

Digital Silver Hub: Technical Document

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Abstract

Europe is on the brink of a significant demographic shift that will increase the silver population and a decline in the working age group. This change highlights the importance of addressing the evolving needs of individuals, especially older adults. With this in mind, the European Union and the Baltic Sea Region are leading the way in groundbreaking research in aging and technology-driven services aimed at empowering older adults to live fulfilling lives.

The OSIRIS project, funded by the European Union, is a vital initiative in this regard. Its primary focus is on creating a 'Digital Silver Hub' that provides solutions specifically designed to tackle the challenges faced by the silver population. The Digital Silver Hub is an ecosystem that fosters collaboration between various stakeholders, including private companies, public institutions, academic organizations, and, most importantly, older adults themselves.

This document provides an in-depth exploration of the user dialogue model and system architecture of the Digital Silver Hub, which are the intertwined components driving its functioning. We use the Unified Modeling Language (UML) to represent the parts of the platform and show how it brings together collective intelligence to support the silver economy.

This research is a testament to the dedication, innovation, and forward-thinking of those committed to improving the quality of life for the silver population. It shows that technology and collaboration can combine to meet the preferences and needs of older adults, ensuring they can live independently with dignity and a strong sense of community.

As demographics continue to shift, this research is a step towards a future where aging is not seen as a burden but as an opportunity to celebrate experience, wisdom, and ongoing participation in society.



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Preface

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Chapter 1

Introduction

The silver economy, as defined by the European Commission, represents all economic activity related to the needs of people aged 50 and over [26]. With the demographic makeup of the EU shifting towards an aging population, targeted strategic approaches are required to cater to active aging and mitigate the negative effects of aged dependency [21]. The European Union (EU) and the Baltic Sea Region (BSR) are actively engaged in research on active aging and technology-driven services to enable the silver population to live an independent life.¹ The OSIRIS project - ‘Supporting the Smart Specialization Approach in the Silver Economy to Increase Regional Innovation Capacity and Sustainable Growth’², funded by the EU, is one such initiative that aims to develop a digital collaborative platform called the Digital Silver Hub (DSH) to accelerate the uptake of innovative solutions to the challenges faced by the silver population in the BSR. The DSH involves the quadruple helix actors [14], which include the private sector, public sector, academic institutions, and older adults, as shown in Figure. 1.1.

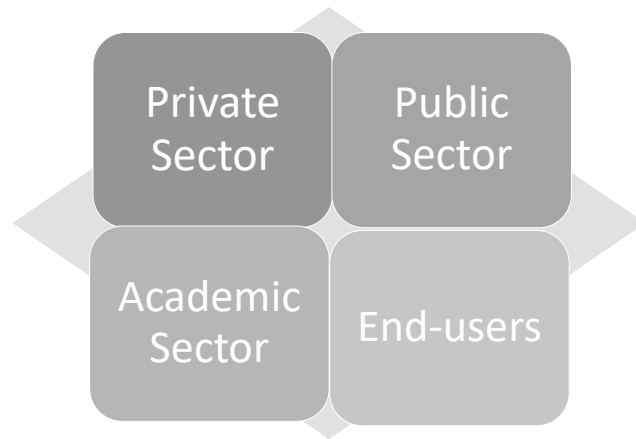


Figure 1.1: Quadruple Helix Actors

This research adopts principles and practices of both design science [24, 29] and, in particular, action design research (ADR) [32] to ensure that the designed and developed artifact contributes to the silver economy and develops innovative solutions that cater to the challenges faced by the silver generation. Therefore, research involves conducting several workshops, questionnaires, interviews, focus group discussions, and information sessions to develop the functionalities of the DSH. Knowledge resources [7], ethical considerations of using Information and Communication Technology (ICT) in the silver economy [6], ways to improve technology readiness of older adults [10], challenges and barriers to ICT adoption [8], and initial conceptualization and inception of the platform have been identified [11]. Moreover, required functionalities by stakeholders of the DSH, which include the OSIRIS project heads and quadruple helix actors from all the regions involved in the project, were identified and developed

¹<https://ec.europa.eu/eurostat/documents/3217494/5740649/KS-EP-11-001-EN.PDF/1f0b25f8-3c86-4f40-9376-c737b54c5fcf>

²<https://osiris-smartsilvereconomy.eu/about-project/>

[12] based on the generic CI model by Suran et al. [34]. These functionalities were further subjected to a comprehensive analysis to refine and expand upon [9] and evaluated using the dimensions of the Technology Acceptance Model (TAM2) [16, 35]; *Perceived Usefulness*, *Perceived Ease of Use*, and *Attitude Towards Using the technology*, along with dimensions of generic CI framework [34]; staffing, processes, goals, and motivation.

This document uses outcomes and evidence from the previous work, and the inputs and outputs of the user interaction process have been defined. The user dialogue model is used to map the user interaction with the system. Different functionalities of the DSH are outlined. We proceed with the paper as follows. In chapter 2, we describe the research methodology of the study. In chapter 3, platform development methodology is defined. In chapter 4, platform architecture is explained. In chapter 5, we provide a description of the Digital Silver Hub system. In chapter 6, we report the user dialogue models. In chapter 7, we conduct a discussion on platform evaluation and future work. We finish the document with a conclusion in chapter 8.

Chapter 2

Research Methodology

To create the user dialogue models for the DSH, three group discussions with six experts were organized. These experts were selected for their knowledge in software development in front-end development, back-end development, and user experience (UX) design. The goal was to work to design the user dialogue models of the DSH, ensuring a seamless and user-friendly interaction between the users and the system.

2.1 Participant Selection

The success of the focus group discussions heavily relied on expert selection. The experts were carefully chosen who had experience in developing digital platforms. The panel consisted of experts in front-end development, responsible for creating the user interface (UI); back-end development, focusing on server-side logic, databases, and application functionality; and UX design, concentrating on improving user satisfaction and usability. By bringing professionals from these fields together, the aim was to incorporate a wide range of perspectives and expertise into the development process.

2.2 Focus Group Discussions

The approach involved conducting three group discussions with each session targeting different aspects of the user dialogue model. These discussions were structured to encourage conversation, promote the exchange of ideas and ensure participation from all experts involved. Throughout the sessions, the dialogue model were continuously refined. The key topics addressed during these focus group discussions included;

1. User interaction flow; We explored how users would navigate through sections of the platform, access functionalities and receive feedback from the system.
2. Visual and functional elements; The experts examined the components of the platform such as color schemes, font styles and layout designs. At the time they also scrutinized elements to determine which features would be most beneficial and intuitive for different users.
3. Error handling and user guidance; We discussed strategies, for handling user errors while providing instructions and support to older adults in case of misunderstandings or mistakes.

2.3 User Dialogue Models

The user dialogue model is a crucial component of the DSH, and it is designed using the Dialog Model, as explained by Dirk Draheim and Gerald Weber in their book Form Oriented Analysis [17]. The model defines the interaction process between the user and the system as a sequence of interchanging client and server states. The client state presents information to the user and offers several options for entering and submitting data. Upon submitting the data, the dialogue transitions to the server state, where the data is processed, and a new client page is triggered. [17]

The ISO 9241-110¹ defines dialogue principles as the interaction between a user and an interactive system as a sequence of user actions and system responses to achieve a goal. The principles include suitability for the task, self-descriptiveness, controllability, conformity with user expectations, error tolerance, suitability for individualization, and suitability for learning.

Unified Modeling Language (UML) Activity Diagrams are used to generate the Dialogue Models as they enable different levels of abstraction and can easily adapt to different contexts of use. The diagrams have a rich graphical notation [4] and modeling capabilities that allow the capture and visualization of the system structure.²

¹<https://www.iso.org/obp/ui/#iso:std:iso:9241:-110:ed-2:v1:en>ISO 9241-110:2020(en)

²<https://www.ibm.com/docs/en/rational-soft-arch/9.7.0?topic=diagrams-uml-models>

Chapter 3

Platform Development

To develop the DSH, the agile methodology was adopted, as shown in Figure 3.1. This approach is ideal as it allows web developers to work on small parts of the project simultaneously, which is useful when multiple iterations are created and reviewed [2]. It facilitates the implementation of changes and constant feedback, which results in the continuous delivery of semantically structured outcomes [2].

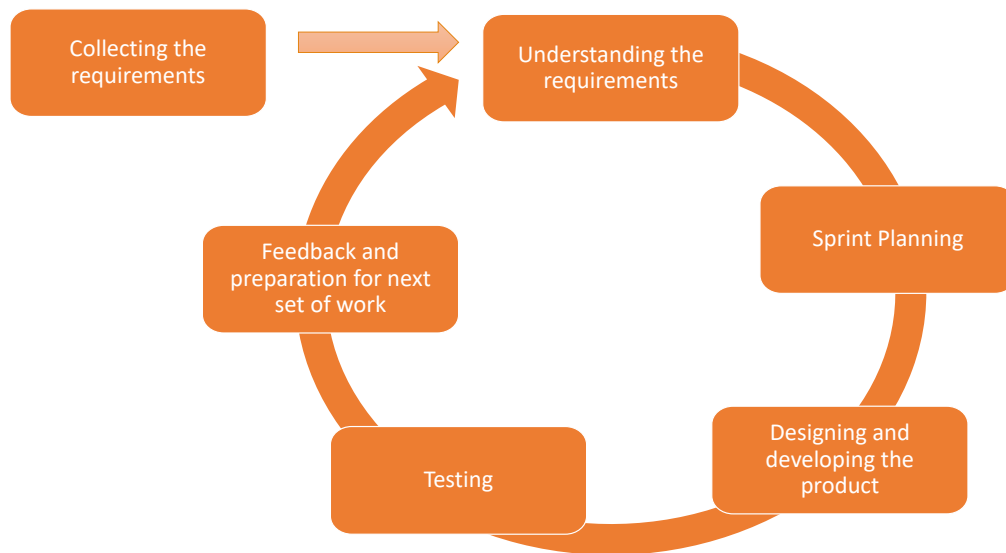


Figure 3.1: Agile Life Cycle

The first step of the agile lifecycle is to collect information about the project by gathering required functionalities from project partners and quadruple helix actors [3, 33, 27, 18]. The next step is to understand these requirements, prioritize them, and allocate necessary resources.¹ To create a backlog, we need data for the system that software developers can use. Once the data (requirements) is collected, it is analyzed and provided to the developer to add to the DSH. We meet with the developer twice a week and provide the requirements to be developed, and the sprint duration is one week. Our partners are expected to provide us with new data (backlog) as they get it, which can then be incorporated into the DSH.

Then, website designing and development are done, which includes incorporating the given requirements into the platform. This way, a part of the DSH is ready for visualization, providing a clearer picture of the outcome. In case of any bugs or errors, the immediate fix can be done, and testing is performed to ensure quality. The developer performs a small set of tasks on the website, feedback is

¹<https://www.techstep.io/articles/requirements-analysis-in-an-agile-world>

given, and changes can be made constantly. Once a reasonable amount of functionalities were collected and incorporated into the DSH, project partners were invited to test the hub and give feedback. Once the feedback has been received, development processes are discussed further, and arrangements are made for the next set of work. [3, 33, 27, 18].

Agile methodology is less time-consuming due to constant feedback, meaning errors and bugs are instantly discovered and fixed, reducing the risks of complete project failure. Moreover, each sprint of work is demonstrated, resulting in a visual representation of the progress and higher satisfaction. It is an adaptive approach providing flexibility to make dynamic changes according to changing circumstances, and because of the direct communication with the developer, a high level of transparency is maintained. [3, 33, 27, 18].

Chapter 4

Platform Architecture

Selecting an appropriate software architecture to support complex and powerful operations performed by modern software applications is paramount [5]. In simpler terms, software architecture refers to the basic structure of a software system and all the functions required to enable the system to behave as desired [20]. There are several software architectures available today, such as client-server, data-centric, microservices, reactive, and rule-based architectures. However, for the DSH, we use the 3-tier architecture to achieve flexibility, easy scalability, enhanced security, and robustness [1].

N-tier architecture has recently gained immense popularity due to its adoption of a client-server model [25]. It is a multi-layered architecture divided into logically and physically separate tiers of presentation, processing, and data functions [30]. It is a request-response service provided over the internet, where the client executes a set of actions over the network, and the server sends the result sets to the client system. There are different types of N-tier architectures, such as 1-tier, 2-tier, and 3-tier architecture, and each one has its own use cases, benefits, and drawbacks. However, for the DSH, we only concentrate on the 3-tier architecture, which has three distinct hierarchies of independent tiers: presentation, application logic, and data tier, and each tier performs a separate job.

Each tier is independent and has its own technology, logic, language, and platform. This means that its operation, maintenance, and troubleshooting are also independent. Despite this, the tiers need to continuously interact with each other and are backward and forward-compatible with other components in the system for the software application to work seamlessly.¹

The presentation tier is the user-interface tier of the software application that manages the input/output data and presents information in an understandable format to the user [1].² The application tier is the middle tier that manages the processing of functions, including command executions, handling of errors, calculations, and any logical decisions [1]. It is the hidden connection between the user interface and the principal database. Lastly, the data tier is the database tier that manages the data store and optimizes the data access. The application logic tier retrieves data from the database stored in the data tier and processes it, and the results produced are stored back in the database [1]. For the DSH, each tier has its technology and language, which is elaborated on in the subsequent sections.

