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**LIST of Acronyms**

Acronym	Description
<b>MVP</b>	Minimum Viable Product
<b>PD</b>	Participatory Design
<b>PPI</b>	Patient and Public Involvement

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## **1 EXECUTIVE SUMMARY**

The goal of this deliverable is to define the methodology that will be used within the living labs, and will be followed by the pilot and the technical partners by involving end-users and stakeholders. The deliverable presents how the end-users and external stakeholders will be engaged in the processes of design, implementation and evaluation, by defining the CAPTAIN Stakeholder community. This body is the official source of requirements for the CAPTAIN system throughout its lifecycle. Given the radically new technologies and approaches that are sought by CAPTAIN, modern approaches dealing with high uncertainty and increased user satisfaction are presented in the context of the CAPTAIN project. The Design Thinking will help the consortium explore the problem, the Lean Startup approach will enable the consortium to build the right things while the agile development will make the technical partners build the things right, avoiding (to a certain extent) wasting resources. The deliverable gives also the framework for the evaluation of this combined approach by providing the corresponding evaluation tools. Finally, this deliverable describes the collection procedure of the experimental datasets that will take place within the living labs and will facilitate the design development and evaluation of the monitoring and coaching algorithms.

## **2 INTRODUCTION**

The aim of this deliverable is to define the methodology that will be used within the living labs. The deliverable presents how the pilot and technical partners, end-users and external stakeholders will be engaged in the processes of design, implementation and evaluation of radically new approaches of ICT that are used by CAPTAIN. Contemporary approaches dealing with high uncertainty and increased user satisfaction are presented in the context of the CAPTAIN project. The Design Thinking will explore the problem and the real needs of the target user and the Lean Startup approach will enhance the validated learning of the consortium in order to maximize the effectiveness of the consortium within the limited available time. The agile development (modified version of SCRUM) will increase the transparency and communication among the technical and pilot partners from the beginning of the process to eliminate misunderstanding and disconnection between the pilot partners (main interface with the end-users) and the technical partners. The described approach in this deliverable will be continuously monitored and measured in order to give insights to the consortium for further improvement of the process itself.

The CAPTAIN Stakeholder community, consisting of those who will actively use CAPTAIN (older adults and their caregivers), and those who can give suggestions (service providers, nursing home management and patient associations), will be the only sources of requirements throughout the project's lifecycle, playing an important and substantial role of co-designers and co-creators. A core group of stakeholders will be selected from the partner's Living Labs' networks which include public-private-people partnerships. The members of this community will commit to participate in small scale pilots where they will be interacting with the releases of the CAPTAIN system, giving their feedback.

The active and continuous involvement of the CAPTAIN Stakeholder community in the design, development and evaluation stages, goes beyond the usual waterfall approaches. A hybrid approach leveraging on concept from Design Thinking, Lean Startup approach and SCRUM agile framework will be followed by the project. Design Thinking (supported mainly by the pilot partners) will explore and identify the target users real needs (the "pain", connection to the elder worries, daily problems and potential upcoming functional difficulties that may be helping to prevent) in order to come up with insights on creating real value. Lean approach (served by both pilot and technical partners) is adopted in order to

deliver a functional prototype frequently enough to the community in order to collect feedback and readjust. The use of SCRUM will instead help organize work across technical partners to collaborate towards delivering high value. This hybrid approach will facilitate CAPTAIN to solve effectively and with high flexibility the complex project's developments required to achieve its goals, as detailed below.

This deliverable presents also the practical details and tools in the context of CAPTAIN: the inputs and outputs as well as the interactions between processes and partners. CAPTAIN, following the aforementioned approaches will be designed and developed in an empirical way, being susceptible to changes if considered necessary. On the other hand, given the innovation of the proposed methodology, the whole process will be measured and evaluated. This will be done with the use of actionable metrics, which can be used to detect improvements and differences in each iteration and will be considered as indicators of improvement of the whole team and a way to quantify the procedure.

Finally, the production of the experimental datasets for speeding up algorithms development through small scale pilot trials early enough in the project is part of this deliverable. A set of activities are indeed needed to the software development and implementation activities of WP4 (Non-invasive user and environment sensing) and WP5 (CAPTAIN Coach behavior design and AI algorithms). The existence of non-artificial data is mandatory for the effective development and the subsequent fine-tuning of software-related components. Therefore, the living labs will be also exploited for the production of the required experimental datasets, driven by the needs of the technical partners. Living Labs are considered as ideal places to collect realistic data, not being produced in a sterile lab environment, but under conditions and places that simulates real-life settings.

This deliverable provides more information on the methodologies and approaches that were adopted, the input and expected output for each of them, as well as the collaboration among the partners in each of them. The time plan of all the activities, presented in this deliverable, can be found in the deliverable D7.1, although it is briefly presented here. Consequently, this deliverable replies to "how" activities will be done while D7.1 replies to "when" the activities will take place.

The document is structured in 8 Sections. Section 1 provides an executive summary of this deliverable while Section 2 provides a brief introduction for the purpose of this deliverable. Section 3 presents the role of the CAPTAIN Stakeholder community as well as how this community will be built and sustained. Section 4 provides information about the agile frameworks that will be adopted while Section 5 focuses on the practical details of these framework in the context of CAPTAIN. Section 6 presents the tools that will be used for the evaluation of the proposed methodology. Finally, Section 7 provides information about the collection of the experimental datasets.

### **3 STAKEHOLDER COMMUNITY ENGAGEMENT**

CAPTAIN, having adopted Participatory Design (PD) design and agile development approaches, provides continuously releases of the CAPTAIN system to the end-users and stakeholders. Actually, they become the basic sources of requirements throughout the project's lifecycle, playing an important and substantial role of co-designers and co-creators. Therefore, CAPTAIN builds the CAPTAIN Stakeholder community which will be the only official source of requirements. While the multidisciplinary team of CAPTAIN will suggest requirements, it will be up to the active stakeholders' network to decide their adoption or not. To do so, a core group of stakeholders will be selected from the partner's Living Labs' networks which include public-private-people partnerships. The Living Labs involved in the project are based on top of the participatory design and co-creation methodologies, where users are involved and drive the innovation at

all stages of design and development, including user acceptability, satisfaction and impact in realistic settings, which is in line with the CAPTAIN's needs for designing radically new ICT concepts.

The final users that will be identified will commit to participation in small scale pilots (T7.4-T7.5) ranging from 1-shot trials, to daily visits, up to the pilot sites for a couple of weeks when needed. Their main tasks will be to interact with the new versions of the CAPTAIN system, give their feedback, follow any evaluation protocols defined in T8.1-T8.4 and suggest changes or features.

Since it will not be mandatory for all of them to participate at each session, the network should be large enough to ensure valuable feedback is provided and, at the same time, small enough to be easily controlled.

The main steps required for the stakeholders of CAPTAIN to be engaged are: identification of clusters of end-users (primary end-users, secondary end-users, service providers and clients), recruitment of stakeholders based on established Living Lab ecosystems and finally build and sustain the community, providing them with motivation and mitigation strategies to alleviate any potential drop outs. The following strategies and planning was performed based on the existing experience from Living Lab partners and personal interviews that were conducted with several stakeholders, utilizing the current structures and services of Living Labs.

### 3.1 STAKEHOLDER ENLISTMENT

CAPTAIN aims to build its network based on two clusters of stakeholders: the first one will include those who will actively use CAPTAIN (older adults and their caregivers), and the second one those who can give suggestions, influence (service providers, nursing home management and patient associations).

#### ***Older adults***

Potential groups of older adults, planned to be included in the Living Lab pilots, include a diverse range of potential difficulties that older adults are living with, e.g. cognitive or mobility impairment. In order to ensure wide reach of older adults though, existing networks of older adults in Living Labs (e.g. people with memory problems that participate in existing Memory Clinic programs or former patients of clinics that visit their doctors) will form the initial pool of participants.

