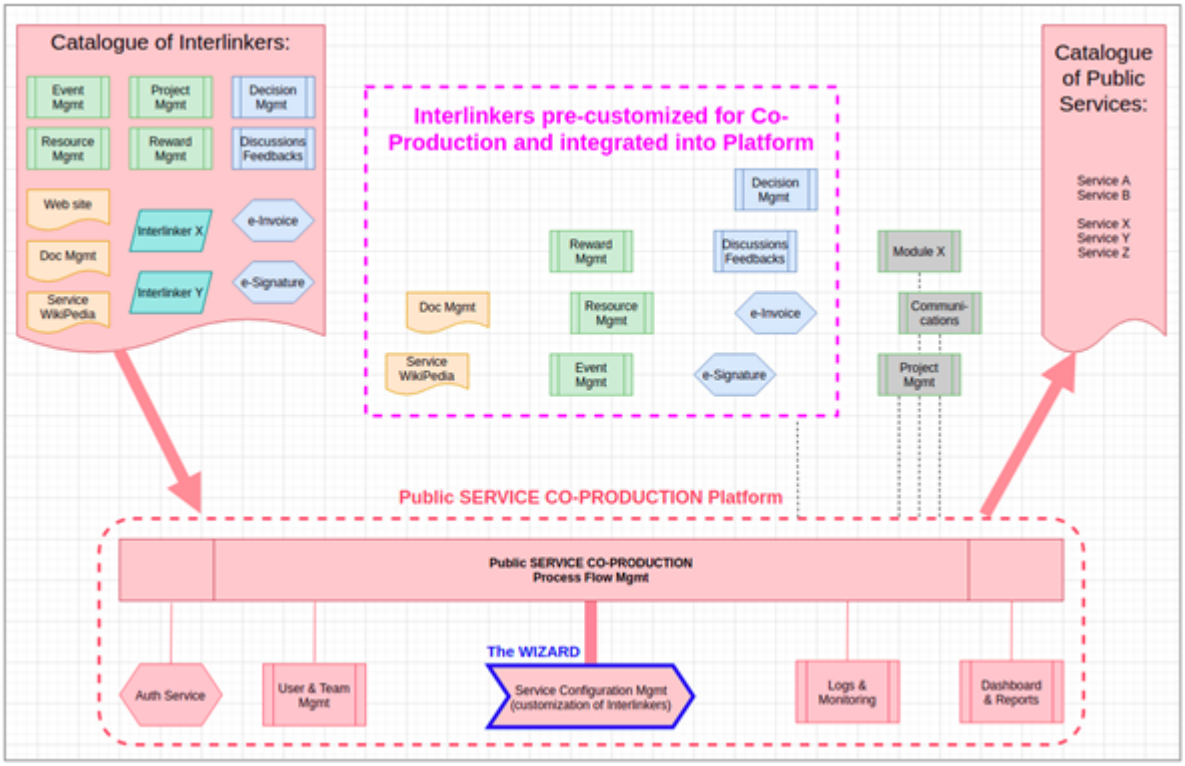


Figure 11. Conceptual architecture diagram of public service co-production platform. Schematic representation of the different categories of INTERLINKERs and platform tools that interact within the INTERLINK platform

As illustrated in the diagram, the main workflow is managed by the public service co-production process flow manager, which is the core of the platform. It implements the generic workflow functionality on the back-end side. The front-end will behave according to the implemented process workflow, with special user-friendly graphical wizard GUI, which will represent visually part of the workflow processes and will have the following two major functionalities:

- Guide users through the public service co-production processes by stages
- Guide users in the selection of available INTERLINKERs out of their catalogue by parameters and features, desired by users for particular public service being co-produced.

The INTERLINKER blocks shown in the center of the diagram in Figure 11 represent those of public service co-production type, since they are especially adapted and integrated into the public service co-production process. In contrast, similar building blocks shown in the catalogue of INTERLINKERs on the left hand side represent generic blocks, re-usable, but not yet customized for a particular public service.

In terms of data model, the result of the public service co-production workflow will be a public service object, which will be composed of customized INTERLINKERs objects and will contain meta-data about included source code for traceability, public service deployment and run-time configurations, as shown in the Figure 12 below. (More details on these aspects will be described in deliverable D5.1.)

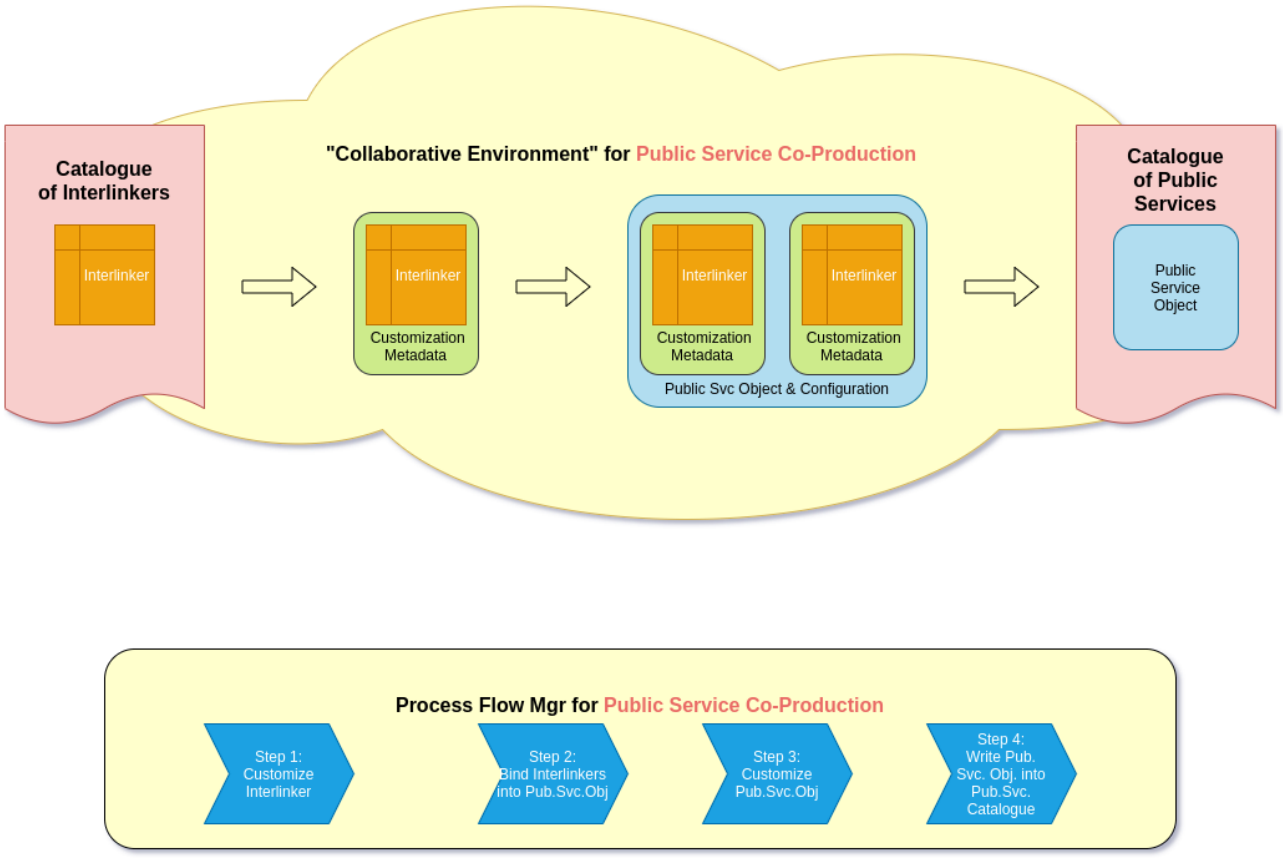


Figure 12. Composition of public service data object of corresponding INTERLINKERs data objects with corresponding configuration meta-data.

The public service co-production platform should also satisfy the following non-functional requirements:

- *Reliability*: both platform core back-end and platform front-end parts, as well as the public service co-production INTERLINKERs, should be available in 24/7 mode with minimal manual interventions (e.g. being able to restart automatically in case of power or infrastructure interruptions);
- *Scalability*: the Docker/Kubernetes technologies should provide easy scaling up of SW services in case of increase of use activities;
- *Maintainability*: the platform core and the platform tools should be designed and implemented in a way which minimizes manual actions on platform operations, which should be clearly logged and monitored;
- *Configurability*: each component (core public service co-production process flow manager, platform tools, as well as all of the integrated INTERLINKERs) should store configuration metadata in a Project common database or data warehouse; the configuration metadata should be properly versioned, archived and easily operated with a configuration manager GUI tool to allow easy re-configuration of each new instance of the INTERLINK platform being deployed in a new EU region. In order to promote **component and service reuse** such metadata will be used to recommend or suggest suitable INTERLINKERs or existing public services depending on the user context.

All the platform core components, platform tools and most of INTERLINKERs will be orchestrated using Docker images running on INTERLINK Kubernetes cluster (on Amazon AWS cloud).

The data operated by platform core, platform tools and deeply integrated INTERLINKERs (and locally running microservices) will be hosted within the INTERLINK cloud. Only data operated by INTERLINKERs which are remote 3rd party cloud software services (SaaS) could be stored remotely on cloud clusters belonging to that software services (e.g. Google Documents, etc). In such cases the compliance with GDPR and security requirements must be ensured.

6. List of socio-technical requirement descriptions

This second part of the deliverable digests the knowledge described in the previous sections into a list of selected requirements directly relevant for the INTERLINK project. It is conceived as a technical inventory, to be used as a reference guide by project partners to inform development decisions and perform regular evaluation measurements. The gathered list of socio-technical requirements aims at: (i) identifying desired functionalities that the INTERLINK platform needs to expose to effectively guide the co-production process and the collaborative work of a network of stakeholders; (ii) collecting functional needs that pertain to concrete examples of co-production projects, as emerged from the three INTERLINK case studies; (iii) identify the common technical requirements to be satisfied by INTERLINKERs and the overall platform architecture.

6.1 Requirements for co-production guidance

The set of requirements for co-production guidance is particularly important for the design of the INTERLINK platform front-end and includes:

GUID.REQ.1 - Raise awareness on co-production models
GUID.REQ.2 - Step-by-step guided co-production flow
GUID.REQ.3 - Go-no-go strategy
GUID.REQ.4 - Catalogue of INTERLINKERs
GUID.REQ.5 - Catalogue of Public Services
GUID.REQ.6 - Catalogue of success stories
GUID.REQ.7 - Customized views for stakeholders (PA, citizens, SME) and Users
GUID.REQ.8 - Support the co-production team in overcoming barriers related to government and PAs adoption of ICT for co-production

ID	GUID.REQ.1
Name	Raise awareness on co-production models
Requirement type	Functional requirement
Content/description	The INTERLINK platform should raise awareness and provide easy to understand information about the different types of co-production models and

	co-business models, considering that INTERLINK users have different expertises and heterogeneous levels of knowledge on co-production processes. INTERLINK should provide guidance on the available partnership processes for the public-civic-private co-creation and co-delivery of public services and enhance users' awareness of the importance of considering sustainability aspects since the beginning of the process.
Motivation/rationale	Co-production is a broad concept: the spectrum of public service delivery is defined by a number of variables (Linders 2012) , in particular should be considered i) the level of citizens participation, ii) the spectrum of government-citizen relationships, iii) the type of service, iv) sustainability models.
Fit Criterion (Measurable)	Information provided by INTERLINK on the governance models are available and understandable by different target groups, including PAs, citizens, private companies representatives. During the project pilots this requirement will be evaluated with actual stakeholders. A specific task in the project workplan (T5.3) is in charge of user engagement activities and thus, of investigating and evaluating methods on raising awareness on co-production models.
Author	FBK
Revision	v1