The 3-tier architecture is used for the DSH because it has three separate components, making it convenient to maintain each component of the architecture without affecting others, thus increasing flexibility. Because of this factor, it is also easy to upgrade one component without affecting other components' performance, significantly improving scalability. Each tier can have its security privileges, enhancing the security of the DSH by assuring that each component is protected according to its criticality level. Moreover, recovery times are shortened in case of a partial service disruption, as the 3-tier architecture allows restoration of an individual component with other tiers unaffected.³

¹<https://www.techopedia.com/2/32100/software/a-detailed-look-at-3-tier-software-architecture>

²<https://www.ibm.com/topics/three-tier-architecture>

³<https://www.geeksforgeeks.org/advantages-and-disadvantages-of-three-tier-architecture-in-dbms/>

4.1 Data Tier

The data tier is the back end of the DSH, where user information is stored and managed. The DSH uses a NoSQL database as it offers more flexibility and rapid scalability to manage extensive data sets [28]. Moreover, as NoSQL is also a distributed database, information is stored on various remote or local servers, ensuring robust availability and data reliability [28]. This means that if some of the DSH data goes offline, the remaining database will still be functional. NoSQL provides the speed and ability to manage vast amounts of data generated from the DSH by scaling horizontally. The NoSQL database will be managed using object storage as the data model. Structured data, such as user profile information like name, date of birth, etc., will be stored in a regular NoSQL database. However, images, audio and videos, and other binary data will be stored with object storage. According to the focus group discussions, it was identified that the data generated from the DSH cannot be structured in rigid tables and hierarchies, and therefore, a more flexible database has to be chosen, which leads to our choice of object storage. Object storage offers ease of use and improves scalability [19], which means that when more and more users join the DSH and data grows, object storage also grows without limits. Moreover, due to the limited budget, an infrastructure team cannot be hired full-time, which means if any changes are made to the platform by the developer, it can be easily done with agility.

The expert focus group discussions identified that the DSH may produce isolated pools of data, resulting in a fragmented storage portfolio that adds to the complexity and, consequently, slows down innovation. The DSH needs a database solution that is durable but also secure, and compliant, leading to our choice of Amazon Web Services (AWS) cloud solutions. Amazon Simple Storage Service (Amazon S3) and Amazon Glacier deliver the advantage of managing the DSH data storage in one place at an optimal cost. AWS cloud services are estimated to provide 99.99% durability and are the only cloud service providing three different forms of encryption. “Amazon S3 & Glacier support more security standards and compliance certifications than any other offering, including PCI-DSS, HIPAA/HITECH, FedRAMP, SEC Rule 17-a-4, EU Data Protection Directive, FISMA and many more, helping satisfy compliance requirements for virtually every regulatory agency around the globe”.⁴

4.2 Application Logic Tier

The application logic tier interacts with the presentation tier, handles all processing functions defines solutions to complex problems, and communicates with the underlying database to, for example, retrieve or store data. NodeJs will be used to write the application logic tier. It is an open-source server-side JavaScript runtime environment. Based on a JavaScript engine called the V8, NodeJs supports many web browsers like Google Chrome and includes many V8 optimizations that help in running server-side applications. It is input/output (I/O) intensive, which makes it efficient for real-time applications running on distributed devices and, consequently, leads to improved scalability. NodeJs supports a single-threaded architecture “using non-blocking I/O calls, allowing it to support tens of thousands of concurrent connections held in the event loop.”⁵

The DSH provides a platform where quadruple helix actors can collaborate using the real-time collaboration tool that offers project management, file uploading, scheduling, video and audio conferencing, and much more. Keeping this in mind, NodeJs offers an asynchronous and event-based architecture with events and I/O requests occurring concurrently. As the users grow in number, the load on the server will also increase; however, Node’s WebSockets and Event API ensure that heavy I/O operations do not hang the server. NodeJs is event-driven and a non-blocking architecture that instantly propagates updates and makes it highly suitable for collaboration environments.⁶

4.3 Presentation Tier

The presentation tier defines the user interface of the DSH by managing the I/O data and how it is displayed. The users can access the DSH by using any existing web browser like Google Chrome, Safari, Internet Explorer etc. According to the expert focus group discussions, user interface requirements were identified which are as follows:

⁴<https://aws.amazon.com/what-is-cloud-object-storage/>

⁵<https://www.toptal.com/nodejs/why-the-hell-would-i-use-node-js>

⁶<https://www.netguru.com/blog/node-js-apps>

- The user interface should be easy to use and convenient;
- The user interface should be well-designed and of high quality to attract users to its main functionalities;
- Webpages should load quickly and render quickly;
- If functionality is added to one component of the DSH, it should not cause a ripping change throughout the codebase;
- The data flow and structure should provide code stability with seamless performance;
- There should be a possibility of upgrading the DSH from web development to a mobile app;
- The changes made to the platform should be trackable;
- Triggered outputs, functions, events and any other technical aspects should be testable.

Keeping in mind these requirements, React.js was chosen as the major web-scripting language exploited in designing the presentation tier of the DSH. React.js is a JavaScript library widely used for creating user interfaces for websites.⁷ Top companies like Airbnb, Tesla, Walmart, Paypal, and many more are using React due to its numerous functionalities and features. React works with many components, making it easy to iterate with the system and allowing a larger user interface to be built. It uses virtual DOM (Document Object Model) that allows faster loading of web pages and helps in Google Search engine optimization, resulting in greater visibility online and further opportunities.

⁷<https://uu.diva-portal.org/smash/get/diva2:971240/FULLTEXT01.pdf>

Chapter 5

System Description

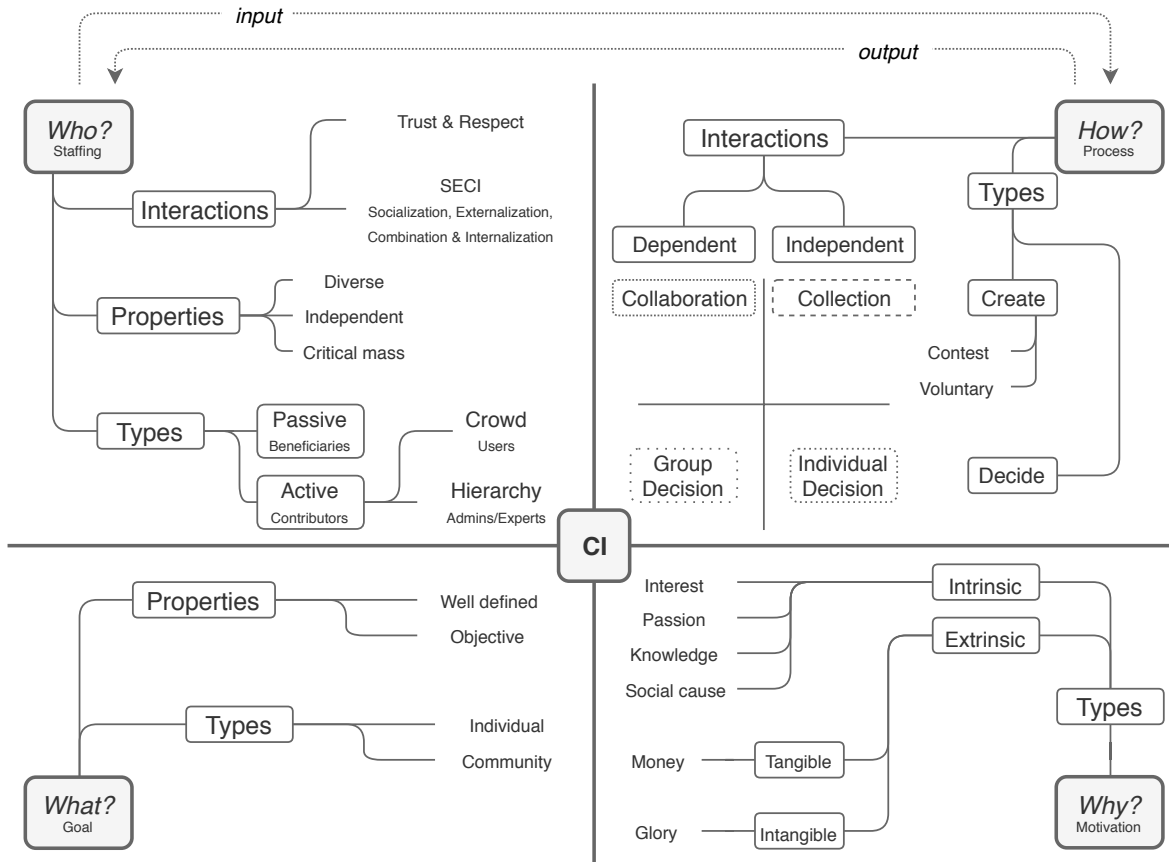


Figure 5.1: The Generic CI Model [34]

The DSH’s functionalities are based on a generic CI model [34], which encompasses key components such as staffing, processes, goals, and motivation as shown in Figure. 5.1. It serves as a collaborative space for a diverse group of stakeholders and innovation actors, such as private sector representatives, academicians, policymakers, and older adults. The success of the platform hinges on the effective utilization of these quadruple helix actors, with policymakers being instrumental in delivering public value, engaging older adults, and identifying market gaps. The participation of older adults is also crucial, as they serve as consultants on senior needs, and their contributions towards developing innovative solutions on the platform are highly valued. Stakeholders can join in by sharing innovative ideas, discussing the feasibility of these ideas, organizing training programs, and providing networks for collaboration. [12]

To ensure platform success, loyal users, up-to-date content, and successful collaborations are essential. Integrated systems like Zoom/Skype/Teams facilitate smooth collaboration between innovation actors. LinkedIn and Facebook can be utilized to channel networking and build public relations. Chatting is preferred over calls to maintain privacy. The DSH platform is an open innovation ecosystem that enables the development, testing, and collaboration of innovative solutions. Incorporating patenting and copyrights is crucial to protect stakeholders. Decision-making is democratic, with no hierarchies. Contests can also be held to attract and encourage users to generate innovative ideas, with cash prizes or gift cards as rewards.

External incentives are crucial in motivating stakeholders and innovators to participate in the platform. Senior members of the community can benefit from feeling valued and involved in the creation of goods and services, as well as combating social isolation and loneliness. The platform should be engaging, user-friendly, and easy to access to ensure that users remain active. It would be beneficial if the government, incubation centers, and private sector to provide funding for the platform to support innovation development and address social challenges. The components of the DSH according to the generic CI model are shown in Figure. 5.2.

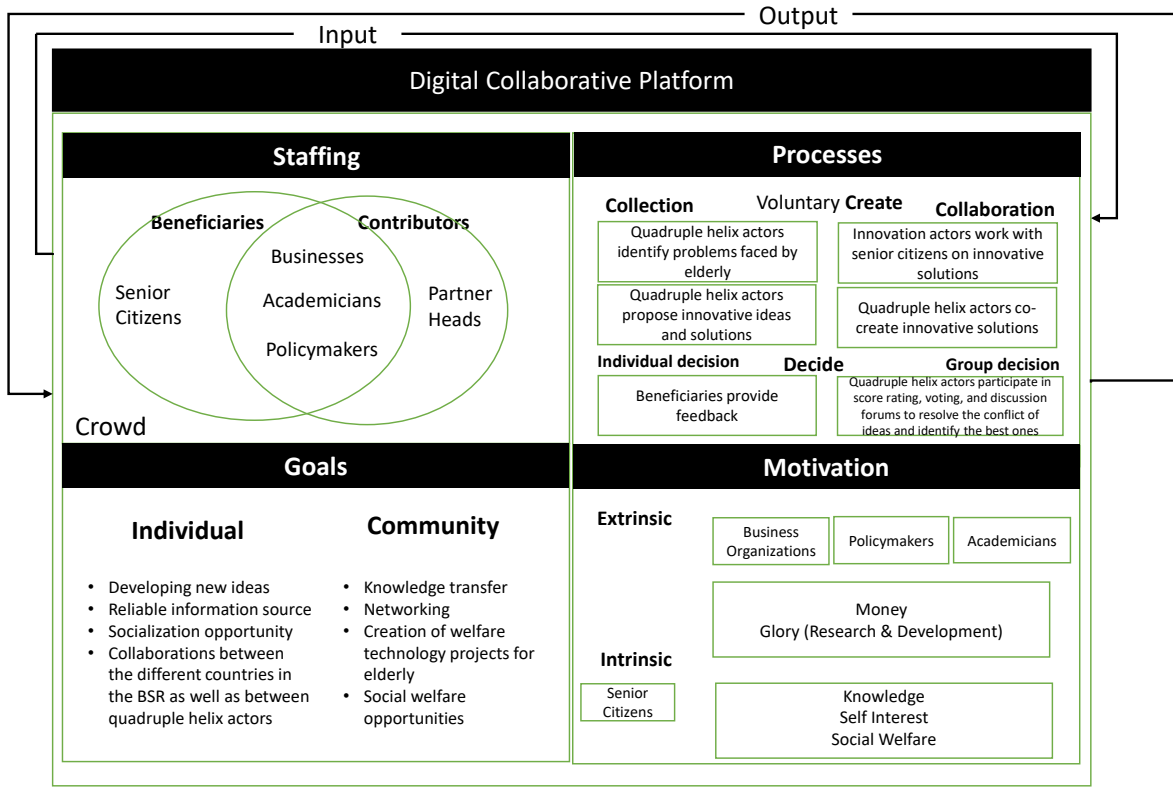


Figure 5.2: Components of the Digital Silver Hub [12] according to the Generic CI Model [34].