#### ***Caregivers***

Caregivers are people who offer care to older adults who are in need of support. In particular, in CAPTAIN we consider both formal and informal caregivers. Formal caregivers include all types of professionals, e.g. doctors, nurses, psychologists and physical therapists. Informal caregivers are both family members living or not with the elderly and paid healthcare workers, not necessarily undergoing qualified training, who provide day-to-day help/assistance to elderly people.

Caregivers' role in CAPTAIN would be dual in scope. On the one hand, they will provide us with valuable feedback about interpersonal relationships (social dimension), collaboration on matters related to self-management care activities and opportunities and barriers in place. On the other hand, having both relatives and elderly people being committed to CAPTAIN co-creation activities will strengthen the engagement of both sides. In addition, relatives, for instance are a source of support in hand in order to train older adults in using technology, so their involvement will also include training activities of the CAPTAIN solution.

#### ***Advisory stakeholders***

Advisory stakeholders should include healthcare technology and/or service providers, who are suppliers of solutions for eldercare and policy makers, such as social organizations, e.g. patient associations. This

group of stakeholders may share its views towards the business development of the final CAPTAIN solution, but also contribute to best practice development in the area of assisted technologies for older adults in the community. Lessons learnt and cumulative experience derived from previous experience, while interacting with older adults in light of technological support in daily life, will be beneficial to adjust technology accordingly at different stages, and especially when the CAPTAIN system will be deployed at older adults' homes and community settings. Especially, when the system is to be applied in the nursing home of AMEN, close interaction of personnel during daily care practice will allow to readjust according not only the needs of the older adults, but the caring team as well.

In a multiple helix Living Lab environment, it is important to map all involved stakeholders into a Living Lab panel. In CAPTAIN, as mentioned above we have mapped four broader clusters of users, utilizing a Panel Circle diagram. In the center of the panel, older adults in need of guidance consist the primary end-users and the ones who will be mostly engaged and involved in Living Lab activities. Within the second circle, formal and informal caregivers represent the secondary end-users of the CAPTAIN stakeholder ecosystem, while in the third and fourth outer circles represent on the one hand intermediaries and possibly policy makers and on the other hand the supply and demand for services such as the one planned to be offered by CAPTAIN.

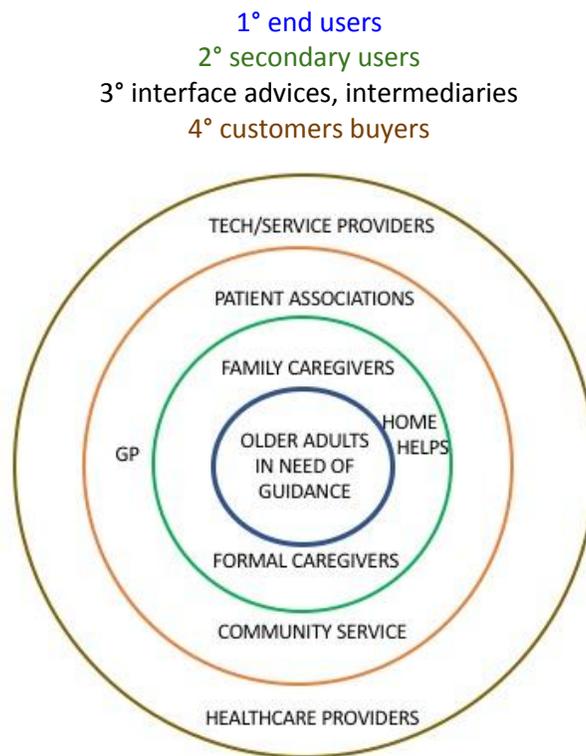


Figure 1 Panel Circle visualization of CAPTAIN Stakeholder Community Network

### 3.1.1 Existing stakeholder networks

In the initial phase of stakeholder engagement, the most common approach for pilot partners to start enlistment activities is to start by using established networks and contacts and then evolve by adding new contacts over time. Indicative examples of existing networks within CAPTAIN's consortium are listed in Table 1.

Table 1 Existing Networks for stakeholders' enlistment

Existing Networks	Description
Day care centers	<ul style="list-style-type: none"> <li>Existing network includes older adults, formal caregivers, relatives</li> </ul>
Patient associations	<ul style="list-style-type: none"> <li>Trust already exists within a network of peers with common needs</li> </ul>
Memory Clinics	<ul style="list-style-type: none"> <li>Familiarization with R&amp;D activities</li> <li>Already existing database with clinical data</li> <li>Already recorded needs and well-known motivation</li> <li>Familiarity with professional of reference within the Living Lab organization</li> <li>Continuous interaction with care services provided onsite by the organizations' facilities</li> </ul>
Rehabilitation Center	<ul style="list-style-type: none"> <li>Continuous interaction with care services provided onsite by the organizations' facilities</li> </ul>

### 3.2 COMMUNITY BUILDING AND ENGAGEMENT

#### 3.2.1 Motivation & Incentives for active involvement

Main motivations and incentives for CAPTAIN's stakeholders to be involved, are listed in Table 2, based on the experience of the relevant end-user organizations, involved in the piloting activities of the project and personal interviews conducted by Living Labs (AUTH, NIVELY, INTRAS, AMEN, APSS) with sample of 24 participants distributed as follows: individuals, older adults (n=17) and caregivers/healthcare professionals (n=7), part of CAPTAIN's target group.

Table 2 Motivation & Incentives for stakeholders' engagement

Motivation & Rewards (LL experts' input)	Motivation & Rewards (personal interviews)
<ul style="list-style-type: none"> <li>To feel useful in the development of a system that can improve their peers' quality of life</li> <li>To be in touch with health care professionals</li> <li>To increase social connection and peer support</li> <li>To try new experiences, i.e. the use and knowledge of new technologies</li> <li>To promote healthy lifestyle</li> <li>To increase their confidence in daily activities and reduce the need for assistance</li> <li>To increase sense of safety, improve quality of their life and maintain physical and cognitive health</li> <li>Annual event to provide official recognition for the active involvement in the co-creation activities</li> </ul>	<ul style="list-style-type: none"> <li>Part of LL activities (for older adults who already visit LL or facility which is affiliated to LL)</li> <li>Provide technology after the project ends for a trial period in their own homes</li> <li>Increased QoL due to technology use</li> <li>Meet with peers to socialize</li> <li>No or a small incentive, i.e. material good or money</li> <li>Participation into joyful activities</li> <li>Discover and learn new technologies</li> <li>Actively involve and provide their opinions on the matter</li> <li>Understand needs of older adults when they use new technologies</li> <li>Contribute to the development of products or services that help preserve autonomy of people with cognitive impairment</li> <li>Interact and use resources, they would not have access to without any costs (for caregivers)</li> <li>Get constant feedback about changes and improvements introduced in the technology</li> </ul>

<ul style="list-style-type: none"> <li>• Rewards from their participation: socialize, share knowledge and experiences</li> <li>• Participate in thematic information days about Third Age, organized by LLs</li> </ul>	<ul style="list-style-type: none"> <li>• Help other peers who face daily problems</li> </ul>
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### 3.2.2 Barriers to participate and mitigation measures

Main barriers and major concerns about engaging into Living Lab continuous activities are listed in based on the inputs of Living Labs experts and the personal interviews performed with older adults and their caregivers.