ID	GUID.REQ.2
Name	Step-by-step guided co-production flow
Requirement type	Functional requirement
Content/description	INTERLINK should support users in managing the different phases of a co-production process, namely: co-design (comprising engagement and design) and co-delivery (comprising implementation and sustainability). A step-by-step guided co-production flow should be integrated in the INTERLINK platform to support actors in coping with the different challenges of a co-production process and use the most appropriate resources and INTERLINKERs (defined in T3.1) at the different stages of the process. INTERLINK should provide PAs and other actors guidance to: - evaluate and monitor the availability of needed resources and eventually support the co-production team to find adequate external resources (e.g. expertise, financial resources, etc). - structure and coordinate a collaborative effort - provide guidance on the most appropriate INTERLINKERs to be used in the different phases This requirement opens the way to different design solutions that can be implemented to support users in managing the process and finding the most appropriate resources at the right time, such as for instance matchmaking mechanisms and wizard functionalities that match users needs and expectations with INTERLINK features. A more detailed description of the software solution will be included in D4.2. and D4.3.
Motivation/rationale	A number of challenges exist that can lead to the failure of a co-production process such as the lack of analytical, operational and political resources and capability that are required to carry out successful co-production initiatives

	(Howlett and Ramesh, 2017). Besides, there may be different co-production paths according to different government models and types of services. Guidance provided by INTERLINK should be acceptable, flexible enough to accommodate different types of co-production models with different needs and goals.
Fit Criterion (Measurable)	Availability in INTERLINK platform front-end of a Collaboration Environment powered with matchmaking or wizard-like tools for teams' co-production flow management and support.
Author	FBK
Revision	v1

ID	GUID.REQ.3
Name	Go-no-go strategy
Requirement type	Functional requirement
Content/description	A strategy that supports the co-production team in iteratively evaluating whether the service is feasible and viable in the longer run (sustainable) or not, and hence decide if it is worth continuing the co-production effort for is eventual integration in the INTERLINK solution.
Motivation/rationale	INTERLINK should support PAs and other stakeholders in analyzing the needed resources for carrying out a co-production process, encouraging the co-production team in reflecting and assessing under what conditions and constraints the initiative is likely to succeed or fail. Proceeding across the different co-production phases (design, etc) should not be hastened until a common understanding within the co-production team has been reached and that the service concept has enough potential which justifies further development.
Fit Criterion (Measurable)	Availability of a checklist per co-production stage so that transition from it to the following is verified before committing to continue the co-production process. As a first step, co-production teams will go through the checklist and confirm their fulfilment manually. A future evolution of this facility might give place to a score on different sustainability criteria based on a set of questions issued through a wizard-like tool.
Author	FBK
Revision	v1

ID	GUID.REQ.4
Name	Catalogue of INTERLINKERs
Requirement type	Functional requirement

Content/description	The catalogue of INTERLINKERs is a software component that contains all the available INTERLINKERs, that are building blocks fostering co-production that will be specified in WP3. It will index INTERLINKERs' metadata so that advanced search and matchmaking can be performed over the available enablers. Features associated to the Catalogue of INTERLINKERs are: ● *User exploration (search & find)*: INTERLINKERs can be be explored and browsed thanks to a number of filters/categories that depend on the INTERLINKERs classification: ○ Co-production process phase (e.g. engagement, design,.) ○ Co-production activity (e.g. communication, raising awareness,..) ○ Placement of the artifact in the SOC mapping (Specification, Enabling Service, Operation Service, Enhancing service, or an accompanying Service Documentation) - this search filter is of particular interest to technical users and developers of INTERLINKERs ○ Corresponding digital problem (Core Profile) tackled by the INTERLINKER. ○ Nature of the INTERLINKER: Software INTERLINKERs (referred to as IT Enablers in the project description, e.g., various digital tools for decision making, group and activity coordination) and Knowledge (partnership tools, templates, canvases, best practices, guidelines). ○ Involved stakeholders – the intended user types for the INTERLINKER, being, for instance, citizens, PA and their representatives, SMEs, etc. This should be further refined in roles w.r.t. the co-production process. ○ Context in which the INTERLINKER is applicable. ○ Usage in the INTERLINK platform. ○ Associated INTERLINKERs ● *Use of the INTERLINKERs*: INTERLINKERs can be selected from the catalogue to be reused. INTERLINKERs are associated to a set of resources, depending on the type of INTERLINKER (e.g. Knowledge vs ICT-based INTERLINKERs): ○ Software INTERLINKERs: a procedure with all steps and actions that are needed for the initialization and deployment of a new instance of the resource, such as source code/ reference to implementation, Licensing, lessons learned, etc. ○ Knowledge INTERLINKERs: guidelines, best practices, canvas ● *Rating, promotion and feedback of INTERLINKERs*: end users might be able to rate available INTERLINKERs so that those highest ranked appear at a more relevant place in the catalogue, add comments providing feedback about their experience using them, suggesting changes to be performed or promoting their usage by disseminating information about them in social media.
Motivation/rationale	INTERLINK aims to simplify the co-delivery of public services by promoting the reuse of ready-made building blocks or enablers (INTERLINKERs) among those stakeholders willing to tackle the joint co-production of innovative and sustainable public services, which might be triggered following a top-down, bottom-up or even a hybrid approach. For that, it is essential to publish a range of illustrative value-added INTERLINKERs that will encourage adopters of the INTERLINK governance model and supporting platform to facilitate their co-production of brand new or derived public services leveraging those available enablers. The success of INTERLINK highly relies on making available to the

	Open Government community a significant range of useful widely-adopted INTELINKERs which can be integrated into different public services belonging to diverse cross-European public administrations.
Fit Criterion (Measurable)	Availability of an INTERLINKERs catalogue populated with useful widely reusable knowledge and software INTERLINKERs. The ambition is to populate the catalogue with at least 10 INTERLINKERs by April 2022 (M16) when the 1st pilot evaluation iteration takes place. The 2nd iteration of piloting will start in M27 (March 2023) and another additional 10 INTERLINKERs are envisaged.
Author	FBK, DEUSTO
Revision	v1

ID	GUID.REQ.5
Name	Catalogue of Public Services
Requirement type	Functional requirement
Content/description	The catalogue of Public Services is a software component that contains a range of exemplary public services which might be adopted, refined and extended by third PAs and their corresponding stakeholders. The aim of such catalogue is to ease finding and selecting relevant public services to those in need to embark on a new public service co-production which might have resemblance with a previous INTERLINK-powered public service. In INTERLINK, a new public service can be co-producted from scratch orchestrating a set of already readily available INTERLINKERs or giving place to new INTERLINKERs demanded. On the other hand, INTERLINK also allows a co-production team to import an existing public service, customizing, adapting and extending it to the actual needs and objectives set by the co-creation team. In this context, the existence of such a catalogue to be able to browse, search and select available public services is paramount to realize the INTERLINK mission as a facilitator of sustainable widely adopted public services. Features associated to the Catalogue of Public Services are: • *User exploration (search & find)*: Public Services can be explored and browsed thanks to a number of filters/categories that depend on the public services classification criteria: purpose, categories, public administration type, stakeholders involved, license model, deployment model and so on. • *Use of the Public Services*: public services can be downloaded or accessed through intermediary code repositories, e.g. GitHub, from the catalogue to be reused. Licensing and documentation on how to enable deployment of such public services will be an integral part of each public service view. • *Rating, promotion and feedback of public services*: end users might be able to: rate available public services so that those highest ranked appear at a more relevant place in the catalogue, add comments providing feedback about their experience using them, suggest changes to be performed, or promote their usage by disseminating information about them in social media. Very importantly, new published public services will also be linked to those public services which served as inspiration or that were extended.

Motivation/rationale	INTERLINK aims to simplify the co-delivery of public services by promoting the reuse of existing public services and ready-made building blocks or enablers (INTERLINKERs) among those stakeholders willing to tackle the joint co-production of innovative and sustainable public services. The success of INTERLINK highly relies on making available to the Open Government community a significant range of useful widely-adopted INTELINKERs and public services employing them so as to demonstrate their usefulness. Concretely, in the Project an average of 2 public services will be created at each of the 3 pilot sites involved.
Fit Criterion (Measurable)	Availability of Public Services catalogue populated with useful, widely reusable, public services. The ambition is to populate the catalogue with at least 3 public services by April 2022 (M16) when 1st pilot evaluation iteration takes place. The 2nd iteration of piloting will start in M27 (March 2023) and another additional 3 public services are envisaged.
Author	DEUSTO
Revision	v1

ID	GUID.REQ.6
Name	Catalogue of success stories
Requirement type	Functional requirement
Content/description	The catalogue of success stories describes how INTERLINK and INTERLINKERs have been used to carry out specific co-production processes. Success stories should support end-users in understanding the value of using the INTERLINK approach (its associated governance model and collaborative environment) and the INTERLINKERs provided through the platform. Success stories can be browsed according to some criteria: 1) Type of INTERLINKER used, 2) Application field, 3) Type of service co-produced. Success stories will be cross-linked to INTERLIKERs and public services available in their respective catalogues.
Motivation/rationale	Success stories and examples can support users to better understand how INTERLINK can support actors in the co-production process.
Fit Criterion (Measurable)	Measure the number of success stories and examples that are used to initially populate the INTERLINK platform. Publication of 3 success stories per iteration is envisaged during the project execution.
Author	FBK
Revision	v1

ID	GUID.REQ.7
Name	Customized views for stakeholders (PA, citizens, SME) and Users
Requirement type	Functional
Content/description	INTERLINK platform should provide customized views to the different

	stakeholders and end-users of the platform. Tailored information about co-production process and how to engage with INTERLINK platform should be provided in order to meet end-users expectation and to guarantee users accessibility to the available resources. Moreover, recommendations on the most appropriate co-production model should also be tailored to the end-users.
Motivation/rationale	Possible participants of the co-production team can be divided into four main groups (according to the Quadruple Helix approach for innovation) 1) public authorities, 2) citizens, 3) businesses and private non-profit organisations and 4) research organisations. These different target groups have different motivations and values to participate in a co-production process and to use the INTERLINK platform. They also might have different levels of familiarity with co-production processes and with ICT. The INTERLINK platform will offer the following user roles: a) *admin role*, usually associated to a PA responsible for the deployment and maintenance of the INTERLINK platform; b) *co-producer role*, associated to users in a collaboration team who take an active part in the different phases of the co-production of a public service; and c) *consumer role*, associated to users that browse INTERLINK platform, review INTERLINK approach discovery materials, success stories, assets and can rate and comment them.
Fit Criterion (Measurable)	Availability of *admin, co-producer and consumer views* in INTERLINK platform front-end. Two versions will be available before each pilot evaluation iteration and one final version before the Project ends.
Author	FBK
Revision	v1

ID	**GUID.REQ.8**
Name	Support the co-production team in overcoming barriers related to government and PAs adoption of ICT for co-production
Requirement type	Non functional
Content/description	INTERLINK platform should provide guidance on how to cope with challenges related to the adoption of ICT for co-production Garcia et al. (2019). Strategies to cope with these issues should be foreseen: ● **Financial capacity** is a common barrier to a government's promotion of ICT-enabled coproduction. --> INTERLINK should provide guidance on sustainability issues, and on how to select the most appropriate ICTs considering different aspects. ● **Technical capacity** constitutes a barrier to ICT-enabled co-production as well as lack of planning for the day-to-day ICT use → INTERLINK should provide clear and easy to access information about co-production processes, explaining the different expertises needed to carry out an ICT-enabled co-production process. Besides, guidance on how ICT can be exploited throughout the whole co-production process might be provided (e.g. practical recommendations, best practices, risks related to potential technical failures, etc)