A smart specialization approach was employed to develop the DSH supporting the silver economy. Considering this, a Smart Silver Framework was developed, representing a pilot cooperation model enabling collaboration between stakeholders and increasing their capacity to generate economic growth through innovation. The Smart Silver Framework comprises three layers, with the first focusing on the quadruple helix actors. The second layer includes infrastructure focus areas for each helix actor, and the third layer includes classification and references. The Smart Silver Framework has been evaluated and validated by each region and found to be flexible, scalable, and transferable [9]. A comprehensive report on the Smart Silver Framework can be accessed publicly.¹

The Smart Silver Lab is a multi-level governance structure that employs the Smart Silver Framework and serves as an open innovation ecosystem.² The Lab focuses on innovation actors and enables them to connect, coordinate, and build collaboration to develop innovative products and services for the

¹<https://osiris-smartsilverconomy.eu/smart-silver-framework/>

²<https://osiris-smartsilverconomy.eu/smart-silver-lab/>

silver economy in the BSR. The Lab's first layer of governance consists of quadruple helix actors who communicate and establish collaborations using the DSH. The Smart Silver Lab also includes the Idea Lab, a repository for all innovative ideas that have been shared, given feedback on, concluded, or are still in development.

To support innovation management, various innovation-supporting tools are put to use, such as the Open Innovation Development Toolkit³ for developing innovations, prototyping, accelerating market uptake, and enhancing partnerships. The Silver Financing Mechanism⁴ for connecting innovation actors with various funding instruments, while the Knowledge Diffusion Toolkit⁵ for enhancing the utilization, transfer, and reuse of knowledge amongst innovation actors. [9] The toolkit is structured in accordance with the innovation development phases shown in Figure. 5.3.

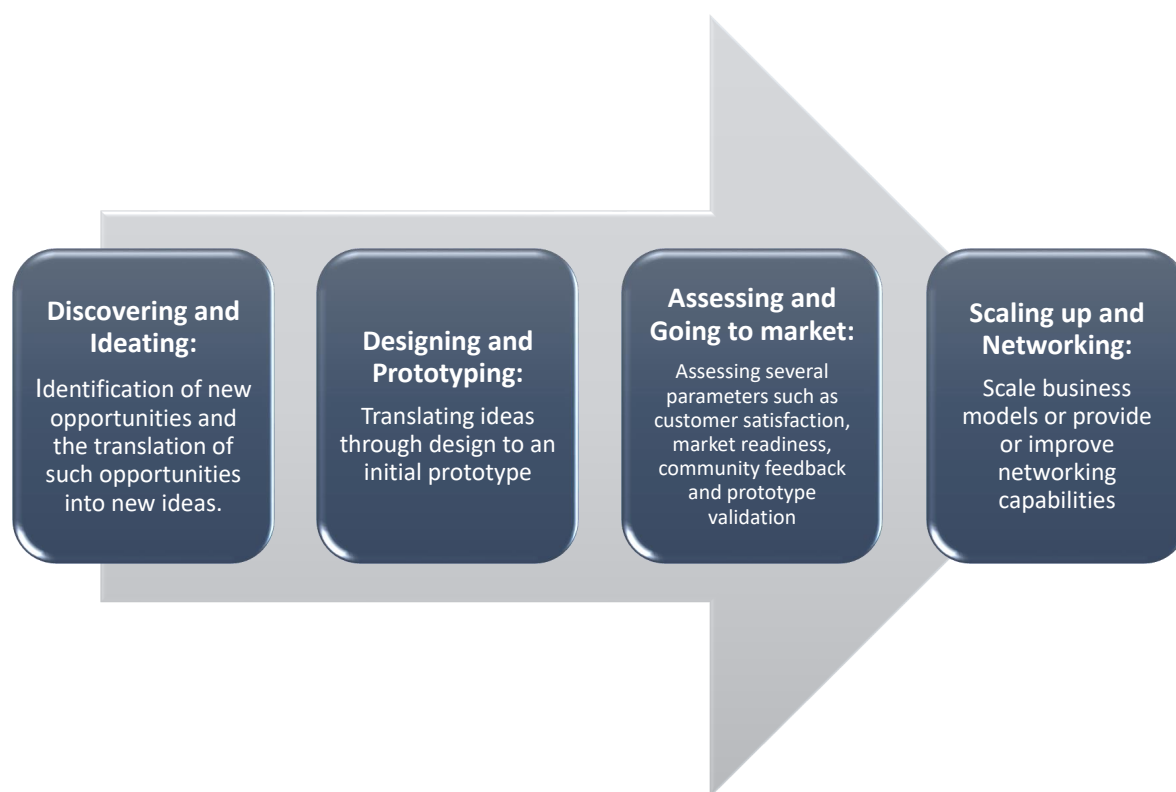


Figure 5.3: Innovation Development Phases

The mission of the DSH is to facilitate collaboration among quadruple helix actors by emphasizing networking. The platform provides a space for innovation actors to interact and exchange ideas, with the potential to form partnerships on future projects. It features discussion forums that serve as a social hub for innovation actors to chat and share ideas and a dedicated partner search function. The DSH acts as an information hub for events and publications related to the silver economy, with a library of silver market characteristics that can be updated and modified by users. The collaboration tools are the most important feature of the DSH, as they allow project owners and managers to invite new partners, assign tasks, create agendas and workflows, schedule deadlines, and hold Zoom meetings. Users can also make notes, upload files, and archive no longer active projects, enabling innovation actors to work together efficiently and effectively.

To access certain functionalities on the DSH platform, users must sign up and log in with the correct email and password format. Users will be redirected to an error message and asked to re-enter their credentials if entered incorrectly. After logging in, users can manage their accounts, edit their data, and change their passwords.

³<https://silverhub.eu/ww/c/10054/p/1>

⁴<https://silverhub.eu/et/c/10064/p/1>

⁵<https://silverhub.eu/et/c/10284/p/1>

Market research can be conducted on the DSH platform through one-on-one discussions with different actors, creating and sharing surveys, or organizing focus group discussions. Competitions can be held on various themes related to the silver market, offering rewards such as gift cards, prize money, or collaboration opportunities to grow the DSH user base and encourage innovative ideas.

Chapter 6

User Dialogue Models

6.1 Smart Silver Framework

The project partners highlighted that the project employs the smart specialization approach and develops a virtual system supporting the silver economy. A smart specialization is an approach that enables regions to focus on their strengths and comparative advantages and invest in carefully chosen priorities to boost regional enterprise innovation to ensure the greatest impact¹. The DSH enables the six regions of the BSR, Finland, Estonia, Denmark, Latvia, Lithuania, and Russia (St. Petersburg), to come together and collaborate to develop innovative solutions for the growing aging population in the BSR.

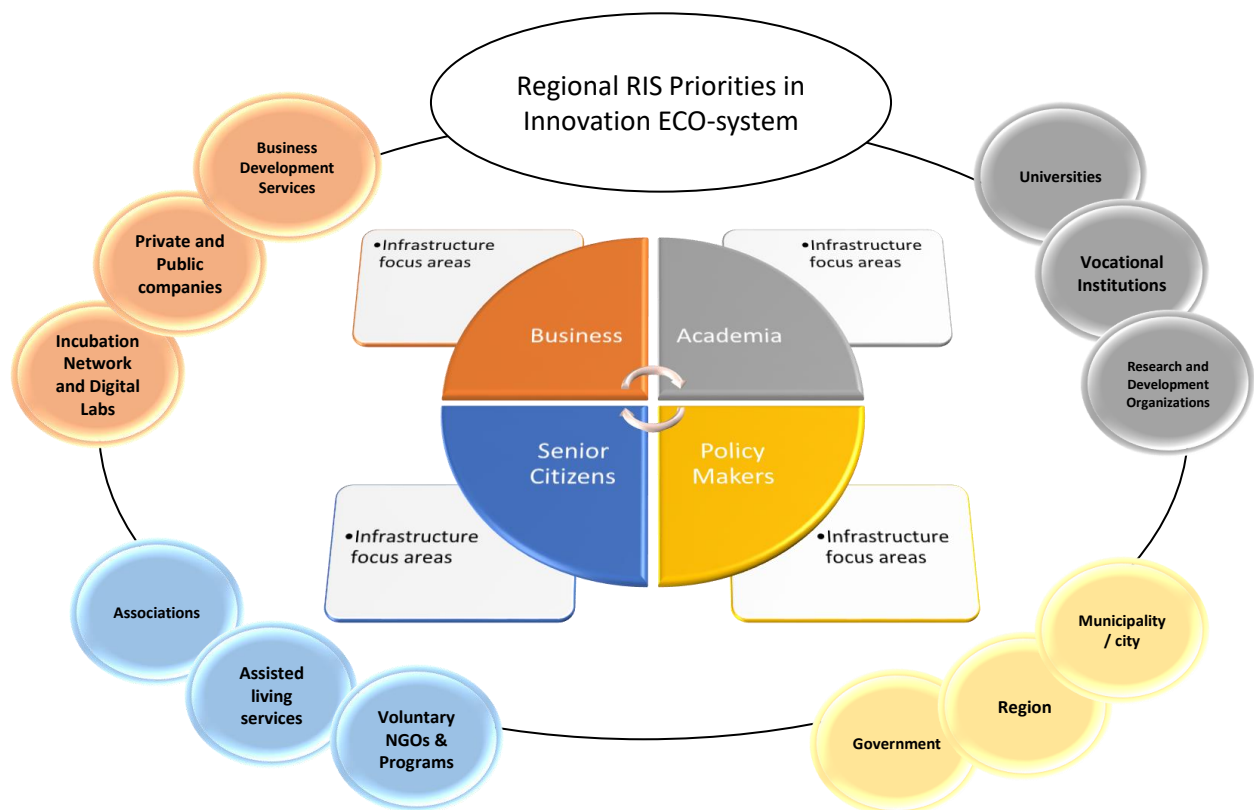


Figure 6.1: Smart Silver Framework

Considering this, a Smart Silver Framework was developed, representing a pilot cooperation model

¹<https://s3platform.jrc.ec.europa.eu/what-we-do>

that uses a smart specialization approach to enable collaboration between stakeholders and increase their capacity to generate economic growth through innovation. The Smart Silver Framework consists of three layers (See Fig 6.1), and the first layer consists of the quadruple helix actors. The development of the silver economy cannot be done in isolation and therefore requires input from all the major sectors of the economy that are identified in the quadruple helix model of innovation.² This model identifies the four innovation actors the academic sector (researchers and institutions), the private sector (businesses and companies), the public sector (government and policymakers), and end-users (in this case, older adults). An integrated response from all the helixes can reap greater benefits, efficient utilization of resources, and consequently, foster smart innovations for the silver economy. The second layer of the Smart Silver Framework consists of the infrastructure focus areas for each helix actor. These focus areas can vary and depend on the actors' priorities, which can be determined by analyzing their region's silver market characteristics. The third layer, which is also the outer layer of the Smart Silver Framework, consists of classification and references, which are as follows:

- Senior Citizens: Associations/NGOs; Assisted living services; voluntary program
- Business: Business development services; Companies; Incubator Network and Digital Lab
- Academia: Universities; Vocational institutes; Research and development organisations
- Policymakers: Municipalities/Cities; Region; Government

The Smart Silver Framework was further evaluated and validated by each region, and it was concluded that the framework is flexible, scalable, and transferable. A detailed report on the Smart Silver Framework is publicly available.³ The framework aimed to develop a structure to implement the DSH and incorporate Smart Silver Labs.

6.2 Landing Page

When the user opens the URL, there will be a landing page with the main title, 'Digital Silver Hub' and introductory statements to familiarize the user with the main concept of the hub. The taskbar shows the sections: 'About', 'How it works?' and 'Login/Signup'. The landing page will also have the option to choose from different languages as the platform targets the BSR region, so the DSH will have the option to choose from the languages in Table. 6.1.

Table 6.1: Languages

Languages
English
Estonian
Finnish
Russian
Danish
Latvian
Lithuanian

The landing page will also consist of the 'Help' icon to assist the users to navigate through the system and asking the chatbot for instant queries (as shown in the user dialogue model in Figure. 6.2. The FAQ will also be developed to help users identify solutions if they get wedged at some point on the hub. The landing page will show the signup option not only on the Taskbar but also as the main text below the introduction of the DSH to familiarize the users that it is a platform, and the precondition to use it is to signup and log in to the system.