Table 3 Barriers and mitigation measures to engage in the stakeholder network

Barriers reported by LL experts	Mitigation measures
<ul style="list-style-type: none"> <li>• Travel costs</li> <li>• Lack of time</li> <li>• Social or cultural issues</li> <li>• Season festivities</li> <li>• Relative concerns or social prejudices against activities targeting vulnerable populations</li> <li>• Feelings of non-competence</li> <li>• Lack of feedback</li> <li>• Medical issues or increased caregiving responsibilities</li> <li>• Denial of participation, i.e. due to saturation</li> </ul>	<ul style="list-style-type: none"> <li>• Adapting methodology to facilitate participation in equal conditions</li> <li>• Keep participants informed, updated and aware that their contribution is essential for the project</li> <li>• Introduce new technology features frequently to fight boredom</li> <li>• Recruit large enough number of stakeholders to account for possible dropouts</li> <li>• Resolve concerns of relatives since the beginning</li> <li>• Introduce flexibility with respect to the timetables</li> <li>• Organize end-user transportation to and from the LL facilities</li> <li>• Involve LL team in the engagement and encouragement of participants</li> <li>• Emotional management through sensible working methods, especially with older adults and relatives</li> <li>• Focus on what people can do and their strengths (Appreciative theory)</li> <li>• For professional caregivers and stakeholders with advisory role in the project ensure that as little of their time as possible is taken while maximizing their input</li> <li>• Flexible management mechanisms, such as online, individual interview, respond to videoed clips of prototype devices, etc.</li> </ul>
<p><b>Barriers reported by end-users in personal interview</b></p> <ul style="list-style-type: none"> <li>• Loss of interest</li> <li>• Variety of activity to keep end-users engaged</li> <li>• Fear of technology becoming a barrier to their autonomy level</li> <li>• Privacy and data protection</li> <li>• Time availability</li> <li>• Inadequate competency with technology skills required</li> </ul>	

### 3.2.3 Continuous engagement strategy

CAPTAIN's strategy to engage its stakeholders to the long lasting period of interaction within the Living Lab activities is based on: i) the internal organization of Living Labs, and ii) a strong dissemination and communication plan.

### ***Living Lab roles' distribution***

Main roles that have been recognized within the Living Labs to accomplish the engagement of stakeholders, include a variety of tasks, such as:

- Communication and interaction with primary end users, co-ordination of the inter-professional team
- Facilitating end-user sessions and deal with day to day needs of the pilots
- Promotion of awareness and dissemination of the results of the project

The above roles and tasks are part of the activities that are undertaken by the Living Lab staff, whereas for the activities below, a distribution of tasks may be organized among the stakeholders' groups. More specifically:

- Contact points who provide advice to stakeholders, usually scientific or medical personnel may help to build initial trust between Living Lab partners and the stakeholders and especially the older adults
- Contact point for a group of participants could be one of the primary end-users. This may happen within naturally occurring groups.
- Sharing responsibilities and peer support may foster long-term commitment

Identifying different types of end-users (expert users; extreme users; defectors; lead users; ordinary users) may help to initially define the proper people from the stakeholder group who – with some training, will undertake a more active role. People having the tendency to centralize the discussion, may create important imbalances in the group participation or even influencing negatively the group perceptions. For this reason, selection of people leading a group of stakeholders should be very carefully planned.

Finally, secondary end-users as being defined in the Panel Circle of CAPTAIN will have an advisory role. An advisory board may constitute from end-users, such as family, caregivers, community leaders, institutional leaders, ethics experts, research societies and patient associations.

### ***Communication and dissemination strategy***

In order to ensure uninterrupted operation of the continuous Living Lab pilots several actions are required. More than a single contact point in order to have a smoother operation of the program in case of absence or other liabilities. The individuals should trust the contact people and feel that they can communicate when they need it. Also, a dedicated email address and phone number will be in place for the participants to ask questions and raise any requests to the Living Lab team.

Where feasible a helpdesk structure will be developed through the Living Lab coordinating area to account for any on-site issues that need to be resolved. The option of having different contact points per stakeholder cluster will be examined, so as to allow for more flexible communication and arrangements.

Finally, provision of constant feedback is crucial to retain the interest of stakeholders and for this reason a flyer which summarizes main contributions of the community, towards the completion of the project's scope and objectives will be released after the completion of each sprint and prior to make arrangements with end-users for the next sprint and Living Lab activities/pilots.

### 3.2.4 Exit strategy plan

During the continuous Living Lab pilots is expected than, for different reasons, members of the community network will drop out. Also, there should be certain actions that will be planned in order to ensure smooth transition of the stakeholder to keep them engaged within an active community which will continue beyond the end of the CAPTAIN project.

The protocol of actions required in the case of early drop out is the following:

#### Prior to LL pilots

- Evaluation of possible drop out percentage
- Inclusion of a contingency number of participants from the beginning
- Informative material about obligations and rights of leaving the pilots

Early Drop out

#### After LL pilots start

- Stakeholders may express their willingness to leave the study at any time point
- Exit questionnaire – voluntary answer the reasons of drop out
- Interview staff should make sure that the project has come to closure satisfactorily
- Informative material about obligations and rights of leaving the pilots

The situation in which the pilot period has come to an end should include the following actions to ensure smooth transition of stakeholders to post CAPTAIN period.

#### Prior to LL pilots

- Let participants know the exact pilot period and the end date will be communicated
- Make clear how the pilot will come to closure ensuring participants are aware of the ending strategy and to prepare them for transition and closure

LL pilots have come to an end

#### After LL pilots end

Procedures that follow the end of LL pilots shall include some of the following options:

- A social farewell thank you and gathering
- An open invitation to participants for further dialogue, if desired
- Plaques, books, and gift cards given at the end of the study
- Certificate of attendance
- Options to continue using the platform can be discussed (if budget and time are available)
- A final newsletter/report in lay terms that clearly explains the results of the project

### 3.2.5 Meetings Design & Organization

Important factors that have been identified by the CAPTAIN Living Lab partners, which could affect the active involvement of stakeholders are: frequency and duration of meetings and participation in group-based or individual-based activities. An initial planning of the Living Lab sprints has been performed in D7.1, however detailed information about the frequency and the duration of meetings within sprints is yet to be determined. A tradeoff between sparse meetings and intense periods should be kept in mind when setting the dates for the Living Lab sessions.

With respect to the duration of the sessions, it is suggested that for older adults a maximum time period of 1.5 hours or 2 hours should be kept, so that they do not get tired. Again, this depends on the type of interaction that is designed for each session. An interaction session with technology should not last for too long, because it will cause mental fatigue to the participants. However, a design thinking session could last more time probably, since participants will express ideas and their opinions in a more relaxing atmosphere.

With respect to the formation of group-activities versus more person-centered sessions, it seems that the participatory/group activities are the ones to suggest the most appropriate type of participation. Group based activities may involve the needs definition of end-users, feedback focus groups, whereas personal sessions may include the interaction of older adults with the technology per se or the provision of feedback in the form of a personal interview. Therefore, decision relies on the scope of each Living Lab activity and of course on the desires of stakeholders. Initial inputs gathered by Living Lab partners revealed that:

- Most of them prefer to participate in group activities, outside their homes
- Participating in group activities allow individuals to gain new perspectives and acquire new strategies when dealing with technology
- Personal sessions may be a lengthy process.

### 3.3 OWNERSHIP OF IDEAS GENERATED IN CO-CREATION SESSIONS

The CAPTAIN Stakeholder community becomes a body that co-designs and co-creates with the consortium the CAPTAIN system, similarly with the Patient and Public Involvement (PPI) in research. INVOLVE defines public involvement as “research being carried out ‘with’ or ‘by’ members of the public rather than ‘to’, ‘about’ or ‘for’ them”. By ‘public’ INVOLVE means patients and their relatives as well as members of the general public<sup>1</sup>. Obviously, this could raise questions about IPRs and ownership of the ideas generated in the co-creation sessions. The consortium has already identified this issue and will try to handle it in the most proper and fair way. Although this issue will be covered in detail in the deliverable D1.7 (First version of the innovation strategy), CAPTAIN relies on the Initial feedback that was received by 2 partners (INTRAS and DCU) with previous experience in relevant issues.

At a more practical level, the pilot/living lab partners will be asked to communicate any information originated from the group's input to the leader of T1.6-*Innovation Management* in advance and then to the group so that the group can see and approve the way the information is going to be used. In addition any publication that refers to their work, should include an acknowledgeable mention to the group (in many cases as co-authors) and that the group approve how they are going to refer to them and how their

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<sup>1</sup><http://www.healthtalk.org/peoples-experiences/improving-health-care/patient-and-public-involvement-research/what-patient-and-public-involvement-and-why-it-important#ixzz5MdvXLgWZt>

contributions will be presented (Gove et al., 2018). The mechanism for this acknowledgement should be agreed by all in advance and included in the deliverable D1.7-*First version of the innovation strategy*.