	• **Legal issues**: The complexity of legal regulations can prevent governments from taking up ICTs to co-produce and can cause significant delays in the deployment of solutions → INTERLINK should provide a clear regulatory framework that promotes deployment of ICTs to facilitate co-production. • **Cultural barriers:** Negative perceptions and fears on the part of government staff about ICTs may undermine their roles → INTERLINK should provide flexible and adaptable solutions that do not introduce additional bureaucracy to processes.
Motivation/rationale	Garcia et al. 2019 ICT-enabled co-production of public services: Barriers and enablers. A systematic review. In Information Polity 24(4):1-24.
Fit Criterion (Measurable)	Availability of set of guidelines and checklists to aid co-productions teams to overcome financial, technical, legal and cultural obstacles associated with sustainable co-production of services and assess whether such obstacles have been overcome in each co-production process.
Author	FBK
Revision	v1

6.2 Requirements for ICT support to collaboration projects

This set of requirements is particularly important for the design of the INTERLINK collaborative environment and includes:

COLL.REQ.1 - Project creation and management
COLL.REQ.2 - Team management and coordination
COLL.REQ.3 - Registration / Authentication
COLL.REQ.4 - User profile
COLL.REQ.5 - Collaboration environment
COLL.REQ.6 - Building blocks for service implementation

ID	COLL.REQ.1
Name	Project creation and management
Requirement type	Functional requirement
Content/description	INTERLINK allows registered users to create a "project", that is a new co-production initiative described by a set of metadata fields (e.g. Title, objectives, description, resources - some are mandatory some are non mandatory). Related functionalities are: • Invitation to join the project: users can add members to a project through personal email • Monitoring co-production progress of project and tasks issued at each stage, e.g. current phase in co-production process, assets generated in each covered phase, validations (go-no-go) overcome in earlier stages, status of tasks assigned. • Project cancellation: The project can be cancelled by the user who created the project

	• Visibility of the creator of a project: A collaborative venture needs a reputable stakeholder to play the role of initiator and facilitator of the collaboration, i.e. the "convener" of the collaborative network (Svendsen and Laberge 2005; Jamal and Getz 1995).
Motivation/rationale	Co-production is a joint venture that requires a long-term collaboration of heterogeneous stakeholders to reach a shared goal (service co-created). A new project can be initiated by different actors, e.g. local or national PAs, private entities, NGOs, citizens, representatives of citizens associations.
Fit Criterion (Measurable)	Availability of front-end screens to create a new co-production project, associate to it a team, assign tasks, monitor progress and share resources among team members
Author	FBK
Revision	v1

ID	COLL.REQ.2
Name	Team management and coordination
Requirement type	Functional requirement
Content/description	INTERLINK should support group activities through different features: • possibility to send invitations to external users to join the project (.e.g email) • visualization of the members/participants of the project and their role within the project • Workplan management • Information and data sharing • Tasks distribution among team members • Tracking of project progress • Ideation and decision making • coordination tools (e.g. calendars and Doodle like functionalities)
Motivation/rationale	INTERLINK should encourage different actors to collaborate toward a shared goal. The co-production teams should hence be supported in managing a collaborative network(s) of stakeholders that should be quickly visible in order for team members to understand roles and responsibilities and facilitate the collaborative effort.
Fit Criterion (Measurable)	Closely linked to "Project creation and management" requirement. It will be validated by the availability of a usable set of screens that allow to manage teams involved in co-production projects and coordinate their work (task) and contributions (assets).
Author	FBK
Revision	v1

ID	COLL.REQ.3

Name	Registration / Authentication
Requirement type	Functional requirement
Content/description	INTERLINK should: • ensure controlled access to the co-production projects • support secure login to the platform • ensure that users who register into INTERLINK platform are able to use the same credentials for authenticating themselves into all components from the platform. • manage the individual account or management of a corporate account. • support the use of existing account (e.g. Google, Facebook) to facilitate registration and authentication
Motivation/rationale	INTERLINK registration process should ensure controlled access to the co-production projects and be easy to use for users in order to facilitate registration to the platform, considering different users groups with different levels of ICT skills
Fit Criterion (Measurable)	Availability of a single sign-on solution (SSO) which is also compatible with CEF eIDAS.
Author	FBK
Revision	v1

ID	COLL.REQ.4
Name	User profile
Requirement type	Functional requirement
Content/description	Registered users can create a personal profile that will be visible by other members of the co-production team. INTERLINK will require some mandatory information (e.g. Name; Surname; e-mail) and some non mandatory information (Role, Organization, picture, skills, interests…). User personal profile can be modified or deleted. Users' data notified by the data sources must be stored by the platform in order to make them usable when necessary. INTERLINK wishes to encourage fulfilment of CEF Once Only Principle[10]. Hence, user profile should allow to manage common data fields input by a user in its iteration with other public services, to avoid reentry of data, whenever the user consents access.
Motivation/rationale	INTERLINK collaborative environment should guarantee trustworthiness of the members and transparency about members of the co-production team. (WeLive D1.5, requirement CDV.2)
Fit Criterion (Measurable)	Availability of use profile management module which complies with Once Only Principle.
Author	FBK
Revision	v1

[10] https://joinup.ec.europa.eu/collection/connecting-europe-facility-cef/solution/cef-once-only-principle/about

ID	COLL.REQ.5
Name	Collaboration environment
Requirement type	Functional requirement
Content/description	The collaboration environment should support the team members to carry out different type of tasks: ● to share files and information ● to communicate with each other regardless of their physical location ● to jointly work on a project or a task seamlessly on a real-time basis. The collaboration environment should support the teams with three basic functionalities: a) communication; b) team management and c) knowledge sharing. Some of their main features might be: Project Management, Instant Messaging, Video Conferencing, Synchronous Document Management, Creating & Sharing Content, Informative Calendar, Online Whiteboard, Interactive Dashboard, Powerful Search, Centralized Repository This requirement will be further investigated in detail in task T3.1.
Motivation/rationale	The INTERLINK collaborative environment has to ensure that the INTERLINK governance model can be applied in the co-production of public services. Such an environment should facilitate the online and offline collaboration of different team members towards their common aim. Progress should be traced by managing tasks and deliverables associated with those tasks.
Fit Criterion (Measurable)	A useful and accessible collaborative environment successfully validated in the creation of several co-produced public services.
Author	FBK
Revision	This requirement will be further detailed in D3.1

ID	COLL.REQ.6
Name	Building blocks for service implementation
Requirement type	Functional requirement
Content/description	For VARAM use case: ● *Servicepedia*: group of functionalities which allows the co-production team to annotate web documents with comments, questions, answers, terms which can be browsed, queried or even suggested to users when accessing different parts of a web document. The annotations can be voted, commented, extended by other users in a Wiki-like manner ● *Incentives and rewards*: Sustain participants engagement in the long-term and reward participation. ● *Quality of Service surveys*: Survey to monitor and assess the quality of service co-delivered ● *Partnership enablers*: regulatory framework, administrative and legal support, partnership tools to guide stakeholders in identifying roles and responsibilities and guidelines to manage external agents participation in public services co-delivery. For Zaragoza use case:

	• *Open & accessible service catalogue* of services and activities arranged in eTOPIA_ Open Innovation and Science building • *Calendar* of events and activities organized in eTOPIA_ • *Loyalty module* to acknowledge attendance and contributions to eTOPIA_ • *Resource management* of facilities provided from eTOPIA_ • *Audience tracking and satisfaction module* for activities in eTOPIA_ For MEF use case: • *Open repository of Good Practices* • *Problem exploration and co-design tools* (e.g. tools for interviews, surveys, task analysis templates for personas, scenarios and user journeys) • *Service Design specification tools* (e.g. Service design requirements templates) • *Decision making features* (e.g E-voting, Ideas crowdosourcing) This requirement will be further investigated in detail in tasks T3.1 and T5.1.
Motivation/rationale	Facilitate a set of enablers, both software- and knowledge-type INTERLINKERs, which can be integrated in the public services made available in the 3 pilots and which have a good potential of being reused in other pilots for 2nd iteration or by external parties.
Fit Criterion (Measurable)	Availability of at least 2 new INTERLINKERs per pilot integrated in 1 new public service per pilot for the beginning of iteration 1. Again, for iteration 2, 2 new INTERLINKERs will be made available for yet another new public service per pilot. The created INTERLINKERs and public services should be published in the respective catalogues by M16 and M27.
Author	FBK, DEUSTO
Revision	This requirement will be further detailed in D3.1

6.3 Common requirements for INTERLINKERs

The common requirements for the development of INTERLINKERs include the following:

INTER.REQ.1 - INTERLINKER specification model compatible with Service Offering Canvas
INTER.REQ.2 - Compatibility with the CEF Building Blocks
INTER.REQ.3 - Interoperability and composability
INTER.REQ.4 - Openness of catalogue of INTERLINKERs for extension with new INTERLINKERs in the future
INTER.REQ.5 - Configurability of INTERLINKERs
INTER.REQ.6 - Traceability by design
INTER.REQ.7 - Open Source Licensing when possible

ID	INTER.REQ.1
Name	INTERLINKER specification model compatible with Service Offering Canvas
Requirement type	Operational and Environmental Requirements and Standards

Content/description	To facilitate the definition and promotion of building blocks which are interoperable and reusable at an European level, the CEF methodology introduces the Service Offering Canvas (SOC) – a tool for the standardized description and definition of important digital solutions (themes), providing a comprehensive vision of the purpose of a solution, for whom it is intended, and how it is realized. The INTERLINKERs specification model should be compliant with SOC.
Motivation/rationale	By design, INTERLINKERs should be compatible with the CEF Building Blocks methodology. Building Blocks are endorsed by the European Commission and ensure that digital services will be fully compatible with others on the market and become interoperable, EU-compliant final products. In the CEF approach definition, a Building Block is an open and reusable digital solution. It can take the shape of a framework, a standard, a software, or a software as a service (SaaS), or any combination thereof. This definition matches well with the concept of INTERLINKERs and the overall vision and philosophy of the INTERLINK project. https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/CEF+Digital+Home https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/Service+Offering+Canvas+Playbook
Fit Criterion (Measurable)	Deliverable D3.1 will define a model of INTERLINKER specification compliant with SOC. Each INTERLINKER will be designed and implemented according to this approach. Each INTERLINKER will be accompanied by a SOC-like specification.
Author	FBK
Revision	v1

ID	**INTER.REQ.2**
Name	Compatibility with the CEF Building Blocks
Requirement type	Functional
Content/description	When applicable, the INTERLINKERs should be compatible at the level of standards, interfaces, and protocols with the specifications and implementations of the common capabilities promoted by EU CEF.
Motivation/rationale	Connecting Europe Facility (CEF) initiative defines and promotes a series of basic general purpose capabilities that facilitate the implementation of cross-border interoperable digital services. In these regards, the INTERLINKERs identified within the Project for the realization of the platform and the co-production process should be aligned and made compatible with the CEF building blocks that are relevant for the domain and for the functionality of that INTERLINKERs. Such a compatibility refers to, e.g., standards and specifications compatibility, interoperability and compliance with the reference software implementations.
Fit Criterion (Measurable)	The specification and implementation of the INTERLINKERs (deliverables of WP3) will be validated against available CEF building blocks both at the level of specifications defined by the building blocks and at the level of software interoperability based on the corresponding compliance software.