²<https://northsearegion.eu/media/11651/a-quadruple-helix-guide-for-innovations.pdf>

³<https://osiris-smartsilvereconomy.eu/smart-silver-framework/>

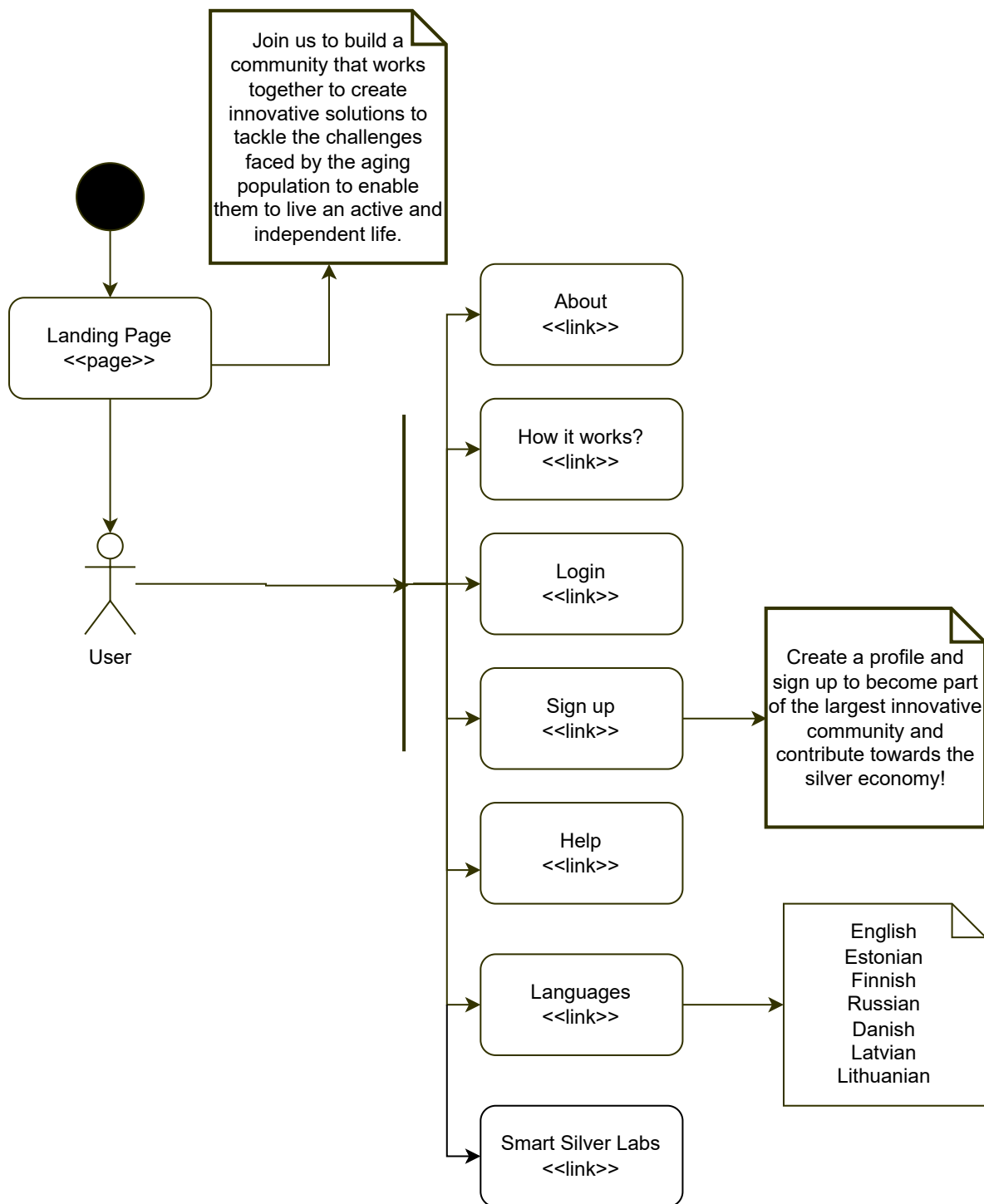


Figure 6.2: Landing Page of the Digital Silver Hub

6.3 Signup and Login

The precondition to use the platform is that the user has to signup, build a profile, and login and then be able to access all (or most of) the functionalities. The signup form will be different for each of the roles at the DSH. Each entry on the form will become a row in the database, and every piece of information they provide should be verifiable. The verification process will be outsourced to the verification company (e.g., Veriff) which will provide all the information that is required from each participant to ensure security and credibility on the DSH. When a user clicks on Signup, a form will

appear to allow them to choose one of the roles as shown in Figure. 6.3.

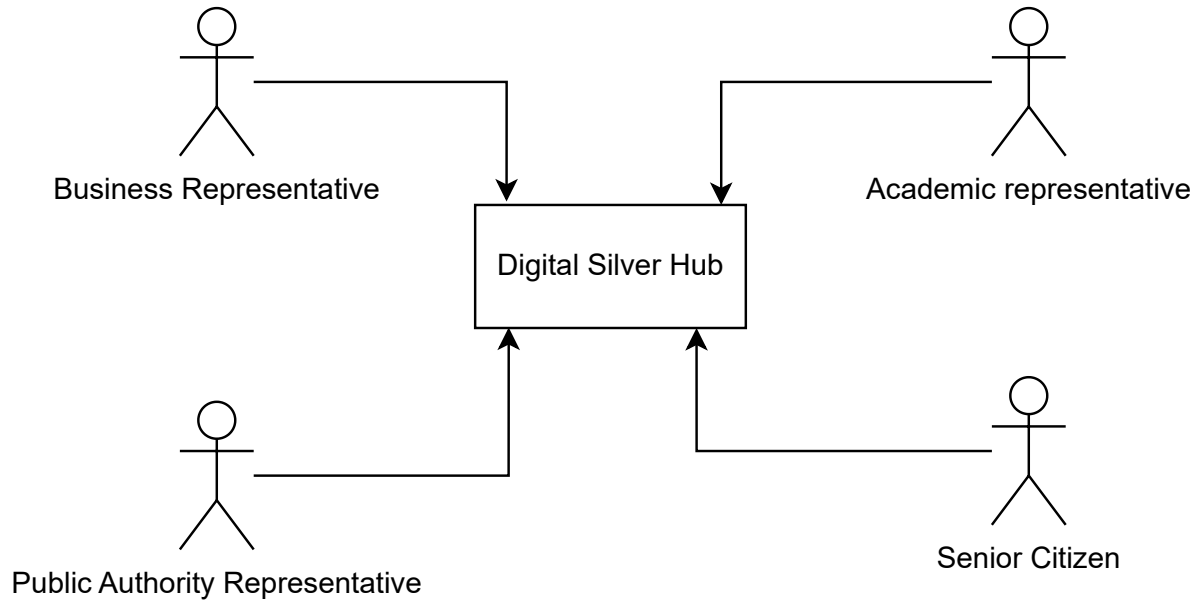


Figure 6.3: Choose a Role

The basic information required from each participant will be the same, and the form is shown in Figure. 6.4.

The screenshot shows a signup form on a dark blue background. The form consists of two columns of input fields. The left column contains 'Full Name', 'Email', and 'Password'. The right column contains 'Country', 'City', and 'Time Zone'. Below these fields are two checkboxes: 'I agree to the [Terms and Conditions](#)' and 'I accept the [Privacy Policy](#)'. A large 'Sign up' button is centered below the checkboxes. At the bottom, there is a link: 'Already have an account? [Log in.](#)'

Figure 6.4: Signup Form

Country and city will give information about the region of the participant, and the time zone will help them when communicating with actors from a different region. For specific roles, the form will include the tabs shown in Table. 6.2.

The precondition to using the different functionalities of the DSH is to sign up and log in. Once the user logs in, entering their username and password, they enter the homepage of the DSH that shows different functions. When a user signs up, the correct email and password format have to be used. If

Table 6.2: Tabs on Signup Form

Senior Citizen	Business Rep	Academic Rep	Public Authority Rep
Age	Company name	University name	Organization name
Gender	Position	Position	Position
Working status	Business Registration/VAT No	Research topic	Sector

entered incorrectly, the user will be redirected to an error message and to re-enter their credentials. When entered correctly, the system will check if data already exists in the system, and if it does not, a verification email will be sent with a link that redirects to the login page where, after putting in the correct credentials, the user should be able to log in and view the home page as shown in Figure. 6.5.

The home page consists of different links that lead to different platform features and functionalities, as shown in Figure. 6.6.

6.4 Smart Silver Labs

The landing page gives information about the Smart Silver Labs (SSL), and the user can choose a region to view the Lab. The Smart Silver Lab is a multi-level governance structure that employs the Smart Silver Framework and serves as an open innovation ecosystem. The Lab focuses on innovation actors and enables them to connect, coordinate, and build collaboration to develop innovative products and services for the silver economy in the BSR. The Smart Silver Lab uses the DSH to communicate and establish collaborations amongst its first layer of governance, which is the quadruple helix actors, to identify new *“trajectories, which each region may need to acquire to access new forms of knowledge, create new recombinations of their resources, and move from path extension to new path-creation.”* The second layer of governance is the Transnational Cluster, which is composed of each regional Smart Silver Lab (Figure. 6.7) and supports innovation actors to *“joint actions to acquire knowledge, to diffuse knowledge, to access global value chains, to improve policy instruments and programs, to exchange best practices, to replicate successful measures, and to combine assets, capabilities, and competences for generating innovative products or services”*.⁴ Each Lab will have a Lab member and its own Managing Committee responsible for processing applications, accepting new Lab members from their regions, and proposing them to become part of the Managing Committee. The Lab members and managing committee of the six regions employ the DSH to interact with each other and conduct meetings and open-access events to connect the ecosystem members and the relevant silver economy actors.

6.4.1 Idea Lab

There will also be an Idea Lab (Figure. 6.8), which will serve as the repository for all the ideas that have been shared, provided feedback on, and concluded, as well as the new and upcoming ideas. Ideas will be presented in a list that will be sorted by the following attributes; publication date, top reactions, or relevance. There will also be a search bar to look for a particular idea using the keywords. The *active idea* is the one that has been recently shared and is open for feedback from the participants, and an *idea contributor* is the participant who shares the idea. An idea will stay active for at least three months, but the idea contributor can decide the time from a couple of weeks up to 6 months. Any participant can look through the list of ideas and give their feedback; however, the idea contributor would be able to see the participant’s profile giving feedback and analyze if their expertise matches the concept of the idea shared. The Moderator of the platform is the administration staff for the DSH and can remove/delete any comment that is against the terms of use or may be offensive without any justification.

Now when an actor shares an idea, participants can vote for it in two ways; they can either up-vote it, which will be depicted as a thumb-up signaling that they like the idea, or they can down-vote it, which will be depicted as the thumb down signaling dislike towards the idea. The number of votes (up and/or down) defines the top reaction and the most voted idea. Along with voting, participants can comment on the idea in the comment box to reason their vote and give suggestions. Participants can sort the ideas from the list by relevance, which will be determined by the ideas on which they