#### **4 AGILE METHODOLOGY IN LIVING LABS**

Participatory Design (PD) is considered as one of the most important requirements of good and effective design as it relies on the active involvement of the stakeholders in the design process. In PD the stakeholders become participants and co-designers in the design process and not just passive receivers of the development's outcome. This kind of participation is the main differentiation of PD from the other traditional methodologies such as user-centred design, although the term participation has different meaning from project to project and from study to study (Halskov and Hansen, 2015).

Most of the studies and recent EU funded projects applying PD approaches, are relying on face-to-face meetings with end-users, clinical and technical professionals who were asked to define early in the project the use case scenarios towards the elicitation of a well-defined and determined list of requirements. To reach this list of requirements list, focus groups, surveys, interviews and literature research or web-based surveys by technical professionals (developers, engineers, etc.) are the main techniques which then lead to accumulate the information for the system to be designed. However, this approach of defining all the requirements upfront, make the project teams run into trouble when the developers read, misinterpret and follow what the requirements document contains. The problem could become even worse when the project teams investigate new, innovative or radical ICT approaches, such as in CAPTAIN. In such cases, when projects aim at a proof of concept, investment in detailed documentation early in the project, which will inevitably change, should be avoided.

CAPTAIN, developing and validating radically new ICT based concepts and approaches for empowering and motivating people in need of guidance, goes beyond the usual PD and requirements elicitation techniques adopted by many EU funded projects, by using agile requirements elicitation and development. Following the agile development process where requirements and solutions evolve throughout the lifecycle process of the development, CAPTAIN's requirements elicitation process is extended from M3 to M28 (8 months before the ending of the project) through the collaboration and participation of cross-functional teams and end-users. The agile development was adopted to increase development performance in terms of continuous, efficient and effective adaptation in user requirements changes (Lee and Xia, 2010). Some of the main principles of agile development include frequent delivery of working modules to maintain end-user satisfaction, the acceptance and welcoming of requirement changes even in late development, face-to-face conversation between end-users and development team, or among development team members is the best practice.

The CAPTAIN stakeholders' community (Section 3), supported by the experience and existing network of the consortium's living labs, will ensure actively users' engagement (e.g. older adults, formal and informal caregivers, Silver Market stakeholders) in the agile development procedure. The CAPTAIN community requires tight bonds to be created among all the stakeholders and the active participation of the stakeholders' network throughout the project.

CAPTAIN extends from the ideation of a radical new ICT based concepts and approaches for empowering and motivating people to the delivery of a proof of concept going from the ideation phase to the actual development of a prototype. To do so, a hybrid approach leveraging on concept from Design Thinking, Lean Startup approach and SCRUM agile framework will be followed by the project. Design Thinking (supported mainly by the pilot partners) will allow the consortium to identify unmet needs and create

value from these insights. Lean approach (served by both pilot and technical partners) will enable delivering a partially functional prototype frequently enough to the stakeholders in order to collect feedback, validate our assumptions and readjust. The use of SCRUM will instead help organize work across technical partners to collaborate towards delivering high value. This hybrid approach will facilitate CAPTAIN to solve effectively and with high flexibility the complex project’s developments required to achieve its goals, as detailed below.

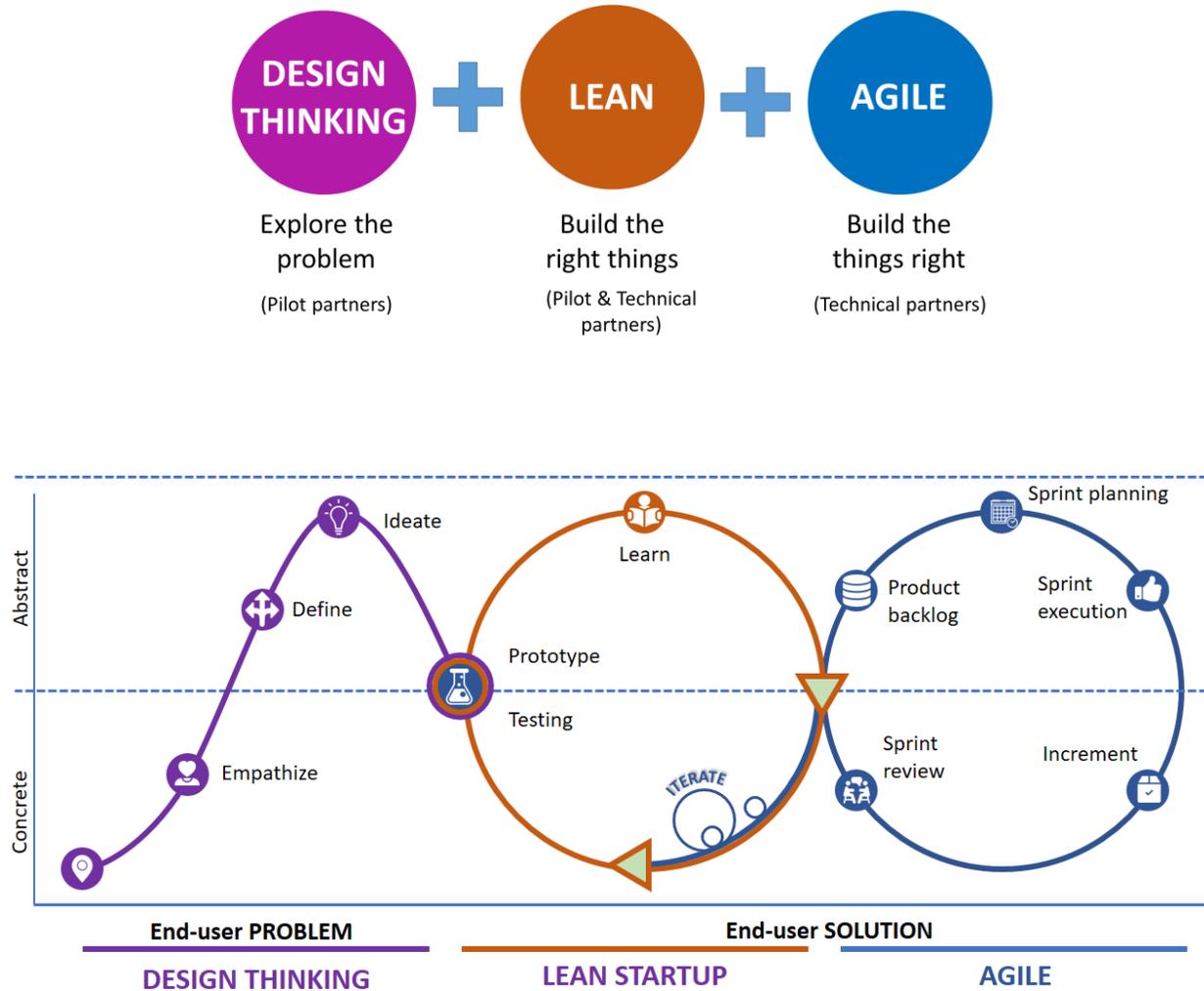


Figure 2: the combination of design Thinking, Lean Startup and Agile methodology. [Original image: Gartner]

CAPTAIN, following SCRUM, will manage the development of the final system through an iterative and incremental framework, meaning a transparent cyclic process of planning, implementation, testing and evaluation as illustrated in Figure 2.