Author	FBK
Revision	v1

ID	INTER.REQ.3
Name	Interoperability and composability
Requirement type	Operational and Environmental Requirements and Standards
Content/description	The INTERLINKERs should satisfy the interoperability requirements at different levels to facilitate the integration with the platform and composability with other components and INTERLINKERs according to the type of the interlinkers and their role in the co-production process.
Motivation/rationale	The INTERLINKER model foresees different types of the INTERLINKERs and their role in the co-production process, differentiating the co-production INTERLINKERs and the ones that are used to implement some of the functionality of the co-delivered public service. For both contexts, it is necessary for the INTERLINKERs to be seamlessly and transparently integrated with other INTERLINKERs and/or the platform components. To facilitate such integration, it is required to address a set of interoperability requirements, in line with the general platform interoperability requirements including ● Protocol interoperability ● Infrastructure interoperability (e.g., for the INTERLINKERs to be integrated within the collaboration environment) ● Security interoperability
Fit Criterion (Measurable)	The INTERLINKER specification (Deliverable D3.1) will take into account the interoperability requirements in line with those of the platform requirements in order to guarantee that the compatible candidates satisfy these requirements by design.
Author	FBK
Revision	v1

ID	INTER.REQ.4
Name	Openness of catalogue of INTERLINKERs for extension with new INTERLINKERs in the future
Requirement type	Functional
Content/description	The catalogue of INTERLINKERs should support continuous addition of new INTERLINKERs to match emerging needs and new INTERLINKERs produced during the different public service co-production processes.
Motivation/rationale	This requirement emerged from Use cases analysis. Different use cases might deal with various types of services that might require the implementation of new building blocks (software and non-software) or the extension of existing ones. The INTERLINK platform should not be a closed environment, but rather support the possibility to integrate/publish new building blocks compliant to

	the INTERLINKER specification model.
Fit Criterion (Measurable)	During the project lifetime the publication of new components inside the INTERLINKER catalogue will be experimented.
Author	FBK
Revision	v1

ID	INTER.REQ.5
Name	Configurability of INTERLINKERs
Requirement type	Functional
Content/description	(Some of the) INTERLINKERs need to expose a configuration interface that allows users of the INTERLINK platform to set different configuration/customization options supported by the module.
Motivation/rationale	This requirement emerged from the analysis of the use cases. Software and non-software INTERLINKERs need to be reusable by different stakeholders in different co-production projects. In some cases, this might require a preparation phase in which the enablers are configured to work in the new application domain. More investigation will be performed in WP3 to identify which Interlikers might offer / need to support this requirement.
Fit Criterion (Measurable)	During the project lifetime the configuration of INTERLINKERs inside the project catalogue will be experimented.
Author	FBK
Revision	v1

ID	INTER.REQ.6
Name	Traceability by design
Requirement type	Operational and Environmental Requirements and Standards
Content/description	Prefer the solutions that allow for tracing their use in order to ensure the transparency and to enable monitoring of the INTERLINKERs within the INTERLINK platform. For the solutions that will be developed and / or tightly integrated into the platform this is an important requirement in order to be able to evaluate the platform and the pilot use cases. Note that for the non-technical artifacts the traceability should be provided by the corresponding environment (e.g., document and/or document management system) so that at least the access to the artifact within the platform (e.g., from the collaboration environment or from the INTERLINKER catalogue) can be measured.
Motivation/rationale	EU regulations and eGovernment platform standards (Baheer et al. 2020)

Fit Criterion (Measurable)	The system architecture and all platform components will have a technical specification that allows to verify how they support traceability. Further information about the compliance to this requirement will be described in deliverable D4.2 on the overall system architecture and in D3.1 on the specification of INTERLINKERs. WP5 evaluation of pilots and platform will leverage this functionality.
Author	FBK
Revision	v1

ID	INTER.REQ.7
Name	Open Source Licensing when possible
Requirement type	Operational and Environmental Requirements and Standards
Content/description	Prefer the solutions based on the Open Source licenses as also suggested by the EU and national regulations. Please note that this requirement does not necessarily mean free software; the way the software is provided, hosted and managed, as well as the support, may be regulated by additional commercial agreements including aforementioned long-term support agreements or master service agreements.
Motivation/rationale	EU regulations and eGovernment platform standards (Baheer et al. 2020)
Fit Criterion (Measurable)	The system architecture and all platform components will have a technical specification that allows to verify how they are related to open source licensing. Further information about the compliance to this requirement will be described in deliverable D4.2 on the overall system architecture and in D3.1 on the specification of INTERLINKERs.
Author	FBK
Revision	v1

6.4 General requirements for the INTERLINK platform

6.4.1 Technical requirements

The general technical requirements for the INTERLINK platform include:

- TECH.REQ.1 - FAIR principles for data and metadata management
- TECH.REQ.2 - Protocol Interoperability
- TECH.REQ.3 - Infrastructure Interoperability
- TECH.REQ.4 - Security Interoperability
- TECH.REQ.5 - Secure storage of data and GDPR-compatibility
- TECH.REQ.6 - Platform usage statistics
- TECH.REQ.7 - Separation between service co-production platform and service operation platform
- TECH.REQ.8 - Service composition
- TECH.REQ.9 - Storage of a new bundled service in the Service Catalogue

TECH.REQ.10 - Configuration of an item in the Service Catalogue for its reuse by other PAs

TECH.REQ.11 - Platform Front-End responsive on different devices, operating systems and browsers

ID	TECH.REQ.1
Name	FAIR principles for data and metadata management
Requirement type	Operational and Environmental Requirements and Standards
Content/description	The INTERLINK platform should adopt open standards for data exchange and management. ● For non-software artifacts: use of open and de-facto standards for document representation and exchange. ● For software artifacts: use XML and JSON as data exchange formats and standard vocabularies whenever available for a specific domain, e.g. W3C Web Annotation Model[11] . More in general, the whole data and metadata management within the INTERLINK platform should comply with the FAIR standard principles. To be *Findable*: F1. (meta)data are assigned a globally unique and persistent identifier F2. data are described with rich metadata (defined by R1 below) F3. metadata clearly and explicitly include the identifier of the data it describes F4. (meta)data are registered or indexed in a searchable resource To be *Accessible*: A1. (meta)data are retrievable by their identifier using a standardized communications protocol A1.1 the protocol is open, free, and universally implementable A1.2 the protocol allows for an authentication and authorization procedure, where necessary A2. metadata are accessible, even when the data are no longer available To be *Interoperable*: I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation. I2. (meta)data use vocabularies that follow FAIR principles I3. (meta)data include qualified references to other (meta)data To be *Reusable*: R1. meta(data) are richly described with a plurality of accurate and relevant attributes R1.1. (meta)data are released with a clear and accessible data usage license R1.2. (meta)data are associated with detailed provenance R1.3. (meta)data meet domain-relevant community standards
Motivation/rationale	EU regulations and eGovernment platform standards (Wilkinson et al. 2016)
Fit Criterion (Measurable)	All platform components will have a technical specification that allows to verify which data and metadata formats are used. Further information about the compliance to this requirement will be described in deliverable D4.2 on the overall system architecture and in D3.1 on the specification of INTERLINKERs.
Author	FBK

[11] https://www.w3.org/TR/annotation-model/

Revision	v1

ID	TECH.REQ.2
Name	Protocol Interoperability
Requirement type	Operational and Environmental Requirements and Standards
Content/description	In general, REST API-based exchange following the Open API 3.0 Specification[12] will be preferred. Depending on the type of INTERLINKER software (freeware which run locally or external SaaS) and availability of API, integration into platform may be: ● deep as a platform plugin for platform tools; ● medium level for microservices integrated via REST API or app-specific API; ● weak or manual (at level of human processes) for external SaaS which do not provide any API
Motivation/rationale	EU regulations, eGovernment platform standards (Baheer et al. 2020) and similar past eGovernment projects (SIMPATICO D5.1, requirement IL.2)
Fit Criterion (Measurable)	All platform components will have a technical specification that allows to verify protocol interoperability. Further information about the compliance to this requirement will be described in deliverable D4.2 on the overall system architecture and in D3.1 on the specification of INTERLINKERs.
Author	FBK
Revision	v1

ID	TECH.REQ.3
Name	Infrastructure Interoperability
Requirement type	Operational and Environmental Requirements and Standards
Content/description	Prefer market standard-based solutions for the self-hosted solutions, adhering to the Cloud-Native Computing Foundation (CNCF) initiative[13]. In particular, ● Allow plugin integration into platform according to micro-kernel architecture pattern for platform tools ● Target microservice-based architecture pattern for integration of INTERLINKER SW modules into platform;. ● Target standard containerization solutions for deployment, such as Docker. ● Target standard Cloud-based orchestration for the management of the deployed applications, such as Kubernetes.
Motivation/rationale	EU regulations and eGovernment platform standards (Baheer et al. 2020)

[12] https://swagger.io/specification/
[13] https://www.cncf.io/services-for-projects/#internationalization

Fit Criterion (Measurable)	The system architecture and all platform components will have a technical specification that allows to verify infrastructure interoperability. Further information about the compliance to this requirement will be described in deliverable D4.2 on the overall system architecture and in D3.1 on the specification of INTERLINKERs.
Author	FBK
Revision	v1

ID	TECH.REQ.4
Name	Security Interoperability
Requirement type	Operational and Environmental Requirements and Standards
Content/description	Use standard solutions recommended by EU and national level practices for accessing the applications, both at the user level and application-level integration. This refers in particular, to ● Use of OAuth2.0 / OpenID Connect protocols for authentication and authorization ● Prefer support for institutional authentication mechanisms, including eIDAS compliant solutions. ● Support, if applicable, SSO experience in engaging the federated usage of the different solutions.
Motivation/rationale	EU regulations and eGovernment platform standards (Baheer et al. 2020)
Fit Criterion (Measurable)	The system architecture and all platform components will have a technical specification that allows to verify security interoperability. Further information about the compliance to this requirement will be described in deliverable D4.2 on the overall system architecture and in D3.1 on the specification of INTERLINKERs.
Author	FBK
Revision	v1

ID	TECH.REQ.5
Name	Secure storage of data and GDPR-compatibility
Requirement type	Functional
Content/description	The INTERLINK platform has to provide secure storage functionalities for the data collected for the legitimate needs of the platform. When using data subject to GDPR, the platform must also provide the required GDPR processes. If personal sensor data, for instance, is saved in the platform, the platform must provide tools for citizens' permissions for personal sensor data and data deletion.
Motivation/rationale	EU regulations and eGovernment platform standards (Baheer et al. 2020) and similar past eGovernment projects (SIMPATICO D5.1, requirements IL.3 and

	IL.4; WeLive D1.5, requirement ODS.6, CDV.4). This requirement is essential to guarantee users' privacy, acceptance and platform credibility.
Fit Criterion (Measurable)	The system architecture and all platform components will have a technical specification that allows to verify GDPR-compatibility. Further information about the compliance to this requirement will be described in deliverable D4.2 on the overall system architecture and in D3.1 on the specification of INTERLINKERs.
Author	FBK
Revision	v1

ID	TECH.REQ.6
Name	Platform usage statistics
Requirement type	Functional
Content/description	The INTERLINK platform should log the usage of the system front end, the number of registered users, and the types of used services. The collected data should be scrutinable in a user-friendly way and should support periodic data analysis to generate reports on system performance, size of the engaged community, most popular INTERLINKERs.
Motivation/rationale	This is important to monitor the Key Performance Indicators (KPIs) of the platform and to assess the progress and success of the Project. (This requirement is similar to WeLive D1.5, requirement ADS.1)
Fit Criterion (Measurable)	During the execution of the two pilot phases of the Project, platform usage data will be collected. Statistics will be computed and compared to the project KPIs
Author	FBK
Revision	v1

ID	TECH.REQ.7
Name	Separation between service co-production platform and service operation platform
Requirement type	Operational and Environmental Requirements and Standards
Content/description	This requirement will be further investigated in detail in task T4.2.
Motivation/rationale	There could be potential for offering an operation environment to manage execution and monitoring of co-produced services, as part of co-delivery stage. This functionality will be offered only for INTERLINKERs and public services used in the pilots.