⁴<https://osiris-smartsilvereconomy.eu/smart-silver-lab/>

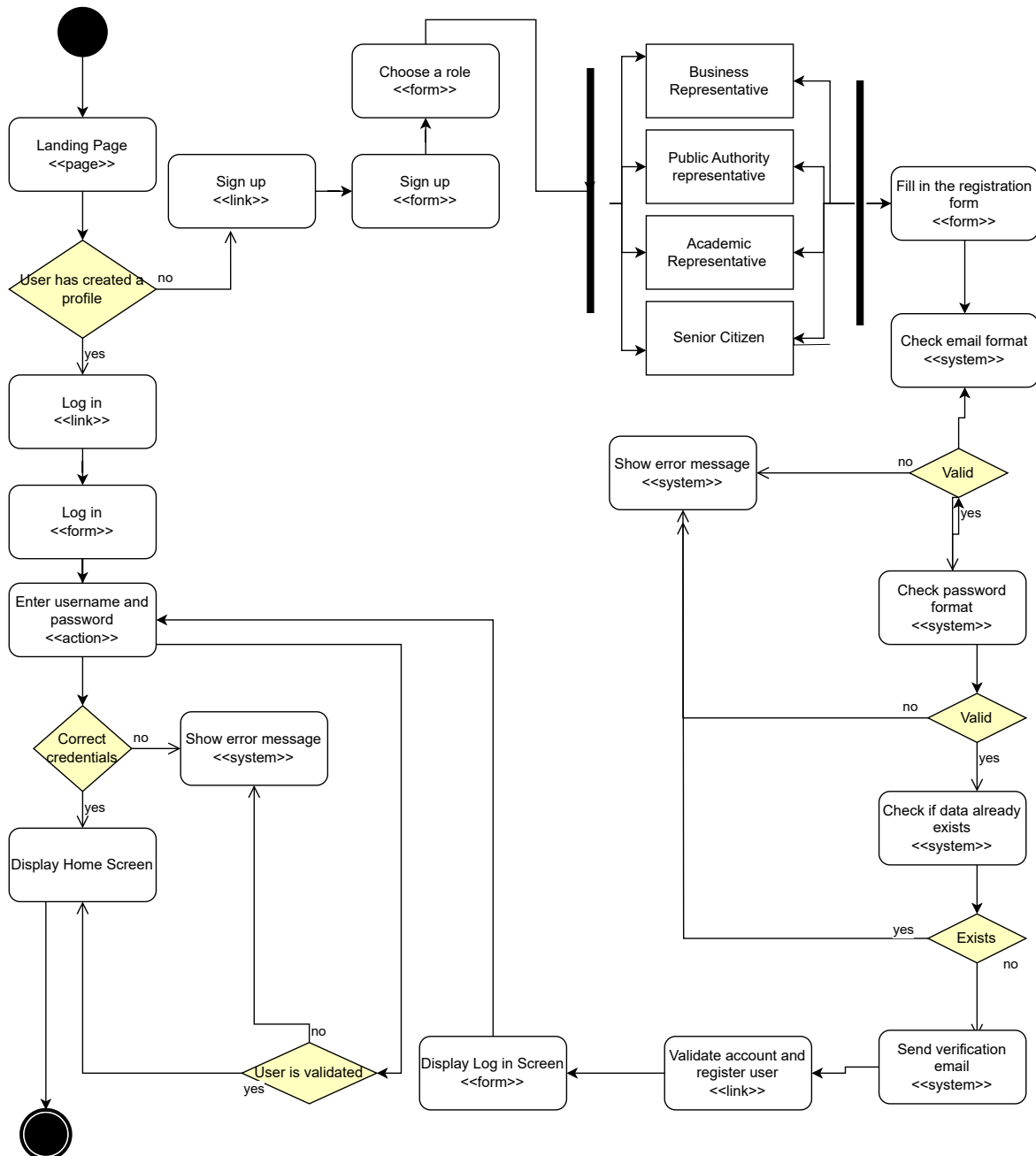


Figure 6.5: Signup and Login

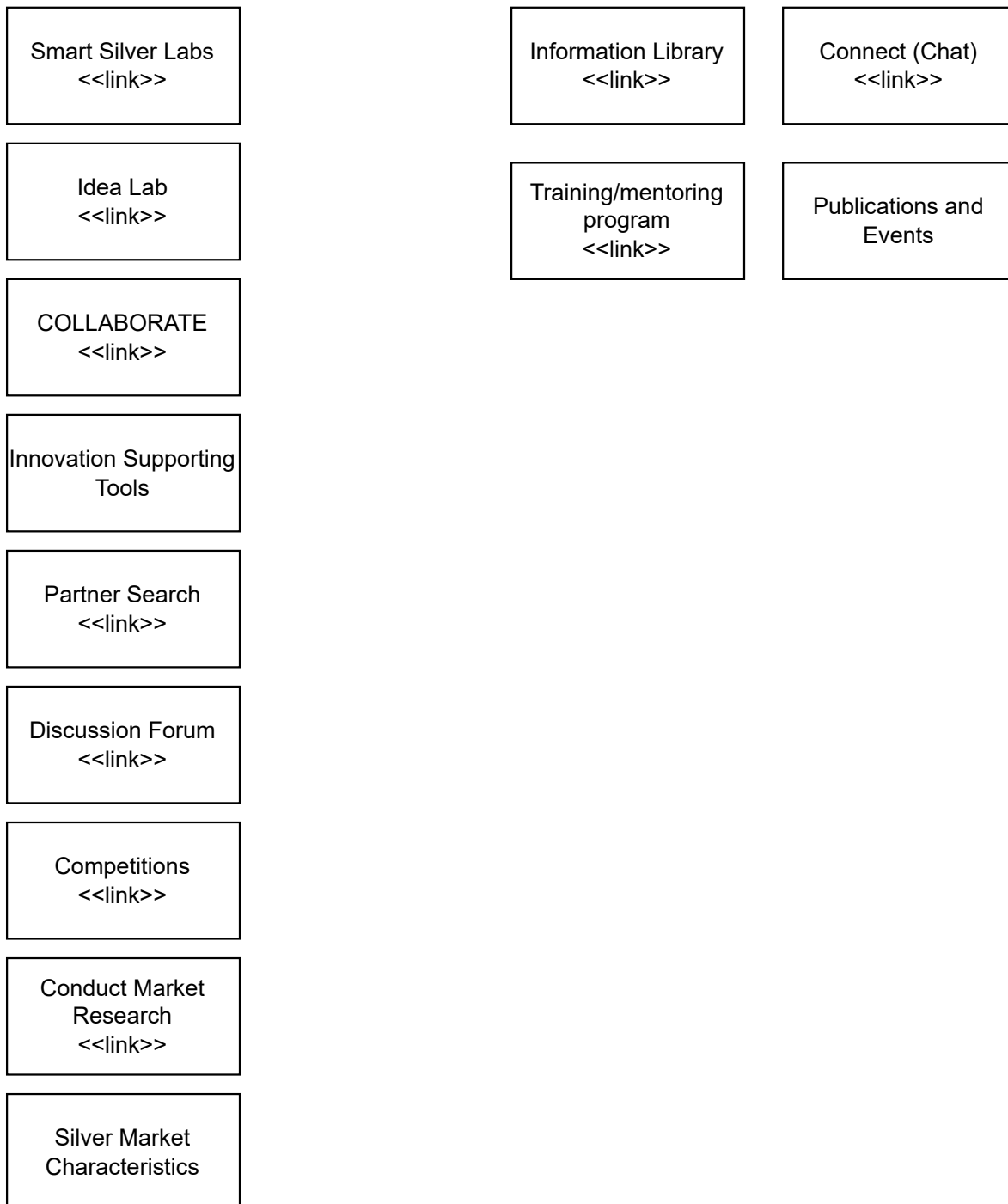


Figure 6.6: Home Page of the DSH

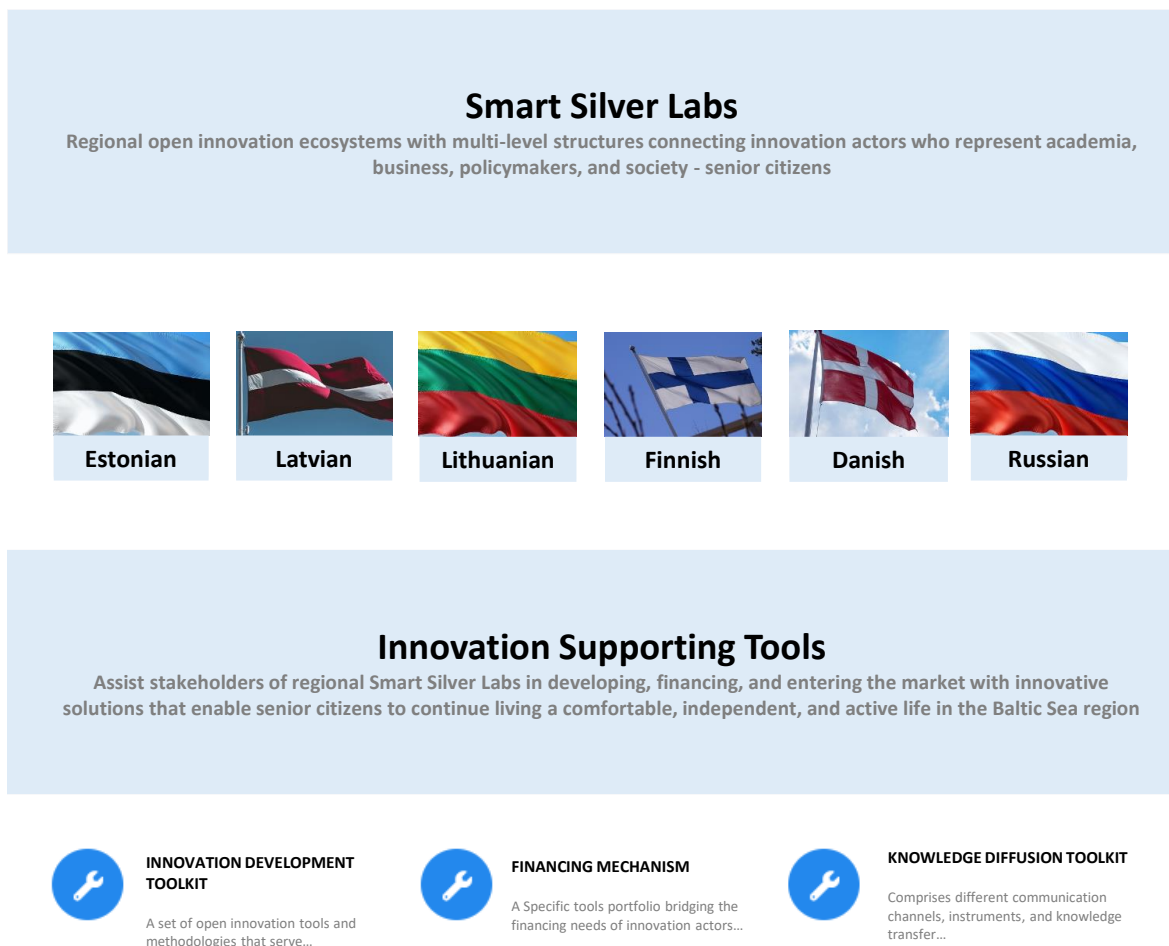


Figure 6.7: Regions and Smart Silver Labs

would have commented. If ideas have to be thoroughly discussed, these ideas can be taken to the discussion forums where all participants can argue, give their critique and/or praise, and offer to build a partnership.

The idea contributor can work further to build on the idea by finding a partner from the comment section, discussion forum, or the partner pool. The partner pool will be organized according to the quadruple helix model. There will be four categories: business representatives, public sector authority representatives, academic institution representatives, and older adults. Within each category, representatives will be listed with a brief introduction of their institution name and position for triple helix and age, gender, and working status for the older adults. Their profiles should be visible when clicked on them individually. Search functionality can be used to identify relevant actors by putting in their names or other keywords. Once a relevant partner has been identified, the idea contributor can connect with them on chat, voice call, or video call using the Zoom integrated communication app.

Moreover, an idea contributor can also check the practicality of their idea and test it with different stakeholders by either organizing a focus group from the DSH or running a survey. If a prototype is in question, it can be tested with the target group, and feedback can be gained. In addition to this, market research can be conducted to identify the likeliness of the idea being successful, if older adults find the product/service idea to be useful to them, or if businesses consider that the idea is feasible and willing to fund it. Once the idea has received feedback, partners have been identified, and it's time to work further to develop it, the idea contributor can use the collaboration tool and ensure that they have everything in one place. Different tasks can be assigned to different partners, and a team can be formed with a decided agenda using the calendar. Deadlines and work steps can be organized, and schedules can be maintained.

6.4.2 Feedback on Idea

If a user comes on the DSH and logs in to submit a new idea, the following steps will be followed (see Figure 8):

1. The user goes to the landing page, and if the user already has an account, logs in to see the home page.
2. On the home page, the user clicks on the Idea Lab, chooses to share an idea, and will be redirected toward an idea proposal form, which allows the user to add a detailed description and attach photos or any other supplementary documents. The idea proposal form would include all fields as mandatory, meaning that the user has to add descriptions or attach files (lower than 3MB) and include keywords and an interesting title to help gain the attention of other participants, as shown in Figure. 6.9. If any one of the fields is left empty, the system will not allow submitting with the help of the logically restricted *Submit* button. Once all fields are filled out, the 'Submit' button will become green, which means the idea is ready for submission.
3. Once the idea has been formulated and submitted, it will be available in the idea lab on the top, as the sorting by default will be set by the publication date. Now, different users will read the title and keywords and, if interested, will open the idea proposal and give their feedback. Feedback will be provided in two ways: votes and comments. Positive votes in favor of the idea will be up-voted by clicking the thumbs-up button, or in case of disliking an idea, a down-vote can be given as a thumbs-down. Moreover, comments can be added to justify their vote choice and general feedback on the idea.
4. If an idea needs to be further discussed, it can be taken to the discussion forum, where different actors can simultaneously comment on the idea and build on it.
5. If an idea receives a majority of downvotes and is rejected by other actors for any further development, the idea will be archived, and the idea contributor should be able to resubmit the idea with improvements from step 1.
6. If an idea has been given upvotes with positive comments, it's considered a good idea, and the idea contributor can either leave it as it is or work further to build on it. The contributor can test their idea, conduct market research, find a partner, and start collaboration.