Some of the main challenges the CAPTAIN consortium will have to face is the “dual recognition”: on the one hand, the end-users will have to change their minds about what they want or need and, on the other hand, there will be challenges unpredictable to deal with. In the context of CAPTAIN, where projected and tangible interfaces will be used for the interaction with older adults, the problem cannot be fully

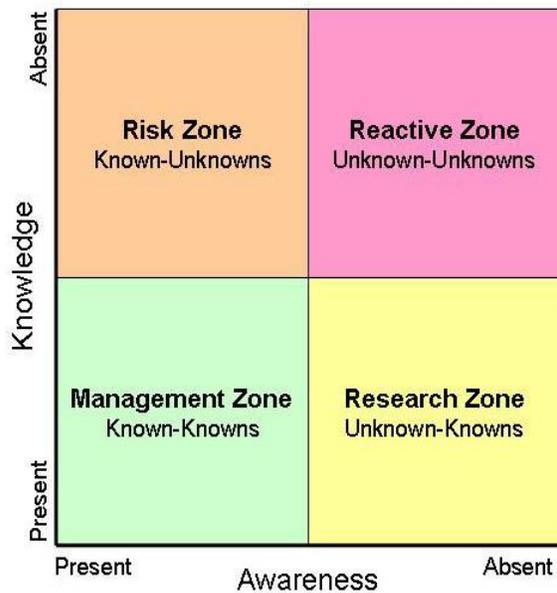


Figure 3: Map of unpredictable zones for SRUM methodology

understood (the so-called “unknown unknowns”) and the solution provided cannot be fully defined up front. On the other hand, it is essential to try to move from the “unknown unknowns” to “known unknowns” and finally to “known knows”, in order to be able to better manage the project’s final deliverable and initial set of common sense requirements. Such an evolution, in fact, would save technical partners precious time and would contribute to minimizing any risk of delay.

Finally, the user requirements and needs (CAPTAIN’s backlog) will be reflected on a living document (deliverable D2.1), evolving throughout the lifecycle of the project, which will be updated after every interaction with the stakeholders, to capture the most valuable requirements (both from the end-users and the researchers’ perspective) and to maximize the acceptance levels beyond the life cycle of the

project (see §4.3 SCRUM).

The following sub-sections will provide a brief description on the 3 different phases (Design Thinking, LEAN Startup and SCRUM), how these methodologies will be adopted and how will be adapted in the CAPTAIN project. The purpose, input source and expected results and outcomes will be described in detail.

#### 4.1 DESIGN THINKING

Design Thinking is a 5-step method- Empathize, Define, Ideate, Prototype, Test that helps a designing team to come up with practical, meaningful and creative ideas that resolve real issues for a particular group of people. The process developed helped to solve problems with innovative new solutions, investigating both known and ambiguous aspects of an existing problem.

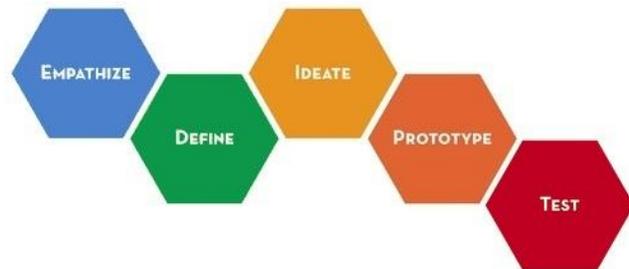


Figure 4 -steps of the design thinking process

During CAPTAIN we will exploit Design Thinking process in the first two sprints (as described in D7.1 Clinical study plan), in order to refine the first version of user requirement presented in D2.1 First version of user requirement analysis. The first sprint will consist of two sessions and throughout it the Empathize, Define and Ideate phases will take place. It will be divided in two sessions (Empathize and Ideate) between which the Living Lab partners of the consortium, guided by AUTH, will consolidate the session output (Define). The second sprint will consist of one session in which the Prototype and Test phases will be carried out. The prototype will be created by the designing team, guided by AUTH and will be tested by end-user’s in the co-creation session of the 2<sup>nd</sup> sprint.

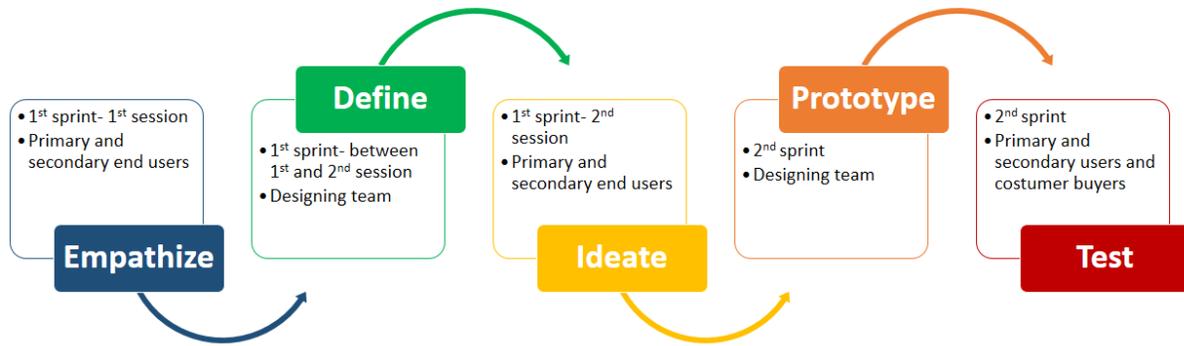


Figure 6 Design thinking timeline and participants

**Purpose:** The purpose the design thinking process is identify in more concrete and precise way the everyday life problems of older adults and to find new, innovative solutions to support them deal with these problems. The design thinking process will extend the consortium’s knowledge and understanding providing new, creative ideas.

**Input:** Input for the whole design thinking process will be the first version of user personas and user scenarios described in D2.1 First version of user requirements analysis that depict consortium’s knowledge and the first backlog of requirements. They will be used as a starting point and initiative for further discussion, but they are susceptible to change drastically.

**Expected results/outcome:** The expected result is a refined version of user requirements that will be delivered to the CAPTAIN technical team. Also, another expected outcome is a new version of personas and user scenarios that will provide a better insight for CAPTAIN’s target group. The outcome will be represented in user stories that are in the format of:

*As a (role) I want (something) so that (benefit).*

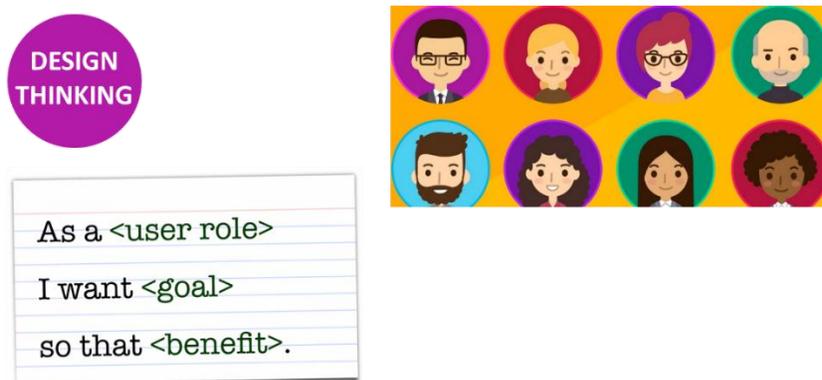


Figure 7 Design Thinking expected outcome in CAPTAIN is refined version of user requirements and personas

The steps of design thinking are:

**Step 1: Empathize**

The purpose of step one is to gain insight about what older people really care about. We need to empathize with their situation. Besides the CAPTAIN consortium's expertise in silver economy and older people's needs, only the user themselves can describe their problems. Input for this phase will be the first version of user personas described in D2.1 First version of user requirements analysis. The personas will be the incentive for the participants to start discussing about their own experiences. Personas play a bilateral role, on the one hand they help the consortium empathize with the CAPTAIN system users and the users themselves to distinguish their everyday life needs and problems. Finally, the expected result is to enrich the personas with thoughts, needs and wants that the CAPTAIN consortium has not yet identified. The first output of this phase will be raw text, sketches or images based on the proposals that will arise during the 1<sup>st</sup> co-creation session of the 1<sup>st</sup> sprint.