Fit Criterion (Measurable)	Availability of continuous operation of public services assessed in pilots' iterations.
Author	TREE TK
Revision	This requirement will be revised in D4.2

ID	TECH.REQ.8
Name	Service composition
Requirement type	Functional
Content/description	The INTERLINK platform must support users in the creation of bundles of INTERLINKERs that compose a new public service. The composition process consists of four major steps: ● Pick up building blocks from the INTERLINKERs Catalogue (see requirement "Catalogue of INTERLINKERs") ● Customize chosen INTERLINKERs (see related requirement "Configurability of INTERLINKERs") ● Bind several INTERLINKERs together into a new Pub. Service obj (this requirement) ● Prepare & publish instructions for deployment and execution of the new Public Service (see related requirement "Storage of a new bundled service in the Service Catalogue") This requirement will be further investigated in detail in task T4.2.
Motivation/rationale	The user must be able to interact with the system to create projects where the INTERLINKERs available within the platform are composed together to satisfy the co-production needs. (This is similar to WeLive D1.5, requirement VC.4)
Fit Criterion (Measurable)	During the execution of the second pilot phase of the Project, the composition of INTERLINKERs into a new service will be experimented.
Author	FBK
Revision	This requirement will be revised in D4.2

ID	TECH.REQ.9
Name	Storage of a new bundled service in the Service Catalogue
Requirement type	Functional
Content/description	After a user has created a bundle of INTERLINKERs that compose a new public service, the new service is stored in a dedicated catalogue for its potential reuse by other PAs. Each public service publication needs to come with instructions for deployment and execution. Users of the INTERLINK platform need to be able to search and browse existing services in the catalogue and inspect detailed descriptions, therefore a proper metadata model needs to be created to annotate services in the catalogue.

	This requirement will be further investigated in detail in task T4.2.
Motivation/rationale	Public services created by a Public Administration in co-production with a network of stakeholders may be potentially of interest for the reuse by other PAs.
Fit Criterion (Measurable)	During the execution of the second pilot phase of the project, the storage of a new bundled service in the Service Catalogue will be experimented.
Author	FBK
Revision	This requirement will be revised in D4.2

ID	TECH.REQ.10
Name	Configuration of an item in the Service Catalogue for its reuse by other PAs
Requirement type	Functional
Content/description	A bundled service in the Service Catalogue conceived to be potentially reused by a PA needs to expose possible configuration settings. This involves defining a metadata model for representing bundled services and the configurable aspects, as well as methods for helping users in the configuration (e.g. written instructions on how to configure knowledge-based INTERLINKERs and a graphical interface for configuring software-based INTERLINKERs). This requirement will be further investigated in detail in task T4.2.
Motivation/rationale	Public services created by a Public Administration in co-production with a network of stakeholders may be potentially of interest for the reuse by other PAs. The reuse might involve some configuration of the knowledge / software INTERLINKERs that compose the bundled service.
Fit Criterion (Measurable)	Focused technical and user tests will be performed within the Project to assess how well the implemented platform satisfies this requirement.
Author	FBK
Revision	This requirement will be revised in D4.2

ID	TECH.REQ.11
Name	Platform Front-End responsive on different devices, operating systems and browsers
Requirement type	Functional
Content/description	Every functionality of the INTERLINK platform should be able to work with the majority of web-browsers, operating systems, devices or with minimal configuration (This requirement is similar to one emerged in SIMPATICO - D3.1. User

	Interaction Modelling and Design - Requirement IF-7)
Motivation/rationale	The usage of the INTERLINK platform should be accessible to all users. The INTERLINK platform will be integrated in several pilots. The stakeholders in each pilot will have different web-browser configurations.
Fit Criterion (Measurable)	Focused technical and user tests will be performed within the project to assess how well the implemented platform front-end satisfies this requirement.
Author	FBK
Revision	

6.4.2 User requirements

The general user requirements for the INTERLINK platform include:

USER.REQ.1 - Usability
USER.REQ.2 - User help
USER.REQ.3 - Acceptability and usefulness
USER.REQ.4 - Trust and privacy
USER.REQ.5 - Accessibility, inclusiveness and internationalization

ID	USER.REQ.1
Name	Usability
Requirement type	Usability and Humanity Requirements
Content/description	Usability of the INTERLINK front-end and INTERLINKERs should be guaranteed following usability principles (see Table 8) ● Visibility of system status ● Match between system and the real world ● User control and freedom ● Consistency and standards ● Error prevention ● Recognition rather than recall ● Flexibility and efficiency of use ● Aesthetic and minimalist design ● Help and documentation
Motivation/rationale	Usability is a key factor in users' engagement with e-government platforms and it refers to the ease of access and/or use of a product or website.
Fit Criterion (Measurable)	A user experience evaluation will be performed with the platform's users before and during the pilots (WP5). User experience can be measured by analyzing: ● *Effectiveness*: the accuracy and completeness with which users achieve certain goals. Indicators of effectiveness include quality of solution and error rates. ● *Efficiency*: which is the relation between (1) the accuracy and

	completeness with which users achieve certain goals and (2) the resources expended in achieving them. Indicators of efficiency include task completion time and learning time. ● *Users' experience*: the users' attitudes and beliefs - satisfaction, usefulness, ease of use, pragmatic and hedonic aspects - towards the use of the system. 'These can be measured by rating scales drawn from the scientific literature. Task 5.4 of the Project will ensure these measurements are made.
Author	FBK, DEUSTO
Revision	v1

ID	USER.REQ.2
Name	User help
Requirement type	Usability and Humanity requirement
Content/description	Users should be supported in discovering and using the platform functionalities and the related INTERLINKERs. Relevant information on the platform should be easy to find as well as the value of the platform should be easy to understand. A set of features should be integrated in the platform to help users: ● Use manual ● In-line help ● FAQs ● Video-tutorials
Motivation/rationale	Different users might have different levels of familiarity with new collaborative technologies.
Fit Criterion (Measurable)	The design of functionalities that support user help will be carefully considered during the design of the platform front-end. The effectiveness of the provided user help will be evaluated in T5.4.
Author	FBK, DEUSTO
Revision	v1

ID	USER.REQ.3
Name	Acceptability and usefulness
Requirement type	Usability and Humanity Requirements
Content/description	INTERLINK platform should be designed considering the following features: ● Pragmatic: that is, the usability and usefulness which is the match between user needs and functionality ● Accuracy, how well the platform addresses the co-production process needs ● Hedonic: likeability and physical appearance: affective evaluation ● Costs: both the financial costs and the social and organizational consequences of buying a product).

Motivation/rationale	The adoption of a new technology is affected by a large number of factors: beyond usability, hedonic aspects (aesthetic, identification) and other factors play a crucial role, such as accuracy, price, robustness (Kim 2014). The specific contexts of use and purpose of the technology should be considered to weigh the different aspects.
Fit Criterion (Measurable)	Measurements through: ● Technology Acceptance Model - developed by Davis (1989) - is one of the most popular research models to predict use and acceptance of information systems and technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably: i) perceived usefulness and (PU) ii) perceived ease of use (EOU). ● Satisfaction and habit - further developments of the previous model include satisfaction and habit as factors that impact the users' decisions to continue using or not a given system (Bhattacherjee, 2001; Limayem et al., 2007) ● User experience (pragmatic and hedonic aspects) - from the short version of the User Experience questionnaire developed by Schrepp et al. (2017). These are dimensions that will be included in the evaluation plan developed by T5.4.
Author	FBK, DEUSTO
Revision	v1

ID	USER.REQ.4
Name	Trust and privacy
Requirement type	Usability and Humanity Requirements
Content/description	INTERLINK platform should be designed considering the following privacy-preserving features: ● *Awareness*: Users should be aware of personal data stored and managed by the platform ● *Data quality* (completeness and accuracy) ● *Security* (data transmission, cookies) ● *Information movements* should be communicated to users ● *User identification* should be communicated to users ● *Choice*: Users should decide if they agree to *collect and store personal data* ● If children are involved, the policy should provide information regarding access by, and involvement of, children ● The way in which sensitive information (e.g. religion) is treated differently to other information should be explained
Motivation/rationale	The acceptance of a new technology strongly depends on the credibility and trust toward the system. The management of personal data is a key factor that impacts on users' acceptance. (Davis, 1989)

Fit Criterion (Measurable)	Trust and credibility of the system are dimensions that will be included in the evaluation of users' attitudes and beliefs included in the evaluation plan developed by T5.4.
Author	FBK, DEUSTO
Revision	v1

ID	USER.REQ.5
Name	Accessibility, inclusiveness and internationalization
Requirement type	Operational and Environmental Requirements and Standards Usability and Humanity Requirements
Content/description	This requirement applies to the overall platform front end, to the collaboration environment and to INTERLINKERs with a user interface. In case multiple existing software solutions comply with the core profile specification of an INTERLINKER, prefer the solution with certified accessibility according to the EU and national recommendations for the user interfaces of the solutions. Guarantee multilingual interfaces and ensure a low technological entry barrier. The same general requirement should be satisfied by the INTERLINK platform front-end
Motivation/rationale	EU regulations and eGovernment platform standards (Baheer et al. 2020) and similar past eGovernment projects (SIMPATICO D5.1, requirement IL.5)
Fit Criterion (Measurable)	The INTERLINKER catalogue that will be devised by the Project in WP3 will include for each INTERLINKER a core profile specification and a description of how the requested functionalities/knowledge are implemented, with possible links to external tools. It will be possible to check whether accessibility and inclusiveness aspects are properly addressed by external tools. For solutions developed within the Project, the design and evaluation phase will make sure this requirement is assessed. I18n will be observed in all interfaces that make up the front-end and its internal collaborative environment.
Author	FBK, DEUSTO
Revision	v1

Future work

D4.1. is meant to provide a first high level list of socio-technical requirements that will be further specified in other Project Tasks.

This list of socio-technical requirements will be further refined and specified including all actors involved in the process (public administrations, citizens, technologists, companies, third sector organizations). according to an inclusive design perspective. More specifically this list will:

- guide the functional specification of the set of INTERLINKERs that will be detailed and described in D3.1. (M10);
- bootstrap the INTERLINK reference architecture model and specification that will be documented in D4.2 "Reference architecture model and specification" (M12),
- inform the preparation of the plans for the execution of the use cases that will be detailed in D5.1 "Use-case plans and guidelines v1" (M12).

References

1. Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). *User-centered design*. In Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications (pp. 445–456).
2. Ajzen, I. (1991). *The theory of planned behavior. Organizational behavior and human decision processes*, 50(2), 179-211.
3. Alford J. (2014) *The Multiple Facets of Co-Production: Building on the work of Elinor Ostrom*, Public Management Review, 16:3, 299-316, DOI: 10.1080/14719037.2013.806578
4. Aoyama M. (2007), *Persona-Scenario-Goal Methodology for User-Centered Requirements Engineering*. In Conference: 15th IEEE International Requirements Engineering Conference, RE 2007, October 15-19th, 2007, New Delhi, India.
5. Baheer Ahmad Baheer , Lamas David and Sousa Sónia (2020) A Systematic Literature Review on Existing Digital Government Architectures: State-of-the-Art, Challenges, and Prospects, In Administrative Sciences 10(2):25
6. Brandsen T., Honingh M. (2016) Distinguishing Different Types of Coproduction: A Conceptual Analysis Based on the Classical Definitions. In Public Administration Review, Volume76, Issue 3 2016. DOI: 10.1111/puar.12465.
7. Bhattacherjee, A. (2001). Understanding Information Systems Continuance: An Expectation-Confirmation Model. *MIS Quarterly*, *25*(3), 351–370. https://doi.org/10.2307/3250921
8. Bovaird, T., Loeffler, E. (2012) From Engagement to Co-production: The Contribution of Users and Communities to Outcomes and Public Value. Voluntas 23, 1119–1138 (2012). https://doi.org/10.1007/s11266-012-9309-6
9. Carroll, John M. (2000): Making Use: Scenario-Based Design of Human-Computer Interactions. MIT Press.
10. CITADEL Deliverable D3.5, Initial Requirements for Co-creation, Contract No. GA 726755, www.citadel-h2020.eu
11. Cooper, Alan, Reimann, Robert and Cronin, David (2007): About Face 3: The Essentials of Interaction Design. Wiley
12. Davis, F. D. (1989), "Perceived usefulness, perceived ease of use, and user acceptance of information technology", MIS Quarterly, 13 (3): 319–340
13. European Commission. (2016). EU eGovernment Action Plan 2016-2020: accelerating the digital transformation of government. http://eur-lex.europa.eu/legal-content/EN/TXT/ ?uri=CELEX:52016DC0179