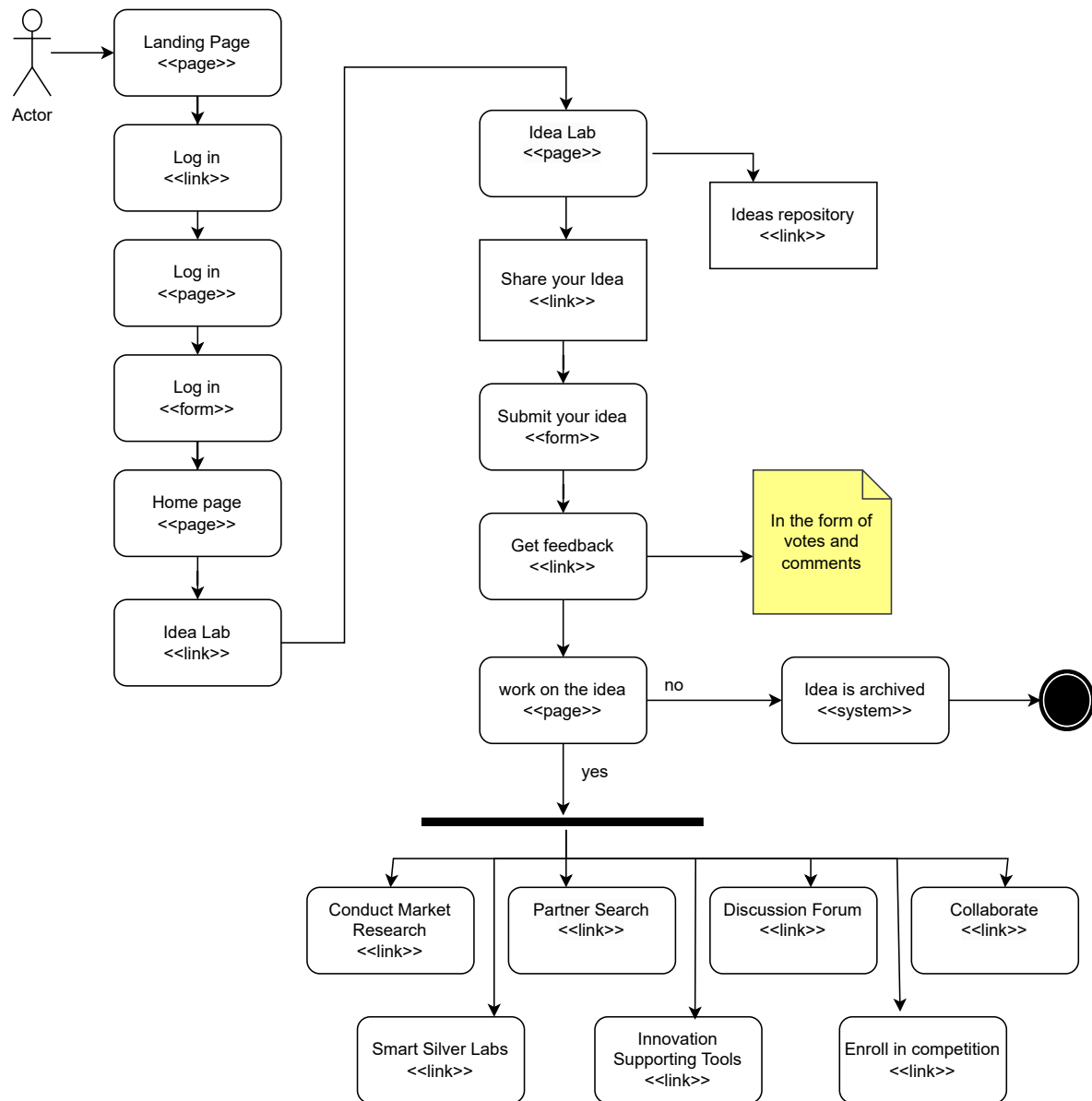


Figure 6.8: Idea Lab

Title*:	Write an interesting title to attract feedback from different experts working in various fields and help you polish your idea!	<i>Submit an innovative idea to help aging population live an active and independent life and get feedback from experts from all over the Baltic Sea region!</i>
Keywords*:	Separate each keyword with a semicolon;	
Idea description*:	Build a proposal for your idea and add as many details as possible to help experts understand the logic and significance of your innovative idea.	
Attachments:	Upload	
		<input type="button" value="Submit"/> <input type="button" value="Cancel"/>
		<small>*Mandatory fields</small>

Figure 6.9: Idea Proposal Form

6.5 Discussion Forum

The discussion forum serves as a bulletin board for the DSH where different users can initiate topics and discuss and help each other out. It can be used to further build on the idea, discuss an infant idea, appreciate it, or criticize one. The discussion forum will appear as a list of topics with titles, and sorting can be done by publication date, most comments, or relevance. There are two ways in which a user can use the discussion forum functionality. One is mentioned above, through the idea lab, when an idea has to be further discussed and taken to the discussion forum. The user who starts a discussion topic is referred to as the ‘discussion starter.’ The other way is when a user logs in and straight enters the discussion forum, the following steps (See Figure. 6.10) are taken:

1. The user goes to the landing page, and if the user already has an account, then logs in to see the home page.
2. On the home page, the user clicks on the ‘Discussion Forum’, sees a list of existing discussion topics, and chooses one to contribute their opinion or create a new topic for discussion.
3. A brief description of the discussion topic must be added with a catchy title to attract other users to participate. Once the discussion topic has been initiated, other users will be able to see it when they go on the discussion forum, add comments, and discuss back and forth in detail about the given topic.
4. If any comment is against the ‘terms and conditions and rendered offensive, other users and the discussion starter can report it, and an admin will be notified who has the right to remove/delete the comment.
5. If the comment is not offensive, the constructive discussion will continue until the discussion starter feels that the topic has been sufficiently discussed and requires no further input. In this case, the discussion starter has the right to switch off comments on the discussion, which means the discussion has been concluded. The discussion will remain in the discussion forum list for others to read; however, with new topics coming in, it will be dragged down in the list and can be fetched using the keywords or by sorting the list accordingly.

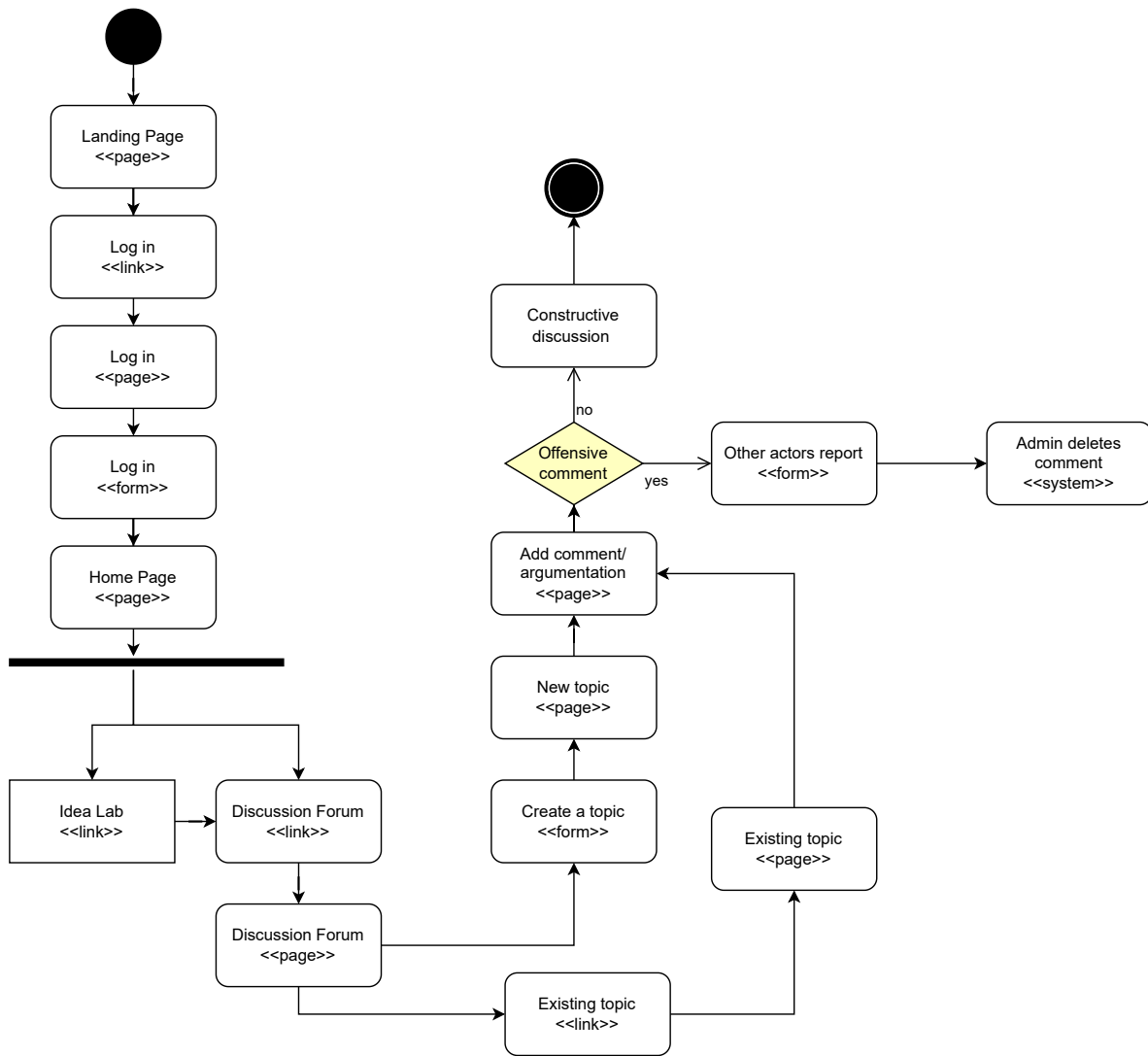
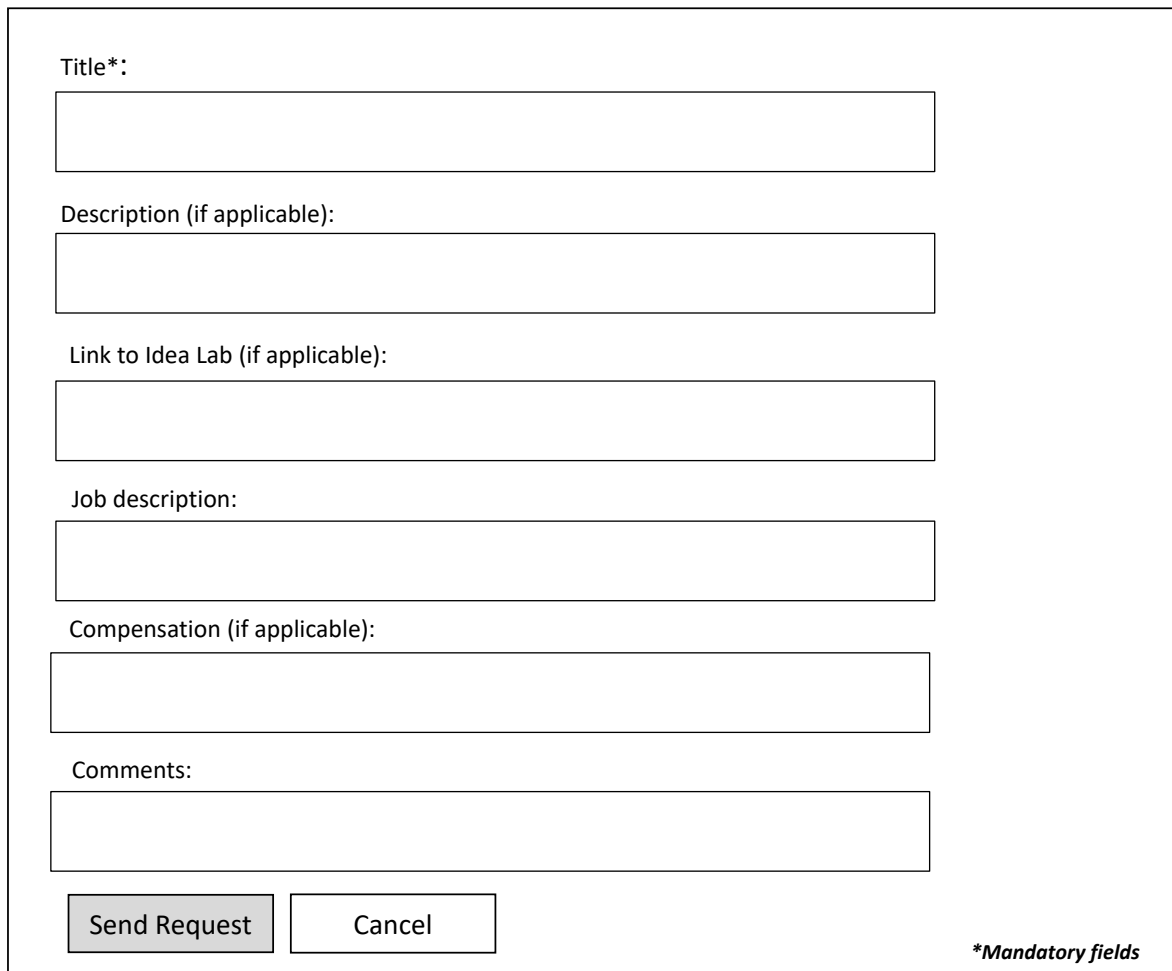


Figure 6.10: Discussion Forum

6.6 Partner Search

The DSH is a collaborative platform that aims to build a network of innovation actors from the quadruple helix model, which means that there will be participants from the private sector, public sector, academic sector, and older adults to come together and work on innovative ideas that are aimed to help the silver population in the BSR to live a healthy and independent life. When the users come on the DSH, they must sign up and build their profiles to be visible to other actors. When an idea contributor posts a new idea and looks for partners to collaborate with, they can search from the partner pool and choose actors from different quadruple helixes using the keywords. Another option is to find a partner and share ideas privately with them either on Zoom or the discussion forum and then collaborate.



The form is titled 'Partner Contact Form' and contains several input fields and two buttons. The fields are labeled as follows:

- Title*:** A single-line text input field.
- Description (if applicable):** A single-line text input field.
- Link to Idea Lab (if applicable):** A single-line text input field.
- Job description:** A single-line text input field.
- Compensation (if applicable):** A single-line text input field.
- Comments:** A single-line text input field.

At the bottom left, there are two buttons: 'Send Request' (highlighted in grey) and 'Cancel' (white with a black border). At the bottom right, there is a note: **Mandatory fields*.

Figure 6.11: Partner Contact Form

When a user goes on the landing page, logs in, and chooses 'Partner Search' from the homepage, the following steps are to be followed (See Figure. 6.12):

1. Choose the helix that the user would like to partner with. Once the helix has been chosen, e.g., the user selects 'Business Representative,' different profiles of various business reps will be listed with their names, positions, and organization names. Users can search for a specific partner by searching for their name or using a keyword in the search bar.
2. Once the relevant partner/s have been identified, they can be contacted using the 'Partner Contact Form' that includes all the details of the idea in question as shown in Figure. 6.11. The mandatory field has to be filled out, and if it is left empty, the system will not allow sending the request with the help of the logically restricted 'Send Request' button. Once all fields are filled out, the 'Submit' button will be highlighted, which means the request is ready to be sent.
3. If the partner agrees, the user can connect with them on Zoom and collaborate with them over the DSH. If the partner is uninterested, the user must find a different partner. If multiple partners from different helixes are to be chosen, then the user must contact partners from each helix individually.