### **Step 2: Define**

Exploiting the information gathered by empathize step, we can understand the actual needs that people are trying to fulfil with certain activities. This is a process of understanding the real problem that older adults face and aggregating the output of all living labs (pilot partners except AMEN). The raw output of the empathizing 1<sup>st</sup> session will be submitted for consolidation and analysis by AUTH. The format of the input could be notes of the Empathize session, images, sketches etc. After the analysis, the output of this step must be the formulation of a problem statement. In complex systems, like CAPTAIN, that are called to solve more complex problems and require an holistic approach, more than one problem statements will be created. These statements should be sort, clearly defined, concise and represent the main objectives of CAPTAIN.

### **Step 3: Ideate**

This step focuses on the problem statement, created from ideation phase and aims at introducing ideas that solve the problem. It represents a process of "going wide" in terms of concepts and outcomes. Every idea is most welcome, and the participants should not be judged but encouraged to take generative role. The problem statements defined by the designing team will be the input for this process. The main goal is not to come up with the perfect idea but to motivate people think what could possibly satisfy their needs. The ideas described will then be included in the user scenarios.

### **Step 4: Prototype**

The insights learned from the different ideas expressed during ideation phase are shaping the creation of a prototype. The design team has to focus on how the ideas fits in the context of older people's actual lives. The solution must be transformed in a real prototype that is good enough to be tested and adds a value to the solution. The main input will be the ideas produced by Ideate and the refined version of user scenarios. The expected output is the first Minimum Viable product (MVP) that will not include all the CAPTAIN components but will represent the CAPTAIN functionality. It could be a simple video or a representation with micro-projectors as the main attributes of the CAPTAIN system will not have been developed, yet.

### **Step 5: Test**

During this step, the prototype will be tested with actual users. The actual goal is not to defend the idea in case people do not like it but to learn and gain meaningful feedback. Testing, in Design Thinking, involves generating user feedback as related to the prototypes you have developed. Gaining a deeper understanding of users' as well as their feedback on the prototype will be the output. Users' comments

on the prototype, how they envisage the product and insights about their first interaction with the system will be recorded.

#### 4.2 LEAN STARTUP

The Lean Startup methodology is an approach for these type of companies to create and manage desirable products for their customers' hands as fast as possible. The Lean Startup method provides insights on how to steer the company, when to change direction (pivot), and when to persevere with maximum acceleration reducing the wasted efforts and time. However, the definition of the "Startup" is partially aligned with projects such as CAPTAIN that develop radically new technologies for "customers" that are not familiar with (older adults and technology). To identify and understand the similarities of a Startup with projects like CAPTAIN, some definitions are provided and analysed as:

1. A startup is a company working to solve a problem where the solution is not obvious, and success is not guaranteed (Neil Blumenthal, cofounder and co-CEO of Warby Parker.)
2. A startup is a human institution designed to deliver a new product or service under conditions of extreme uncertainty (based on Eric Ries <sup>2</sup>, the author of the Lean Startup book)

Not surprisingly, we could re-phrase:

1. CAPTAIN is a consortium working on solving the problem of empowering and motivating people in need of guidance and care due to age related conditions where the solution of projected augmented reality and tangible interfaces is not obvious, and success is not guaranteed.
2. CAPTAIN is a consortium designed to deliver a new service for empowering and motivating people in need of guidance and care due to age related conditions under conditions of extreme uncertainty.

Apparently, someone could perfectly describe the CAPTAIN project with these 2 definitions. This could justify the similarities between the Startups and CAPTAIN, which in turn could justify the adoption of methods that have been proven to be very efficient, such as Lean Startup.

Many similar European funded projects begin with an idea for a solution that they think end-users want. After the first meeting with the end-users, the technical partners get the list of the user requirements which is elicited through interviews with the end-users for the hypothetical final solution and its hypothetical usage and exploitation. After spending a lot of time on the documentation and finalization of the user requirements, they spend months, sometimes a couple of years, perfecting that solution without ever showing the intermediate solution or even **a functional part of it**, to the prospective end-users. When they fail recruiting end-users even for piloting the solution, it is often because they never spoke to prospective end-users and determined whether or not the solution was interesting. When end-users ultimately communicate that they do not care about the idea, the projects end up with a great research project (with promising research results produced in lab settings) that nobody would like to use.

To eliminate the uncertainty, the Lean Startup approach creates order by providing tools to test the projects vision continuously. Lean aim is not simply about spending less resources or just about failing fast and cheap. It is about putting a process, a methodology around the development of a solution/product. According to the Lean Startup, CAPTAIN does not attempt to answer the question "Can this solution be built?" but the question "Should the CAPTAIN solution be built?". To make it more realistic, the question

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<sup>2</sup> Ries, E. (2014). Lean Startup: Schnell, risikolos und erfolgreich Unternehmen gründen. Redline Wirtschaft.

that CAPTAIN attempts to answer is “What do end-users and stakeholders envisage as the CAPTAIN solution to use it in their daily life?”

The core component of Lean Startup methodology is the **build-measure-learn** feedback loop. The first step is to identify and understand the problem that needs to be solved, using the design thinking approach, described in §4.1 Design Thinking, and then developing a minimum viable product (MVP). The process of learning begins as soon as the MVP exists and is exposed to the end-users. Once the MVP is established, the consortium can work on making single changes to improve it. Rather than making a lot of changes at once, focusing on one single thing at a time allows the testing and evaluation of individual hypothesis at a time (tuning the engine). This involves measurement and learning which creates knowledge for the next time. In order for this learning to be efficiently achieved, actionable metrics are defined and included to demonstrate cause and effect.

The unit of progress for Lean Startup methodology is validated learning. Once validated learning is adopted, the development process can shrink substantially. On validated learning the focus is on identifying the right thing to build – the solution end-users want and would use in their daily life. To effectively do so, the consortium should be able to adapt its plans incrementally, day-by-day.

**Purpose:** CAPTAIN project will design, develop and validate radically new ICT based concepts and approaches for empowering and motivating people in need of guidance and care due to age related condition. Having previous experiences in similar projects, where waterfall methodology was applied, the technical partners of the consortium recognized the limitation and impediments that can be caused for innovative projects such as CAPTAIN. Concluding, the LEAN Startup methodology was selected to ensure that the project’s resources will be invested on designing, developing and delivering to the Stakeholder “the right things”.

**Input:** Input for this phase will be the CAPTAIN’s prototypes. Starting from presenting the envisaged functionality of CAPTAIN via virtual reality (to give a first idea of what CAPTAIN could be) and moving through by releasing the partner’s existing prototypes or products that will be key technology in CAPTAIN, a CAPTAIN functional prototype will be released to the CAPTAIN’s Stakeholder community in every iteration. The projected augmented reality from HoloLamp (main component for the CAPTAIN Box (D2.2) and the MentorAge indoor monitoring (main component for the CAPTAIN Satellite (D2.2) devices will be among the first release of CAPTAIN. As the iterations move forward, the released prototypes are expected to integrate the desired CAPTAIN functionality.

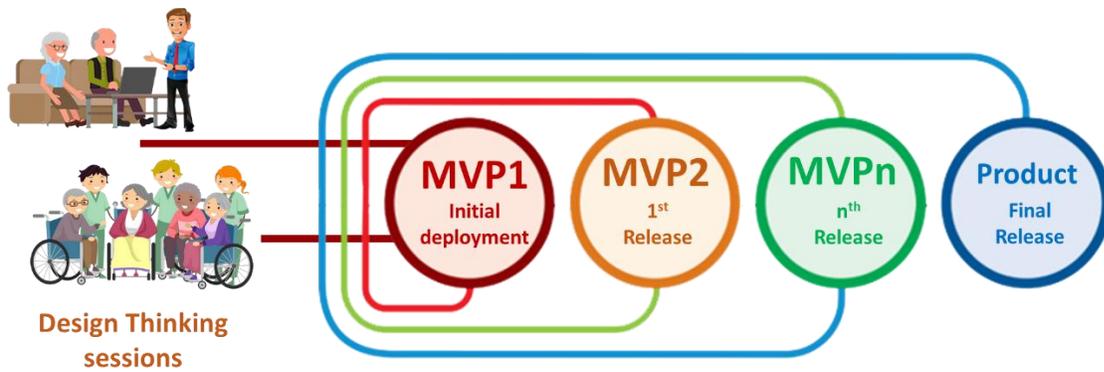


**Expected results/outcome:** The expected outcome of the LEAN Startup adoption in CAPTAIN is the validate learning in order to build the right things for CAPTAIN based on the stakeholders’ feedback. The measurement of the defined actionable metrics will be used to analyze if the consortium is close to the set goal as well as insights on what to improve. From a different perspective, the expected outcome is the feedback that will be used for the next release of the CAPTAIN system.