14. FAMILIES_SHARE Deliverable D1.1 The Families_Share framework, and local and international user needs and requirements, Contract No. 780783
15. Ferreira B., Barbosa S., Conte T. (2018) Creating Personas focused on Representing Potential Requirements to Support the Design of Applications. In IHC 2018: Proceedings of the 17th Brazilian Symposium on Human Factors in Computing Systems. 2018 No.: 15.
16. Garcia L.G., Clifton J., Fuentes D.D., (2019) ICT-enabled co-production of public services: Barriers and enablers. A systematic review. In Information Polity 24(4):1-24.
17. Hassenzahl, M. (2005). The thing and I: understanding the relationship between user and product. In Mark A. Blythe, Kees Overbeeke, Andrew F. Monk, Peter C. Wright, (Eds.), Funology: from usability to enjoyment (pp. 31-42). Netherlands: Springer. (Human-Computer Interaction Series, 3).
18. Howlett, M., & Ramesh, M. (2017). The achilles heels of collaboration: Overcoming critical capacity deficits in collaborative governance arrangements? Paper presented at the NUS-FPZG UNESCO Chair Workshop on The Governance of Collaboration: Co-Production, Contracting, Commissioning and Certification, Dubrovnik, Croatia.
19. Khan S. Dulloo A.B., Verma M. (2014)Systematic Review of Requirement Elicitation Techniques. In International Journal of Information and Computation Technology. ISSN 0974-2239 Volume 4, Number 2 , 2014, pp. 133-138
20. Kim H. C. (2015) Acceptability engineering: the study of user acceptance of innovative technologies. In Journal of Applied Research and Technology, 2015.
21. INTERLINK Deliverable D6.1 Data management plan, June 2021, Contract No. GA 959201
22. Lichtenstein, S.; Swatman, P.; and Babu, K., (2002)"Effective Online Privacy Policies" (2002).ACIS 2002 Proceedings. 27.http://aisel.aisnet.org/acis2002/27
23. Limayem, M., Hirt, S. G., & Cheung, C. M. (2007). How habit limits the predictive power of intention: The case of information systems continuance. *MIS Quarterly*, 705–737.
24. Linders, D. (2012) From e-government to we-government: Defining a typology for citizen coproduction in the age of social media, Government Information Quarterly, Volume 29, Issue 4, 2012, https://doi.org/10.1016/j.giq.2012.06.003.
25. Merčun, T.; Žumer, M. (2017) Exploring the influences on pragmatic and hedonic aspects of user experience. In Information Research . Mar2017, Vol. 22 Issue 1.
26. Misikangas, Pauli, Brandsen, Taco, Honingh, Marlies, Hoevens, Noortje, ... (2021) INTERLINK Co-Production, White paper
27. Nabatchi, T., Sancino, A., & Sicilia, M. (2017). Varieties of participation in public services: The who, when, and what of coproduction. Public Administration Review. doi:10.1111/puar.12765
28. Nielsen J. and Molich R. (1990), Heuristic evaluation of user interfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '90). Association for Computing
29. Nielsen L. (2019), *Personas - User Focused Design*. Springer-Verlag London. Machinery, New York, NY, USA, 249–256. DOI:https://doi.org/10.1145/97243.97281
30. Paletti (2016) Co-production Through ICT in the Public Sector: When Citizens Reframe the Production of Public Services
31. Robertson S.,Robertson J. Mastering the Requirements Process—Second Edition by Suzanne and James, Addison-Wesley, 2006. ISBN 0-321-41949-9.

32. Robertson J., Robertson S. (2007) Volere Requirements Specification Template, Edition 13—August 2007
33. Salminen, Joni & Jung, Soon-Gyo & Chowdhury, Shammur & Şengün, Sercan & Jansen, Jim. (2020). Personas and Analytics: A Comparative User Study of Efficiency and Effectiveness for a User Identification Task. 1-13.
34. SIMPATICO Deliverable D5.1 SIMPATICO Platform. Requirements and Architecture v1, Contract No. GA 692819,
35. Taco Brandsen & Eelco van Hout (2006) Co-management in public service networks, Public Management Review, 8:4, 537-549, DOI: 10.1080/14719030601022908
36. Florian Schütz, Marie Lena Heidingsfelder, Martina Schraudner, Co-shaping the Future in Quadruple Helix Innovation Systems: Uncovering Public Preferences toward Participatory Research and Innovation, She Ji: The Journal of Design, Economics, and Innovation, Volume 5, Issue 2, 2019, Pages 128-146, ISSN 2405-8726, https://doi.org/10.1016/j.sheji.2019.04.002.
37. Schrepp, M., Hinderks, A., & Thomaschewski, J. (2017). Design and Evaluation of a Short Version of the User Experience Questionnaire (UEQ-S). *Ijimai*, *4*(6), 103–108.
38. Sorrentino M., Sicilia M. & Howlett M. (2018) Understanding co-production as a new public governance tool, Policy and Society, 37:3, 277-293, DOI: 10.1080/14494035.2018.1521676
39. Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management science, 46(2), 186-204.
40. Wilkinson, M., Dumontier, M., Aalbersberg, I. (2016), The FAIR Guiding Principles for scientific data management and stewardship. Sci Data 3, 160018, 2016. https://doi.org/10.1038/sdata.2016.18
41. WELIVE Deliverable D1.5 – WELIVE Framework Requirements and Architecture v1, Contract No. GA 645845.

Annex

Annex 1 - Use case template

USE CASE TEMPLATE	
Partner	
Title	
Context and description	(Describe the context in which the INTERLINK solution might be exploited and the stakeholders potentially interested in the solution)
Actual organization of the service	(Please describe the actual organization of the service, if applicable)
Limits/challenge of the actual service/initiatives	(Describe the limits/challenges of the current situation and the type of desired improvement)
Future/desired	(Describe the scenario in which INTERLINK solution might support actors

scenario 1	involved in co-produce a service)
Key Actors and roles	(Define the type of actors involved in the co-production of the service and expected role)
Related initiatives and projects	(Describe related initiatives that can help to better understand the use case)
Available resources and link to other relevant documents	
Desidered INTERLINKERs	
Desired platform features	

Annex 2 – Template for Personas description

Template for Personas description

Based on (Aoyama 2007; Ferreira et al. 2018; Nielsen 2019; Salminen et al. 2020)

- When Stakeholders are citizens and represent the greatest proportion of Platforms/Interlink users, there should be several Personas representing different clusters of citizens

FIELDS		**DESCRIPTION**	**[Enter the text here]**
Persona Identification	**Persona ID**		
	Name		
	Type of Stakeholder represented by the persona	*Stakeholder and role with respect to the service enabled by the Platform/INTERLINKERs*	
	Age		
	Education	*High school, professional college, university bachelor, master*	
	Profession		
	Home life		
	Income Level	*From 0 to 10*	
Digital Savviness & Service Awareness	**Computer/Internet Savvy**	*From 0 to 10*	
	Mobile Savvy	*From 0 to 10*	
	Social Media Engagement	*From 0 to 10*	
	Platform and Interlink Awareness	*From 0 to 10*	
Problems/Needs & Goals	**Activities/Tasks**	*What are the activities/tasks that this person does that relate to the Platform/INTERLINKERs? Are those activities/tasks something that s/he needs to do or something that s/he wants*	

		to do? How does this person currently perform such activities/tasks? Are there any digital services that s/he uses for performing the tasks?	
	Goals	*What are the goals of this person for engaging in the activities/tasks?*	
	Problems/needs (including digital ones)	*What are the problems or needs that this person faces when trying to perform the above tasks? Are there any problems related to technological issues?*	
	Relation to Platform/INTERLINKERs	*What are the Platform/INTERLINKERs that are related to this person's goals, tasks/activities, and needs?*	
Our Goals for User	**Platform & INTERLINKERs' Goals**	*Role of the stakeholder represented by the Persona with respect to the platform/INTERLINKERs:* ● *Creator and user?* ● *Creator only?* ● *User only?*	
	Interlinker Identification	*What are the Platform/INTERLINKERs for which this person is a target user?*	
	Specific interest for Platfrom/INTERLINKERs? (Fit between Platform/INTERLINKERs and user's goals, activitites/tasks, and needs/problems)	● *How could this person use each of the above identified Platform/INTERLINKERs* *a) to facilitate carrying out the above activities/tasks* *b) to address the above problems/needs,* *c) and to achieve the above goals?* ● *Why would this person be interested in using each of the above identified Platform/Interlinker?*	
	Awareness	*How could this person learn and be aware of the Platform/INTERLINKERs and the services enabled by them?*	

Annex 3 – Preliminary version of co-production scenarios for the three project use cases

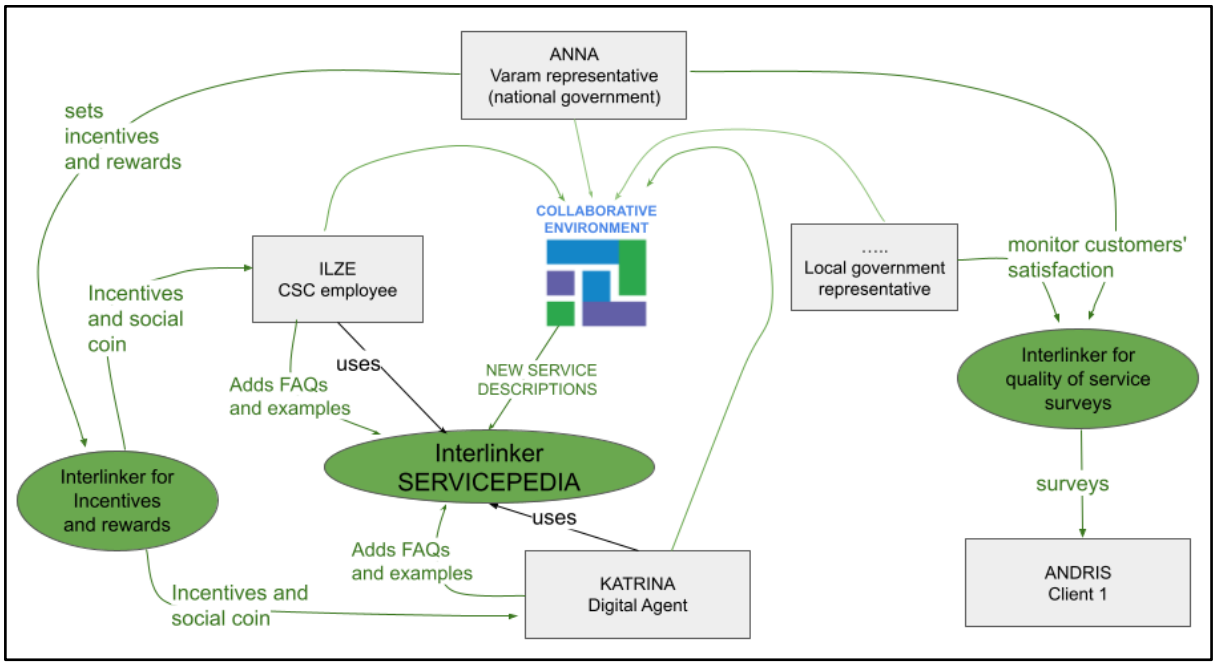
For each use case we present in this Annex a brief summary of personas, relationships between personas mediated by INTERLINK enablers, and envisaged steps of possible co-production scenarios as emerged from preliminary project activities.

Personas

More extensive descriptions of Personas provided by pilot owners are collected in Project internal reports. We summarize here the most salient personas' goals, relevant for the co-production process.