6.7 Collaboration Tools

This is the most crucial functionality of the DSH, as it is the core aim of the platform to help the innovation actors collaborate on ideas and work together as one team as shown in Figure. 6.15. The

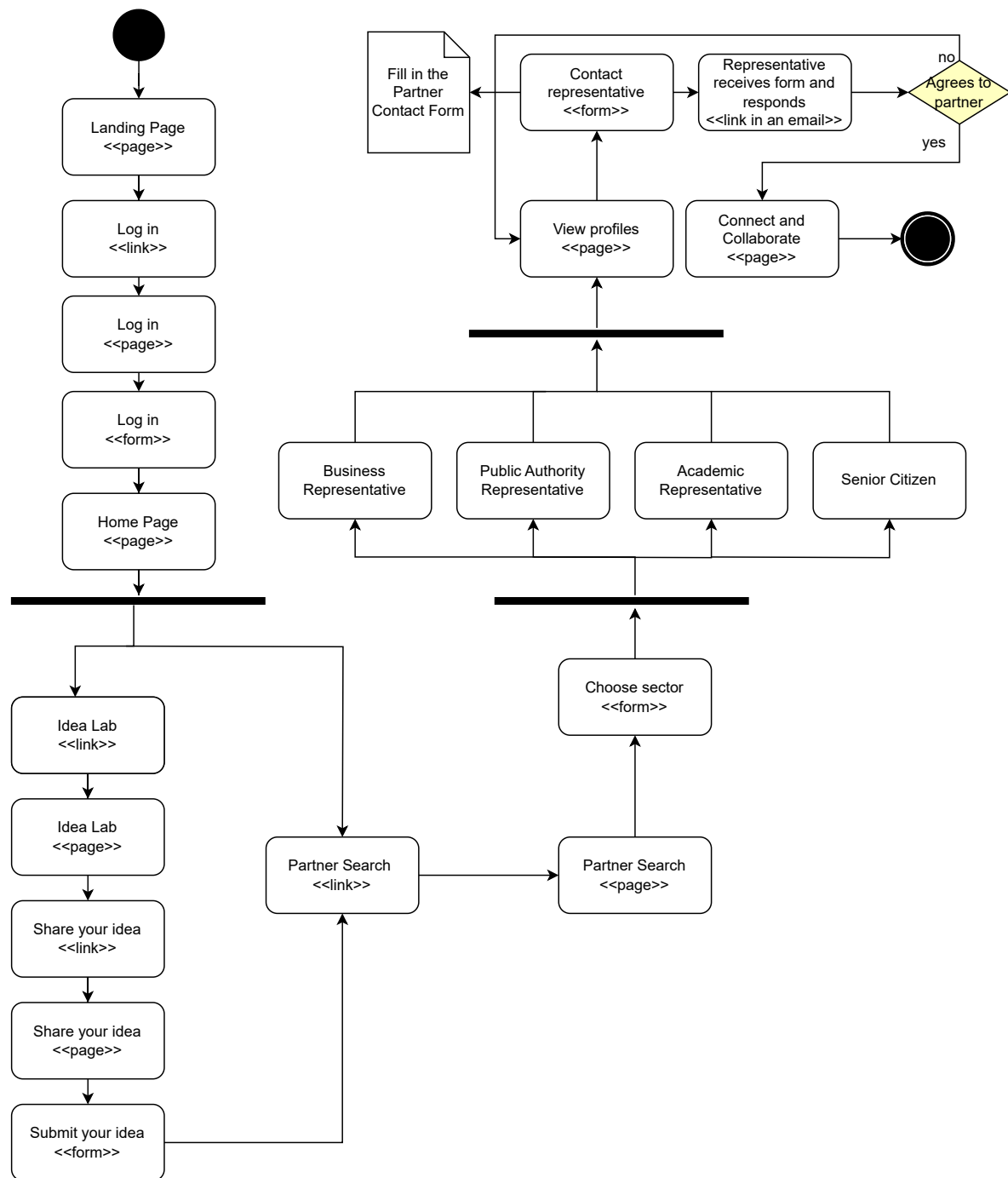




Figure 6.12: Partner Search

Add Project


Title*:

Description:


Members:


Project Manager:




Start Date*:




End Date:



Status*:

Active


Next 

Cancel

**Mandatory fields*

Figure 6.13: Add Project Form

user who adds a new project is the *Project Owner*, and the partners collaborating on the project are *Project Members*. The team can also assign a Project Manager who would be responsible for ensuring that deadlines are met, and necessary resources are available to work on the idea. There are two ways to get to the Collaborate page; one is through the Idea Lab when the user receives positive feedback from innovation actors and has also searched for a partner for themselves, and they should be able to go to the Collaborate page and work to build further on the idea. The second way is to go straight to the Collaborate page from the homepage after logging in. Once a user has logged in and clicked on Collaborate on the homepage, the following steps are followed:

1. Users can either choose the existing project from their dashboard or add a new project. Adding a new project requires the user to fill out an *Add project form* (Figure. 6.13) and choose which tabs they'd like on their project interface (Figure. 6.14). Adding title, start date, and status are mandatory fields and, if left unfilled, would show an error message. Project members can be either added using this form or can be added later in the project from the dashboard.
2. Once the form has been filled out and project tabs have been enabled, the project will be added and visible on the main dashboard of the project owner and other assignees.
3. Now, according to the enabled project tabs in step I, enabled tabs will show on the taskbar when the project is clicked. Given that the user allows for all the tabs on the new or existing project, the user should be able to:
 - *Invite/add new partners*: As the users discover new partners to collaborate with, they can add them to their projects as new members.

Project tabs

Tasks	<input checked="" type="checkbox"/>
Discussion	<input checked="" type="checkbox"/>
Zoom	<input checked="" type="checkbox"/>
Calendar	<input checked="" type="checkbox"/>
Notes	<input checked="" type="checkbox"/>
Files	<input checked="" type="checkbox"/>
Agenda	<input checked="" type="checkbox"/>

Add**Cancel**

Figure 6.14: Enable/Disable Project Tabs

- *Assign tasks:* Different tasks can be added by the project owner or manager and assigned to the project partners. Each task can be associated with a workflow and has its own agenda. Deadlines can be set, and groups can be organized according to the tasks.
- *Make agenda:* Project managers can create an agenda for the whole project and different tasks within the project. Deadlines, calendars, and workflows can be associated with each agenda. This helps develop a direction for the project and assists members in understanding their tasks and timelines.
- *Build workflows:* The user should be able to create and manage activities at different stages of the workflow and keep track of all the tasks within a project. Users can either use an inbuilt default workflow with three stages: Backlog, Ongoing, and Done, or create customized workflows.
- *Discussion:* This is connected to the Discussion Forum, where the users can initiate their own topics and choose to either make them private for their own team only or public to gather opinions from other actors on the DSH.
- *Zoom meetings:* This is a more personalized communication medium and lets project members communicate in real-time. Members can individually interact with one another or form groups. Zoom allows chats, voice calls as well as video calls.
- *Schedule on the calendar:* For the teams and individual members to organize their tasks and events like meetings and deadlines, the calendar helps them have them in one place.
- *Time Deadlines:* The project manager should be able to add deadlines to each task and monitor the estimated and logged time. Timesheets can be created to record logged time, and project progress can be analyzed.
- *Make notes:* Project members can choose to leave notes either for private use or to share with the whole team or selected team members. Notes can be made under each project or task and are easily accessible.
- *Upload important files:* The DSH makes it very convenient for its users to save and share their files linked to the project or even smaller tasks. Files can be attached either directly from the user's computer or other applications like Google Drive, Dropbox, etc. The files attached to the project or team will be visible to all the members within that certain group. To privately share the files with an individual over the DSH, zoom chat should be used.
- *Archive project:* Projects that have concluded or no longer require any collaboration over the DSH can be easily archived and removed from the dashboard.

6.8 Other Functionalities

6.8.1 Conduct Market Research

If a user believes that it has a very good innovative idea but wants to test it before considering investing in a minimum viable product (MVP) or a tangible product, the DSH provides a perfect environment to do so. The user who performs the test will be referred to as the tester, and the audience with whom the idea is being shared will be referred to as the 'testing sample'.

The prerequisites to be able to test the idea are:

- The tester should have a mockup or even a simple sketch to provide a visual representation of the idea to build a connection.
- The tester should be able to describe the idea effectively and explain different use cases to enable the testing sample to understand what problems it will solve in simple language.
- The tester should be able to detach themselves from the idea to allow objective feedback by presenting the idea in a neutral manner to avoid the tester's bias.

The goal of testing an idea is to get an understanding of the customer needs, viability, and practicality of the idea and eventually to improve the idea. Testing can either be conducted with the consumers (older adults) or with other business representatives to understand the market. There are three ways in which the idea can be tested on the DSH:

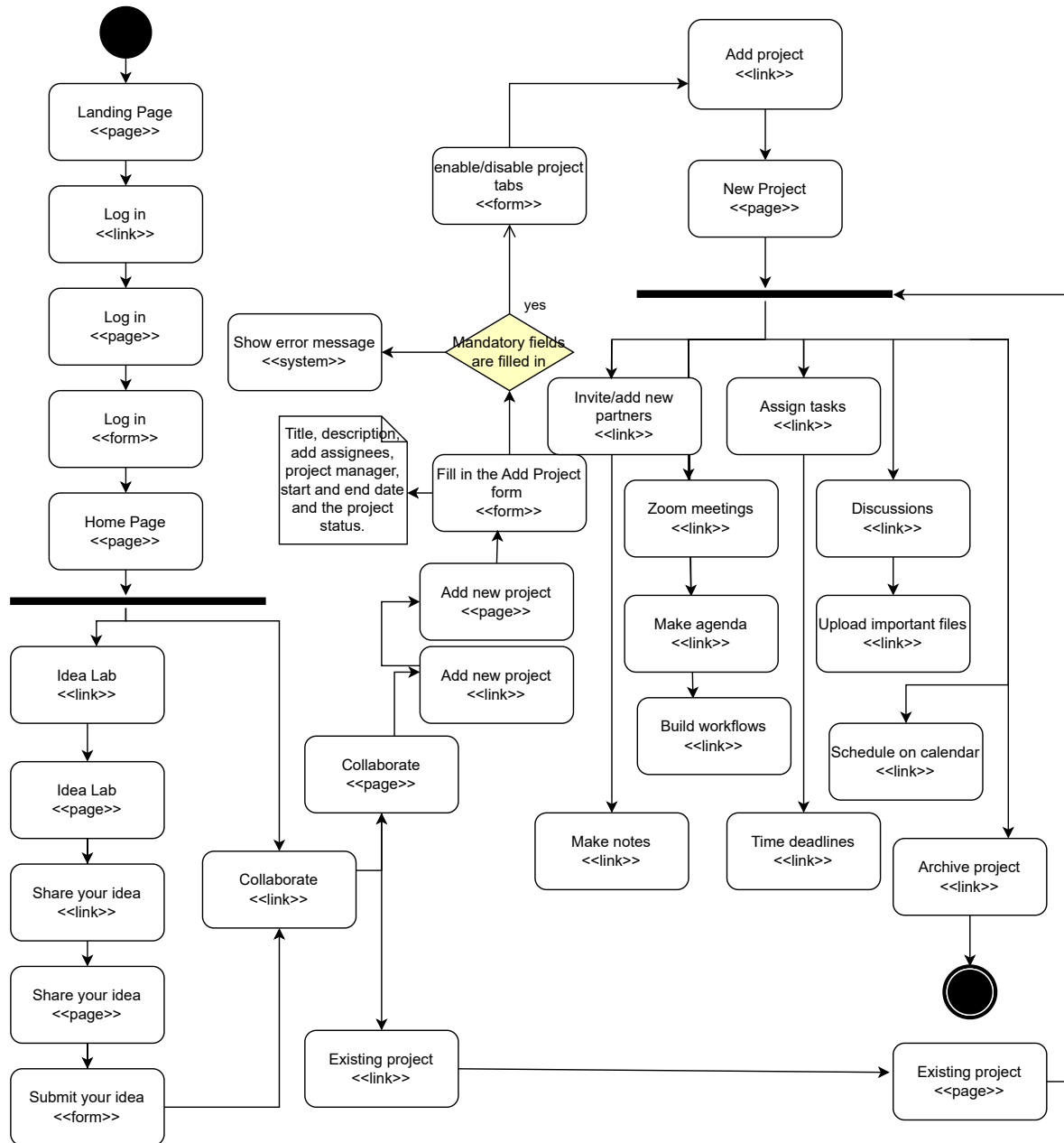


Figure 6.15: Collaboration Tools

1. *One-one discussions:* If the tester only wants to get an initial idea about how someone would respond to the idea, different actors can be contacted, and short interviews can be conducted. This leads to a more personalized and individual reaction to the idea and enlightens the tester about different preferences.
2. *Surveys:* The tester can approach different users, build a testing sample, and share the idea in the form of a survey. Survey questions can be open or close-ended depending on the requirement of the idea in question. Questions about whether they like the idea, if they'd use such a product/service, or what kind of features they'd like to add to the service can be very critical and useful for any idea to materialize. On the DSH, the tester can build their own surveys or use other services like Survey Monkey or Google Forms to build and distribute a survey.
3. *Focus Group Discussions:* A group of about 7-10 people from similar demographic profiles, experiences, and backgrounds can be gathered to discuss the idea. This is ideal if the tester wants to identify the group's behavior towards the idea, their perceptions and the overall viability of the idea. On the DSH, the tester can find appropriate participants and analyze group responses for actionable insight.