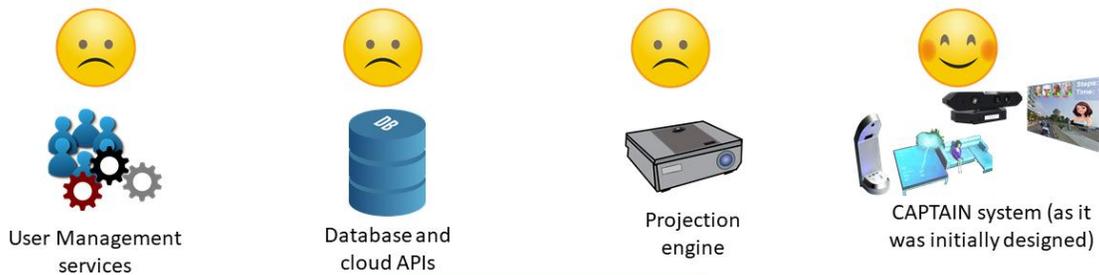
Figure 8 LEAN Startup expected outcome in CAPTAIN is functional prototypes

After the initial engagement of the CAPTAIN consortium in the design thinking sessions, the process starts with initial deployment of technologies into their operational environment. The development will include individual components, not constituting yet a complete solution such as the projected augmented reality device from HoloLamp which will be the main component of the CAPTAIN Box (D2.2), the MentorAge indoor monitoring system from NIVELY which will be the main component for the CAPTAIN Satellite (D2.2), etc. as shown in Figure 9. Also starts the beginning of the (i) evaluation of KPIs and measurement of performance (ii) managing, facilitating and consolidating feedback coming from the CAPTAIN Stakeholders' community and (iii) translating key issues demanded by end-users and stakeholders into improvement by updating the re-prioritizing the user requirements list (backlog in deliverable D2.1). Going through this cycle, the delivered solution is changed with a new set of functionalities and features, leading to a new minimum viable product (MVP). The main source of influence for the choice of features is the CAPTAIN Stakeholders' community, translating into a new and improved MVP compared to the previous deployment, delivering higher value for the end-user. This cycle is repeated with the first release (3<sup>rd</sup> sprint according to Table 4-3 in D7.1 Clinical Study Plan) to test the new set of features, based on the user requirements that will be produced within the 1<sup>st</sup> and 2<sup>nd</sup> design thinking sprints according to Table 4-3 in D7.1 Clinical Study Plan and fine tune them, leading to a better problem-solution fit. The result will be the second release (4<sup>th</sup> sprint according to Table 4-3 in D7.1 Clinical Study Plan), wherein the cycle will be repeated. After each Build-Measure-Learn iteration, the technical partners will re-assess and re-prioritize the list of the technical requirements (backlog) during the Review phase of each sprint (Table 4-3 in D7.1 Clinical Study Plan). A large group of end-users will be engaged (~8 per pilot site, more than 30 in total) to demonstrate the technology in a wide range of stakeholders: older adults, relatives, (in)formal caregivers, healthcare technology/service providers, nursing home management and patient associations. The adaptive solutions and services resulting from this iterative multi-step process will deliver value identified by primary end-users that will fit into production processes (as the CAPTAIN product). The value chain demonstrating economic viability and exploitation strategy targets to commercialize of the project outcomes as early as 12 months after the end of the project, described in O#10 of the CAPTAIN DoA (769830).



Continuous data collection pilots (involving the CAPTAIN Stakeholders’ community, technical and pilot partners) in controlled environments (living labs) (T7.4) will take place during most of the project’s period starting with the production of experimental dataset in a small pilot phase (T7.3) in order to support the tasks of WP4 and WP5. The same pilots, will support the pilot trials in real homes, towards the final evaluation phase (Task 7.5), using the majority of the CAPTAIN adaptive services and solutions in their real living daily life.

**Not like this...**



**Like this!**



Figure 9 CAPTAIN Minimum Viable Product (MVP) approach

The Figure 9 illustrates the approach that CAPTAIN will follow compared to an approach similar to the “waterfall” which was adopted by many projects until recently. Following the simplest definition of an MVP, according to which it is the simplest core feature set of any product that allows it to be deployed and absolutely nothing more, CAPTAIN will be delivering functionality progressively, starting from the CAPTAIN Box functionality to the fully functional system, adapted to the end users’ needs and feedback. Each release is an increment of the previous release adapted every time to the newer user’s feedback. More specifically, the four functional releases of the CAPTAIN system, along with the first release which is expected to be a representation of the envisaged system through virtual reality, are:

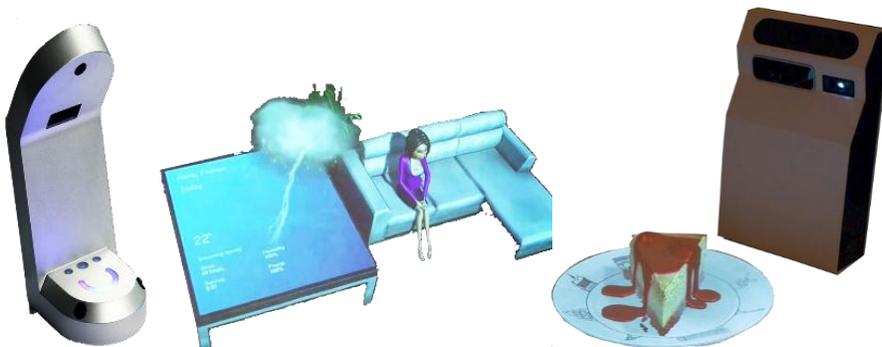
### Virtual Reality (design thinking)

A 360 video will be recorded to simulate the envisaged functionality of the system. Normal projectors, projecting static content in a room, will be paced in the Thess-AHALL (AUTH). A 360° camera will be used to record a video that will then be used during the design thinking session to give a more realistic and clearer image of the CAPTAIN concept. AUTH and NIVELY have already experimented with this approach with success, the result of which was awarded with the 2<sup>nd</sup> Best Living Lab Project Award 2017 of the European Network of Living Labs (ENOLL).



### CAPTAIN Box (1<sup>st</sup> expected release)

The first CAPTAIN release is expected to be the CAPTAIN Box device (deliverable D2.2 First Version of system specification, §3.2.1 CAPTAIN Box). The CAPTAIN Box device will be based on the HoloLamp and it will be composed of an ultra-short-throw pico projector, a multi-touch detection module, a video camera for both the emotion recognition and the head position tracking, an ARM computer (including Nvidia GPU), a network system, a microphone, a battery system. The CAPTAIN Box, the main unit of the CAPTAIN system, will be the gateway for all the components to reach the server as well as to communicate with each other. All the in-home peripherals will be “connected” to the CAPTAIN Box. Finally a casing will hold all the components in the most compact and aesthetic form-factor as possible of the HoloLamp. The main functionality of this release will be the CAPTAIN Box’s basic interaction functionality with the user without any coaching capabilities yet.



### **CAPTAIN Satellite (2<sup>nd</sup> expected release)**

The second release is expected to be the CAPTAIN Satellite (deliverable D2.2 First Version of system specification, §3.2.2 CAPTAIN Satellite). The CAPTAIN Satellite device will be composed of a pico-projector, a 3D tracking device relying on a depth camera (based on Nively's MentorAge), an RGB Camera, a processing unit (Android) and network connectivity (wireless). The Satellite will be a self-functional device, communicating with the CAPTAIN Box. The integrated device will have both monitoring functionality (body gait, posture and gesture analysis) as well as User Interaction one through the projection of content and microphone. The Satellite devices will be distributed in the home, although the testing phase will take part in Living Lab environments during Sprint Reviews, connected wirelessly with the CAPTAIN Box, and will act autonomously based on information coming from the CAPTAIN Box. The main functionality of this release will be the CAPTAIN Satellite's basic interaction functionality with the user without any coaching capabilities yet.