PERSONAS	GOALS / DESIDERATA
ANNA **Varam representative (national government)**	• Improve service delivery at national level and improve service description forms • Improve efficiency of communication with local representatives and CSCs (Customer service centers)
PETRA **Local government representative**	• Improve service delivery at local level and improve service description forms
ILZE **CSC (Unified State and Municipal Customer service center) employee, local government**	• Improve the quality of consultations • Reduce the amount of work/time related to consultations with the aid of digital agents • Monitor the quality of service provided by Digital Agents • Improve the service description forms that are at the basis of her work
KATRINA **Digital Agent**	• Become more expert on national digital services • Be able to assist citizen with online digital services • Get clear guidelines on how to deliver consultations • Be able to access good quality service description forms
ANDRIS **Citizen 1**	• Receive information on a service in a fast and efficient way
IEVA **Citizen 2**	• Receive step by step guidance on how to receive a public service

Relationships between personas mediated by INTERLINK enablers



Envisaged steps of co-production scenario

PHASES	STEPS OF CO-PRODUCTION SCENARIO	SUPPORT PROVIDED BY INTERLINK PLATFORM
ENGAGEMENT	• VARAM starts the co-production initiative • Gathers the network of interested stakeholders (local PAs, representatives of CSC employees, representatives of Digital Agents) • They set the goals of the co-production project and its workplan • They discuss current issues with service descriptions and internal KB	Steps supported by the INTERLINKER collaborative environment
DESIGN	• They collaboratively agree on a template for high-quality service description + template for FAQ structure + type of examples	Steps supported by the INTERLINKER collaborative environment
	• They decide to pilot test a Servicepedia, one of the reusable technological enablers available inside the INTERLINK platform	Selection of "Servicepedia" technology enabler available in the INTERLINKER catalogue
IMPLEMENTATION	• The Servicepedia component is prepared to be used in the VARAM use case context	INTERLINK technological components offer a configuration procedure for their reuse

	• Members of the stakeholders network need to be trained on the use of the Servicepedia	Steps supported by INTERLINK collaborative environment and knowledge enablers
	• National or local PAs select a set of services for which new descriptions are required • CSCs and Digital Agents can give opinions on which are the candidate services • A collaborative and iterative process of description preparation is initiated	Steps supported by the INTERLINK collaborative environment
	• When service descriptions are agreed upon, they are uploaded in the Servicepedia • CSC employees and Digital Agents add new FAQs and new examples that emerge from their dialogue with citizens	Functionalities supported by the "Servicepedia" INTERLINKER
SUSTAINABILITY	• Incentives to encourage contributions to the Servicepedia are put in place for the sustainability of the process in the long-term • Methods to reward contributors are defined to improve their engagement	Re-use of "Incentives and social coin" technology enabler available in the INTERLINKER catalogue
	• Periodic quality checks are performed via quality-of-service surveys	Re-use of "Quality-of-service surveys" technology enabler available in the INTERLINKER catalogue

ZARAGOZA USE CASE

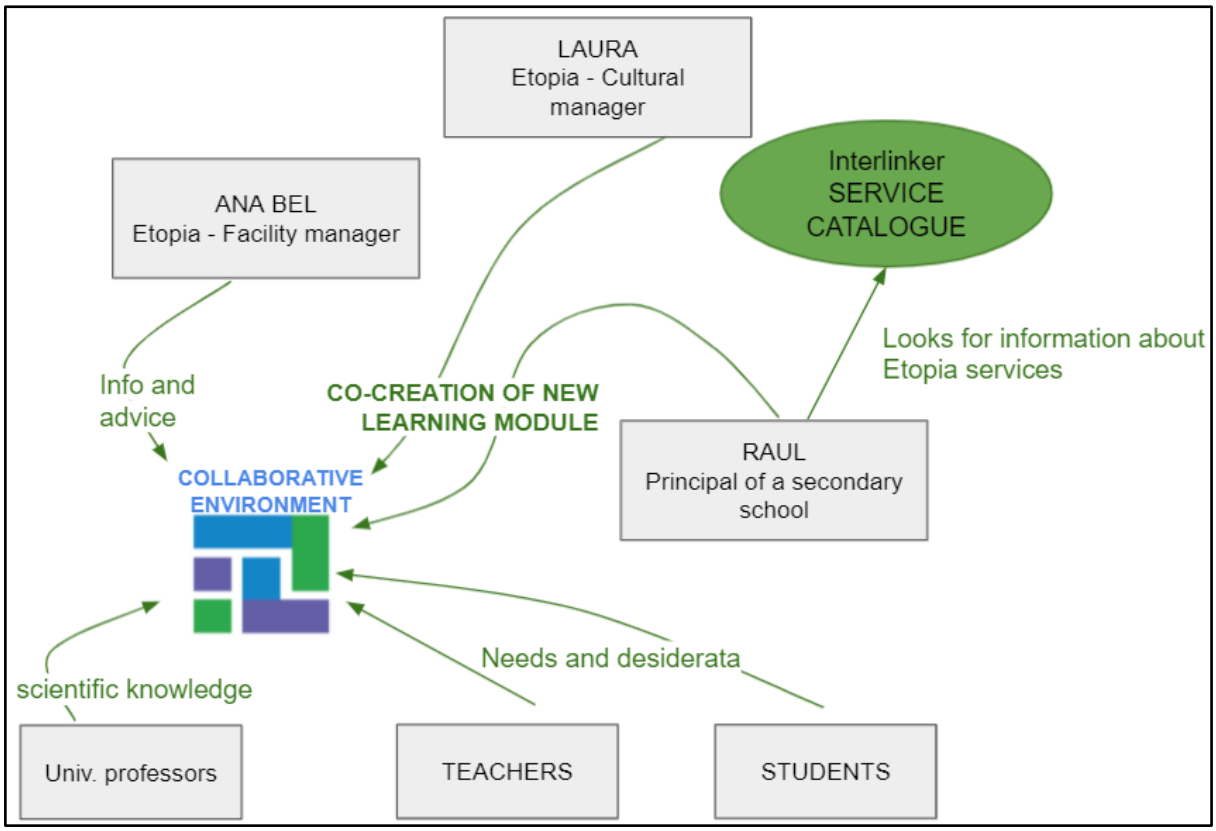
Personas

More extensive descriptions of Personas provided by pilot owners are collected in Project internal reports. We summarize here the most salient personas' goals, relevant for the co-production process.

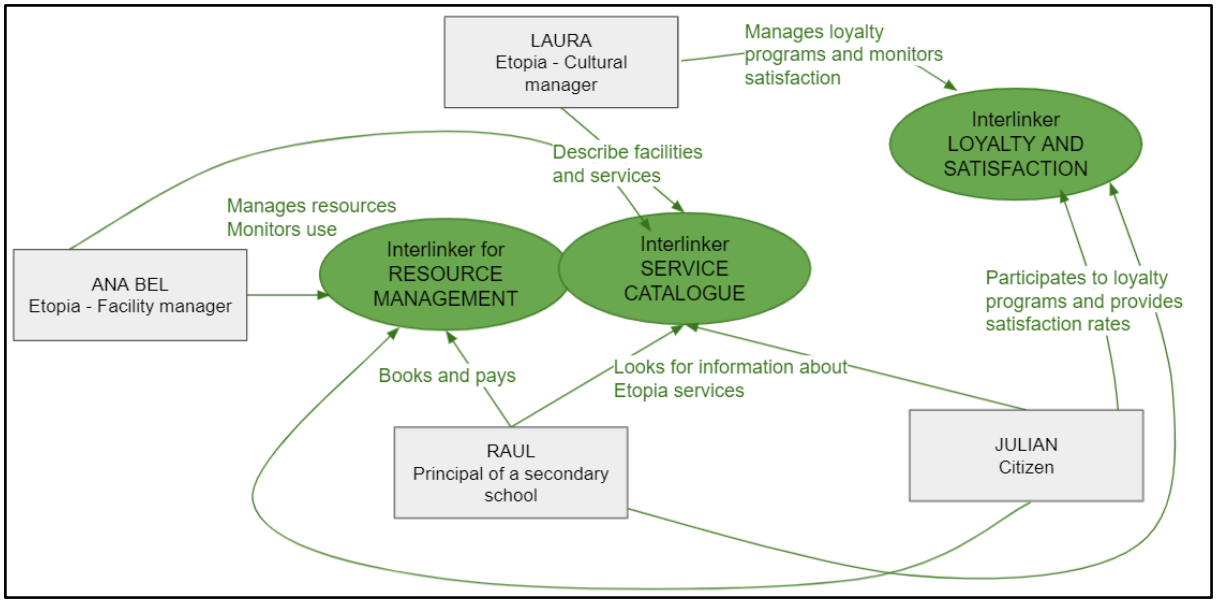
PERSONAS	GOALS / DESIDERATA
RAUL **Principal of a secondary school**	• Understand the offer of eTOPIA_ and the procedures to follow to access the resources (activities, mentorship, spaces, facilities..) • Motivate teachers and students by using eTOPIA_ as a source for new and exciting curricular programs. He wants to position his school as an attractive and innovative secondary school. • Co-create a new learning module to be deployed in his school, more specifically: i) engage teachers and students in the co-design process; ii) receive support from eTOPIA_ experts, use eTOPIA_ facilities (spaces, mentorship, equipements, etc).

	• Monitor the impact of the new learning module in his school and showcase the new learning module to other customers
JULIEN **Engaged citizen**	• Understand the offer of eTOPIA_ and the procedures to follow to access the resources (e.g. space accessibility,..) • Feel rewarded by eTOPIA_
LAURA **eTOPIA_ - Cultural manager**	• Rely on a process with clear steps to follow when ideating and launching services. Laura's goal is to systematize the innovation process related to programme ideation and design (i.e. communication materials, objectives performance and evaluation, production needs and resources.) The whole process must be properly referenced and documented for the future and also for reporting (accountability and transparency). • Deepen the engagement of the already engaged participants • Have an integrated view of attendees and their satisfaction levels
ANA BEL **Facility manager**	• Know the degree of use of different resources for different activities and be able to match the eTOPIA_'s resources with the needs of stakeholders that want to develop a project (e.g. citizens, companies,..). Improve internal processes of resources allocation

Relationships between personas mediated by INTERLINK enablers during the engagement and design phase



Relationships between personas mediated by INTERLINK enablers during the implementation and sustainability phase



Envisaged steps of co-production scenario

This scenario is an example of how a co-production process might be structured when the process is launched by an actor external to eTOPIA_, in this case Raul, the principal of a school. Other scenarios have been envisaged for Zaragoza use case in which the process is launched by the eTOPIA's internal staff.