Similar testing methods can be used if the tester already has an MVP or a tangible service and evaluates it by testing it either individually or in a group and get their reactions in the form of open discussions or using surveys to collect their responses.

Moreover, if an innovation actor (e.g., academician) only wants to conduct market research about a certain idea, problem, solution, or any other topic, should be able to use the three testing methods to conduct their research. To encourage participation in the testing, it is also possible to offer gift cards or any other interesting rewards to participants. This usually helps increase motivation, leads to increased participation, and may also stimulate careful responses.

6.8.2 Competitions

Competitions are a great way to increase the user base and grow a community of like-minded people. Moreover, it can also motivate the participants to come up with interesting ideas and contribute to the cause of the DSH. Competitions can be held on various themes related to the silver market: healthcare, leisure, social life, living environment, safety, etc. According to the theme, a problem will be highlighted that participants can decipher through innovative ideas for solutions. Competitions will be posted on the DSH, and actors already on the DSH or new members can join to participate in the contest. New competitions and details will be presented on the main landing page.

The prerequisite to entering the competition would be to sign up and log in, after which the user can click on competitions, read the details, and participate. Participation would require the user to build a proposal and a sketch of their innovative idea to solve a certain problem. E.g., if the theme of the competition is safety and the problem is that older adults find it difficult to climb up the stairs or ramp, either on foot or wheelchair, how can this be resolved? Now, participants can either come up with solutions on how staircases can be designed or how wheelchairs can be designed, etc. Competitions allow creative juices to flow, and rewards like gift cards, prize money or the opportunity to collaborate with a private firm to fund the idea can be highly motivating.

6.8.3 Information Library

Just like any yellow pages, the DSH will serve as a directory for all the services and products related to/aimed at older adults. To access the library, the user doesn't have to sign up and should be able to access it from the landing page. Every region will have its own list. This helps the elderly to find all related items in one place and choose the most appropriate one. For example, in Estonia, if a senior citizen is looking for a taxi service then using the DSH, just typing taxi would show options (or more) as shown in Table. 6.3.

Brief descriptions for each service will be provided, and the name will be a hyperlink that will redirect to the main service provider from where the user can avail of the service outside of the DSH. Information library is a service of the DSH to make it convenient for the elderly to find all the services in one place without the hassle of looking all over the internet.

Table 6.3: Taxi Services in Estonia

Amigo Taxi	Taxi Per Te Tallinn
Tulika Takso AS	Sõbra Takso OÜ
Yandex	Vaba Takso OÜ
Bolt	Taxigo
Bongo Taxi	Pärnu Taxi
Tallink Takso	TARTU TAXIS
Reval Taxi Ltd.	Yes Transport OÜ
Q Takso OÜ	SETI TAKSO OÜ

6.8.4 Silver Market Characteristics

The DSH serves as a directory for all the services and products related to or aimed at older adults. It consists of all the characteristics of a regional business or market environment, including all the factors, forces, and institutions that directly or indirectly influence the interactions between various innovation actors in the silver economy. Users can also comment, give feedback, and suggest updates to the list. The user doesn't have to sign up to access the library and should be able to access it from the regional Smart Silver Lab. Every region will have its list, and users can get an overview of regional silver markets, their characteristics, and descriptions, and also propose new regional silver market characteristics' descriptions or modifications of existing ones. The silver market characteristics consist of the following categories:

- Actors and Organizations
- Common practice
- Development of new technologies
- Ethics
- Family and extended family
- Funding mechanisms
- Growth drivers
- Legislation and laws
- Market analysis
- Motivation
- Professionals
- Users and Citizens

6.8.5 Training and Mentoring

Different training and mentoring programs will be held at the DSH to help older adults learn different technical skills. Certified trainers from each quadruple helix can offer personal training and attract an audience from the DSH. Other trainings being held in the user's region will also be announced in this section. Users should be able to access this webpage without signing up or logging in.

6.8.6 Publication and Events

The DSH also provides information regarding different events in the six regions. These events may include hackathons, conferences, workshops, and other innovation/technology-themed meetups. Moreover, different competitions will be held on the DSH with various themes related to innovative solutions for the challenges faced by the silver population. News regarding other innovations for the silver economy will be displayed in the newsletter along with upcoming events, seminars, webinars, etc., organized

by the Baltic Sea Region Cluster, where not only the triple helix but also older adults can participate and contribute. Different actors can also use this platform to publish their upcoming innovative solutions and events they are organizing to attract their audience. Actors can also explore publications related to the senior economy of the BSR and give their feedback using the comment functionality.

Chapter 7

Discussion

7.1 Platform Evaluation

The DSH was evaluated in two information sessions; the first one was conducted online due to the pandemic, and the second one was conducted in person. The first information session was conducted to present the DSH webpage to the project partners. Silverhub.eu is still a work in progress however, it was imperative to take input and feedback from the partners. This is the advantage of using an agile approach for hub development, as small iterations can be displayed and tested, and feedback can be instantly incorporated. Help manuals were explained whereby the basic structure of the hub and agile methodology were briefed. Step-by-step instructions were provided to help partners navigate through the hub. Portal management was also elaborated on but very briefly, as this will be explained in more detail in further sessions to come. Once the hub is stable and has enough functionalities, each region will have a representative who will be trained to use and manage the platform on their own. This aims to ensure that country-specific and local language content can be uploaded and kept up-to-date even after the OSIRIS project ends.

Initially, on the DSH home page, the user had to choose a role, and then they were able to see the role-specific content, which was highly objected to as when a user enters the DSH, they will find information only directly related to them, but they might need information from other actors as well. They might not recognize that they have to change their role; therefore, the need to choose a role was eliminated from the DSH home page. Moreover, jargon such as quadruple helix actor or silver economy should not be used on the DSH as these are academic terms and not for common use. In addition to this, the participants pointed out that a section in About Us should be added that explains the silver economy, its challenges, and how the DSH contributes to its development. The discussion forum initially was not a common forum, which means that actors could only access it in their own local languages but could not communicate with other innovators from other countries. Therefore, it was suggested that there should be two forums, transnational and local, as it is very important to support transnational knowledge sharing and collaboration for the DSH to successfully fulfill its goals. Lastly, the DSH should be more user-friendly than it was at the time. Every step should be explained what the DSH is all about (in particular) and well guided in terms of where it could take the user (in the given space reported). This should not be only a fancy mobile tool for ‘diginomadic’ professionals rather, it is important to show that the DSH is created and being under construction to care about reflecting the older adults.

The second information session was conducted when all the functionalities were incorporated into the DSH and were ready for user testing. Participants toured and explored the platform in detail, and any feedback was recorded. It was identified that the majority of the functionalities of the DSH were in place; however, chat, idea sharing, feedback, and collaboration tools were missing from the prototype, which would need further investment for development. Participants appreciated the changes to the discussion forum as it is now possible to use the forum in English or their local languages. However, Innovation Supporting Tools were also made available for the transnational clusters as well as regional Smart Silver Labs, which included the Innovation Development toolkit, Financing Mechanism, and Knowledge Diffusion Toolkit. The tools are readily accessible; however, how they can be used to develop an innovative idea on the DSH is yet to be decided. Therefore, it was decided that further

information sessions should be conducted to evaluate a running case on the DSH which means that an innovative idea will be worked on and developed on the DSH to further enhance and expand its functionalities.

7.2 Future Work

For any platform to be successful, it has to be kept up-to-date and maintained. In the future, it is imperative to analyze and implement measures to ensure the sustainability of the DSH. The DSH is built on a high-quality information structure. Therefore, it must be sustainable and flexible in order to accommodate changes in processes, organizations, and capabilities as innovative products and services are developed, as well as to ensure user and stakeholder support while maximizing long-term impact. Therefore, the next step for the DSH is to discuss, analyze, implement, and evaluate measures to ensure sustainability and maintainability. Moreover, to analyze the full potential of the DSH, a running case must be evaluated whereby an innovative idea is built further to become a full-fledged service with the help of the collaboration between different actors from the quadruple helix model on the DSH. This helps identify the gaps and loopholes in the DSH that can be readily fixed. Further functionalities, needed to support the development of the ideas, can emerge and be built in the DSH. Once the DSH is fully developed and up and running, it can be launched, and different actors using it will be able to give their feedback on the performance of the DSH. This way, user satisfaction can be tested, and the performance of the DSH can be evaluated to help improve it further. The evaluation criterion and methodology on how user satisfaction and performance of the DSH will be measured is yet to be identified and are the next important steps.

Chapter 8

Conclusion

As the world's population continues to age, there is a growing need to address the challenges faced by the silver generation. To this end, several initiatives are underway to incorporate smart solutions that can improve the quality of life for older adults. One such initiative is the DSH, a digital collaborative CI platform that has been developed specifically to focus on creating and boosting user-centered technological innovations.

The DSH uses the Smart Specialization approach to develop solutions that are tailored to the needs of older adults. By encouraging collaboration and partnerships between different actors from the quadruple helix model, the platform is designed to facilitate the co-creation of innovative solutions that can improve the lives of the silver generation.

To achieve this goal, the DSH provides a range of features to its users. These include the Smart Silver Labs, partner search, innovation supporting tools, collaboration tools, training programs, information repository, events, and more. Each of these features is designed to support the co-creation of innovative solutions by bringing together different stakeholders and enabling them to work collaboratively towards a common goal.

To ensure the DSH's sustainability and maintainability, policies, daily practices, and user workflows must be flexible and autonomous. This will allow the platform to adapt to changing needs and circumstances, and ensure that it continues to provide value to its users over the long term.

The impact of the DSH extends beyond the BSR and can serve as a model for other platforms seeking to develop user-centred functionalities for seniors. By focusing on the needs of older adults and leveraging the power of technology to meet those needs, the DSH is helping to create a more age-friendly world.

Chapter 9

Acronyms

ICT	Information and Communication Technology
IT	Information Technology
ADR	Action Design Research
CI	Collective Intelligence
BSR	Baltic Sea Region
EU	European Union
DSH	Digital Silver Hub
UX	User Experience
UI	User Interface
SSL	Smart Silver Lab
SSF	Smart Silver Framework
UML	Unified Modelling Language
I/O	input/output
MVP	Minimum Viable Product
OSIRIS	Supporting the Smart Specialization Approach in the Silver Economy to Increase Regional Innovation Capacity and Sustainable Growth

Chapter 10

Glossary

Silver economy	All economic activity related to the needs of people aged 50 and over [26].
User profile	A description of a person, group, or organization that contains all the details that someone needs. ¹
Quadruple Helix Model	A concept emphasizing broad collaboration in innovation between government, academic research, business, and society [31].
Triple Helix model of innovation	A concept “to foster regional economic growth and promote entrepreneurship, through understanding the dynamics of interactions between three institutional spheres of university, industry, and government.” [13]
Forum	A place on the internet where people can leave messages or discuss particular subjects with other people at the same time. ²
Partner search	Forming part of a pair or set. ³
Online chatting	The process of communicating, interacting and/or exchanging messages over the Internet. It involves two or more individuals that communicate through a chat-enabled service or software. ⁴
Newsletter	A tool used to communicate regularly with your subscribers, delivering the information you want in your email boxes; these messages can contain simple text or a structure composed of images and formatted text. ⁵
Documents sharing	The situation in which two or more people use the internet or a piece of software to access a document at the same time. ⁶
Publications	The profession or business of producing and selling a book, magazine, or newspaper. ⁷

¹https://www.macmillandictionary.com/dictionary/british/profile_1

²<https://dictionary.cambridge.org/dictionary/english/forum>

³<https://www.merriam-webster.com/dictionary/matching>

⁴<https://www.techopedia.com/definition/387/chat>

⁵<https://blog.e-goi.com/what-is-a-newsletter/>

⁶<https://dictionary.cambridge.org/dictionary/english/document-sharing>

⁷<https://dictionary.cambridge.org/dictionary/english/publishing>

Resource centre	A place which provides information, equipment and support. ⁸
Partnering network	The patterns of interpersonal relations emerging from entrepreneurial activities. In their everyday activities, entrepreneurs get in contact with a variety of other actors, playing important roles in the functioning of their business. EN can be analytically distinguished from interorganizational networks, whose nodes are firms and whose ties are, for instance, interlocking directorates, contracts, goods and services exchanges, communications, alliances, or ownership control relations [15].
Crowdsourcing	The act of outsourcing tasks originally performed inside an organization, or assigned externally in form of a business relationship, to an undefinably large, heterogeneous mass of potential actors. This happens by means of an open call via the Internet for the purpose of free, value creative use. The incentive to participate can be monetary and/or non-monetary in nature [23].
Functionality	The platform's ability to provide users with the necessary tools and resources to achieve their intended objectives [36].
Agile methodology	An approach to software development that involves a collection of practices centered around incremental and iterative development. It emphasizes the values of collaboration, communication, feedback, and adaptation to change. ⁹
User dialogue models	"An abstract model that is used to describe the structure of the dialogue between a user and an interactive computer system." [22]

⁸<https://www.collinsdictionary.com/dictionary/english/resource-centre>

⁹<https://agilemanifesto.org/iso/en/manifesto.html>

Chapter 11

Authors

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¹<https://egov.ee/nextgen-group/>

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