	STEPS OF CO-PRODUCTION SCENARIO	SUPPORT PROVIDED BY INTERLINK PLATFORM
ENGAGEMENT	• Raul aims at co-producing a new learning module for his school exploiting eTOPIA_'s facilities (e.g. Artificial Intelligence Lab) and launches a co-production process • The network of interested stakeholders become aware of the initiative and join the process (e.g. eTOPIA_ staff, teachers, mentors)	Steps supported by the INTERLINK collaborative environment INTERLINKERs for stakeholders engagement
	• He understands which is the eTOPIA_'s offer (e.g. mentorship program, equipements, etc).	INTERLINKER "Service catalogue" is used to understand eTOPIA_'s offer

DESIGN	• The team follow a process with clear steps and tasks to discuss, ideate and launch the new learning module • The team collaboratively defines the new module: description of the initiative, content, resources needed, communication strategy, prices, etc... • They set the goals of the co-production project and its workplan	Steps supported by the INTERLINKER collaborative environment and by specific INTERLINKERs related to open call management, that support the team from ideas selection to ideas funding (e.g. template for ideas proposals, open and disseminate call, ideas collection and validation..)
	• eTOPIA_'s facility manager and program manager identify the internal resources needed for the launch of new activities (e.g. define the spaces in which activities for schools will take place)	INTERLINKER for resource management
IMPLEMENTATION	• The learning module co-designed by the team is delivered to selected classes of students. eTOPIA_'s facilities are available for use and manage in order to support the delivery of the learning module (e.g. booking of equipment, spaces and other facilities)	INTERLINKER for resource management is used to manage internal resources (places, equipment..). INTERLINKER for activity booking is used to book and pay eTOPIA_'s offer
SUSTAINABILITY	• The impact and the user satisfaction related to the new learning module and to the eTOPIA_'s facilities are monitored and evaluated. Internal eTOPIA_ staff follow up (and/or track) the audience, generate satisfaction surveys about the services and activities launched by eTOPIA_, and reward participants.	INTERLINKERs for quality of service monitoring and engagement tracking are used to assess the quality of service. The loyalty module is used to track, sustain and reward participants' engagement in the long-term.
	• The new learning module is available for re-use by other schools and institutions. The offer is published on the eTOPIA_'s service catalogue	The service catalogue is updated with a new offer

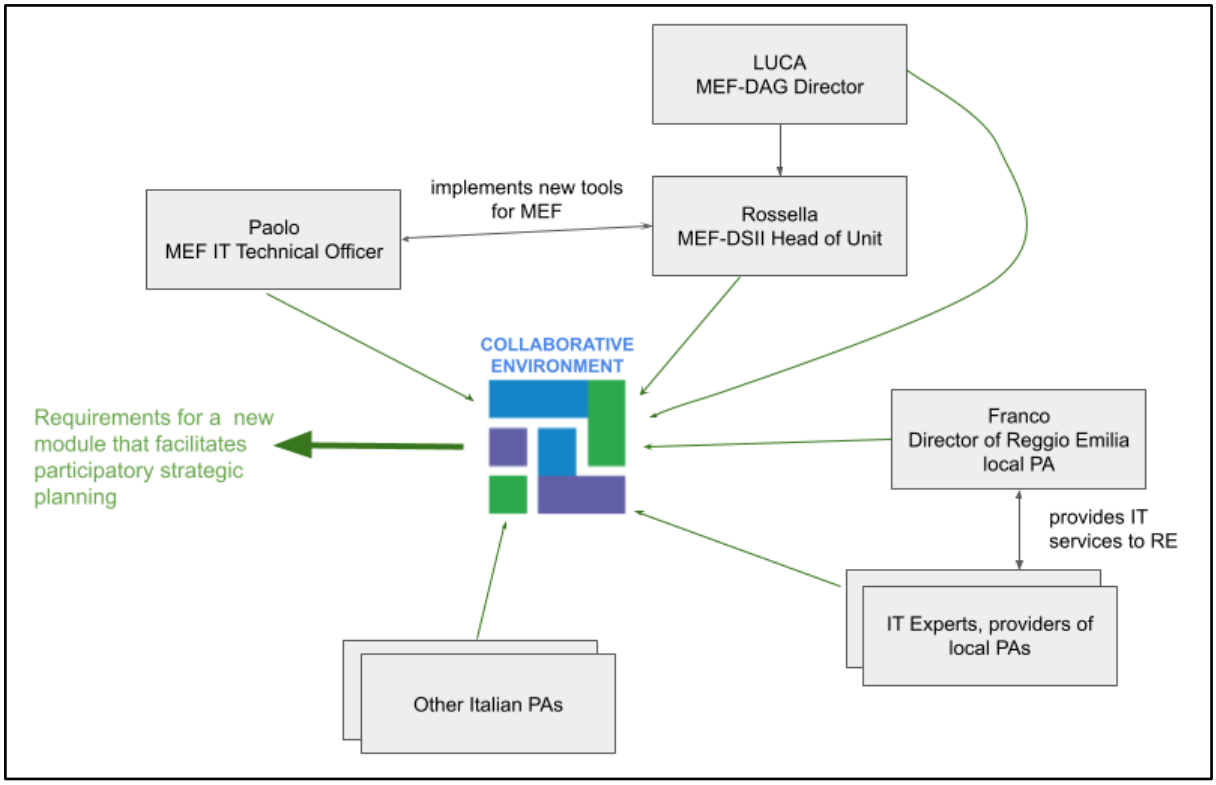
MEF USE CASE

Personas

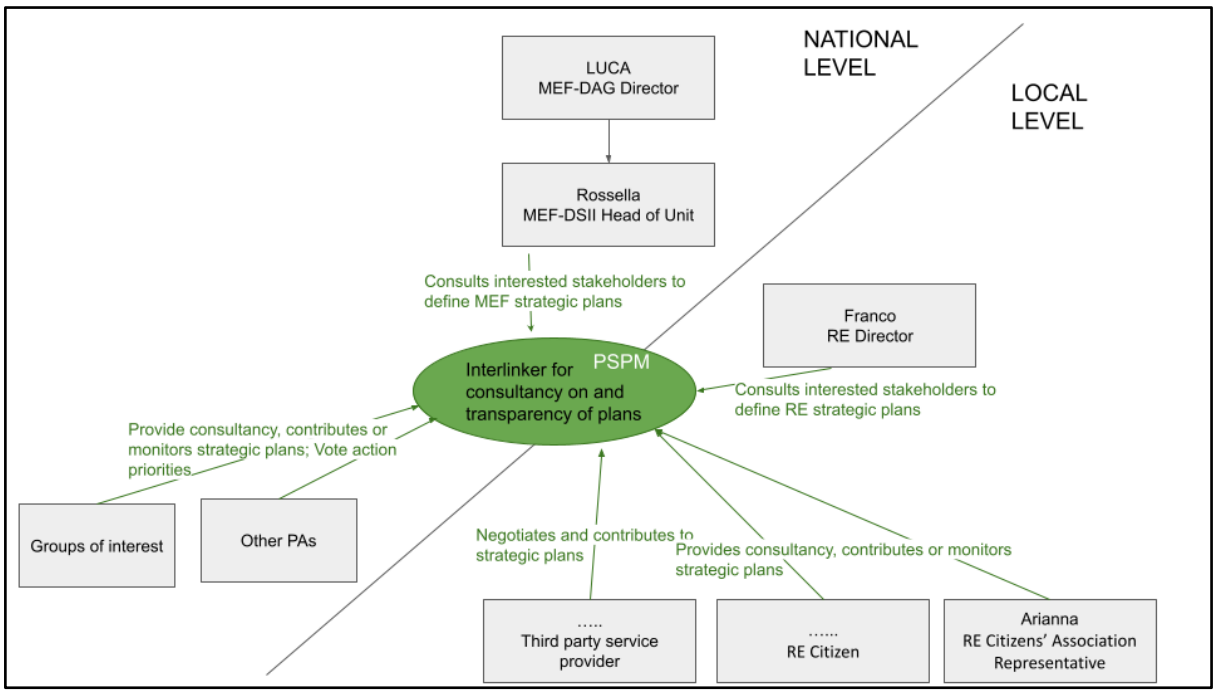
More extensive descriptions of Personas provided by pilot owners are collected in Project internal reports. We summarize here the most salient personas' goals, relevant for the co-production process.

PERSONAS	GOALS / DESIDERATA
LUCA **MEF-DAG Director**	• Foster collaboration between Public Bodies for strategic planning; create opportunities for participation by local PAs, other institutional stakeholders and associations of citizens; enforce transparency • Promote the development of a new Participatory Strategic Planning Module open to other Public Bodies and citizens' associations and which would allow their participation in the definition of a Strategic Plan, as well as the sharing of good practices in terms of strategic planning. • Share good practices in strategic planning
ROSSELLA **MEF-DSII Head of Unit**	• Coordinate the creation of a new Participatory Strategic Planning Module to allow the participation of external stakeholders when developing national strategic plans that can be reused also by local public administrations
PAOLO **MEF IT Technical Officer**	• Supervise the co-design and implementation of new tools for joint participatory strategic planning • Ensure that the new module is in line with MEF needs and with the already existing in-house software. Let requirements converge.
VALERIA **ANCI Director**	• Increase the participation of the Italian Municipalities – through specific associations like ANCI - in the definition of national strategic plans, through direct consultations. • Make Municipalities aware about the new launched tool/module which will give them the chance to express their needs and expectations and to actively participate in the strategic plans' definition
FRANCO **Director of a Local PA (e.g. Reggio Emilia municipality)**	• Access already existing good practices, or governance guidelines already used by other Public Bodies for joint participatory strategic planning • Develop new strategic plans comprehensive of the needs of stakeholders related to the Public Body. • Participate to the design of new tools for joint strategic planning with external stakeholders to possibly adopt them in the future
ARIANNA **Citizens' Association Representative**	• Express the needs of the community she represents to the local and national PAs in a way that is easy and straight-forward • Monitor the advancement status of all the initiatives that are being carried out by municipalities to meet citizens' needs.

Relationships between personas mediated by INTERLINK enablers during the engagement and design phase



Relationships between personas mediated by INTERLINK enablers during the implementation phase



	STEPS OF CO-PRODUCTION SCENARIO	SUPPORT PROVIDED BY INTERLINK PLATFORM
ENGAGEMENT	• MEF starts the co-production initiative (i.e. the co-design of a new Participatory Strategic Planning Module - PSPM)	Steps supported by the INTERLINKER collaborative environment
	• They launch a communication campaigns to increase transparency of the initiative and to recruit participants to co-design	Re-use of "Awareness campaign tool" technology enabler available in the INTERLINKER catalogue
	• They gather a network of interested stakeholders (local PAs, ANCI, associations of citizens,...). These correspond to potential future users of the PSPM	Steps supported by the INTERLINK collaborative environment (tools for stakeholder engagement)
	• They discuss the different needs, expectations and ideas for the new module and set the goals of the project	Steps supported by the INTERLINK collaborative environment (tools for ideas crowdsourcing, discussion boards, document sharing, voting tool)
DESIGN	• They define the functionalities of the new module that facilitates participated strategic planning, in particular: 1) an interface to be shared with external stakeholders, 2) a repository of good practices	Use of a knowledge-based INTERLINKER that provides service design tools such as scenarios, personas, task analysis, user journeys to elicit requirements
	• They define the functional specification of the Participatory Strategic Planning Module (PSPM) and its services	Use of a knowledge-based INTERLINKER that supports the specification of user flow / wireframes
IMPLEMENTATION	• A new module (PSPM) that supports participatory processes of consultation and transparency along the definition and implementation of strategic plans is developed following the requirements and functional specifications collected during co-design • The module depends on a Data Model based on the concept of Canvas/Template for strategic plans • Implementation is carried out under the supervision of MEF by appointed software developers	Some building blocks already available in the INTERLINKER catalogue are possibly re-used to aid the implementation
	• An open repository is set up with the objective of collecting and sharing good	Re-use and configuration of "Open repository" technology

	practices related to strategic planning elaborated by MEF.	enabler available in the INTERLINKER catalogue
	• The new Participatory Strategic Planning Module is published on the Interlink platform and is made available for (re)use by national or local public bodies	Use of INTERLINK portal to publish the new PSPM with all the relevant documentation (best practices, guidelines, examples,...) in the INTERLINKER catalogue
	• The Data Model (template/canvas to define strategic plans) in the PSPM component is prepared to be used in the MEF/RE context • Tools to visualize progress of different variables and KPIs of a strategic plan is prepared to be used)	Configuration procedure of the PSPM INTERLINKER to be used in a specific context is supported by the INTERLINK platform
	• MEF populates the Open Repository of good practices. Other PAs access it to improve their know-how on Strategic Planning	The "Open repository" INTERLINKER is populated with use case-specific content
	• Reggio Emilia Municipality uses the new PSPM to improve collaboration, transparency and public monitoring of Strategic Plans within a given PA scope. • E.g. a strategic plan is shared with third parties and local associations about the exploitation of LORA city network within specific innovation projects.	Usage of the new PSPM INTERLINKER to set up and monitor a specific strategic plan
	• MEF uses the new PSPM to improve collaboration, transparency and public monitoring of their new Strategic Plans	Usage of the new PSPM INTERLINKER to set up and monitor a specific strategic plan