### **Coaching functionality (3<sup>rd</sup> expected release)**

At the 3<sup>rd</sup> release it is expected that the living labs will have the required hardware already (CAPTAIN Box and Satellite). If no major issues are raised by the CAPTAIN Stakeholders community feedback, the 3<sup>rd</sup> and the following releases will focus on the software and applications functionality. Based on the plan's schedule in deliverable D7.1 Clinical Study Plan, *Table 4-3 T7.4 sub-phase breakdown of all sprints with proposed start and end dates and allocated responsibilities*, the 3<sup>rd</sup> expected release [M26] coincides with the second half of the coaching functionality development period within WP5. This could be the best time to get valuable feedback on the design coaching functionality.

### **CAPTAIN system (4<sup>th</sup> expected release) (final within the lifecycle of the project)**

The final release, before moving to the deployment in the end-users' real homes, is expected to have the whole functionality of the CAPTAIN system as this was developed during the evolution of the piloting activities with the CAPTAIN Stakeholder community. At this stage the system will be ready to be installed in 8 older adults homes as well as to be presented and installed for the first time in the AMEN premises (as if it were a commercial product), as staff and older adults of the AMEN nursing home will not be presented and interact with any of the releases, before the final deployment. Thus, the consortium will try to identify and solve issues that come up when the CAPTAIN is introduced for the first time on a real field.

The four release are going to be tested during the CAPTAIN Sprint Reviews with the engagement of the CAPTAIN stakeholder community. Finally, although the project will be reaching its end after the deployment in the older adults' homes (T7.5) the CAPTAIN Backlog (see §5 Practical Activities and Tools) will continue to be updated as the end of the project will be leading to the O#10 according to which, a clear business plan, including definition of market positioning, sales models, etc. will be developed with

active engagement of partner SMEs. Consequently, the CAPTAIN final prototype could be transformed to a product and the product backlog exists as long as the product exists.

Specific and repeatable tasks will be measured during each sprint to gain insights about the improvement or deterioration of the sprint procedure. The statistics to be used are called actionable metrics. Actionable metrics will be used as internal assessment tools that can depict the progress of each sprint and help the partners design the improvements needed.

#### 4.3 SCRUM

Agile Development approaches have many differences from the traditional "waterfall" approaches and effect project management in many ways. The main idea behind all the Agile Development approaches is that the most efficient way to meet CAPTAIN's Stakeholders community needs is through the collaboration of a group of people (technical and pilot partners of CAPTAIN) committed on achieving results quickly.

Scrum<sup>3</sup> is a framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value. Scrum is a framework for effective team collaboration (technical partners) on complex products (CAPTAIN system). Given that CAPTAIN could be considered as a development of a complex solution, the Scrum iterative and incremental practices can effectively be adopted. It increases productivity by enabling organizations, such as the CAPTAIN consortium, to adjust smoothly to rapidly – changing requirements (regular meetings with the project's Stakeholders community). The sought results in scrum projects is the achievement of higher customer satisfaction rates which, in the case of this project, can lead to higher adoption of the CAPTAIN system. However, although Scrum is considered simple to be understood, it is difficult to master. And this has already been identified as a risk (Risk 1 in Table 1.3.5 in Grant Agreement Nr. 769830). The proposed risk-mitigation measure is that five partners of the CAPTAIN's consortium are strongly involved in living lab activities and co-creation methodologies as part of their living labs' daily tasks. Co-creation methodologies are built around the participatory design and thus, these partners will introduce and harmonize the agile approaches throughout the consortium". The Scrum approach presented in this section is a modified version of the Scrum Guide<sup>4</sup> which will be evaluated within the CAPTAIN project's lifecycle.

#### The Scrum Framework

Scrum is not a methodology but implements a scientific method of empiricism build on top of three pillars:

- **Transparency:** aspects of the process must be visible to those responsible for the outcome.
- **Inspection:** All involved users must inspect the outcomes and progress in order to detect and refine any undesirable variances.
- **Adaptation:** If during inspection any aspect is detected to deviate outside of the acceptable limits, leading to an unacceptable result, the process must be adjusted.

When the values of commitment, courage, focus, openness and respect are embodied and lived by the Scrum Team, the Scrum pillars of transparency, inspection, and adaptation come to life and build trust for everyone. The Scrum Team consists of one Product Owner (the technical coordinator of CAPTAIN will play

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<sup>3</sup> <https://www.scrum.org>

<sup>4</sup> Sutherland, J., & Schwaber, K. (2013). The scrum guide. The definitive guide to scrum: The rules of the game. Scrum.org, 268.

this role), the Development Team (the technical partners of CAPTAIN involved in WP4 and WP5), and a Scrum Master (to be designated soon among the technical partners). Scrum Teams are self-organizing and cross-functional, meaning that they have all competencies needed to accomplish the work without depending on others not part of the team (CAPTAIN consortium consists of pilot partners, living lab partners, ethical expert partners, exploitation partners, etc.). The team model in Scrum is designed to optimize flexibility, creativity, and productivity.

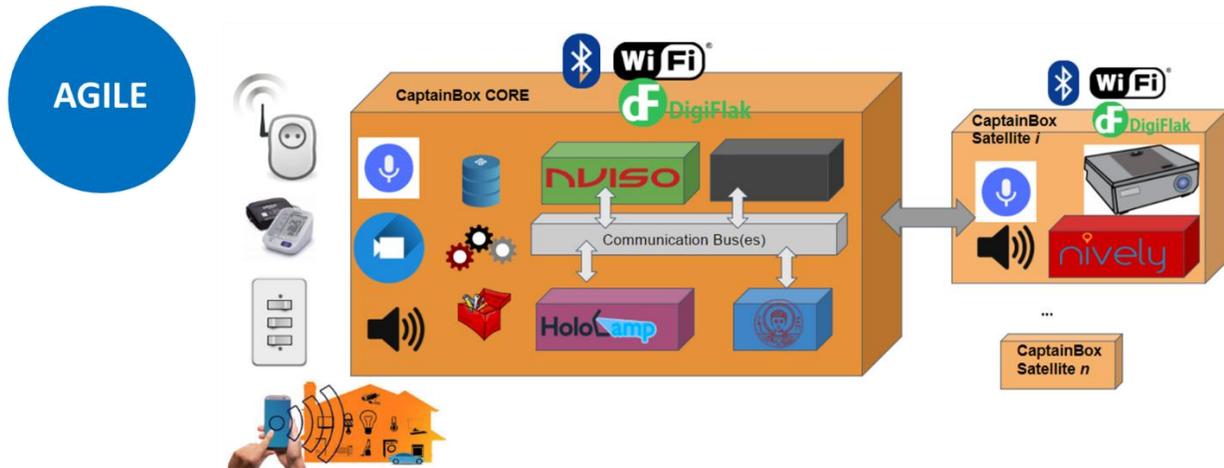


Figure 10 SCRUM expected outcome in CAPTAIN is the releasable increment of the CAPTAIN system

**Purpose:** CAPTAIN project adopts a modified version of the Scrum approach to increase the value delivered to the CAPTAIN Stakeholder community with each increment, and to rise the efficiency, technical and pilot partners collaborate towards a common Goal: the CAPTAIN system. Scrum will ensure that CAPTAIN designs and develops “the things right”.

**Input:** The Input for the Sprint will be the CAPTAIN Stakeholders community feedback, the only source or requirements. The stakeholder’s feedback, collected and analysed by the pilot and living lab partners after every Sprint Review, will be used to update and re-prioritize the CAPTAIN product backlog. The initial input is expected to be the combination of the initial user requirements list (deliverable D2.1 First version of user requirement analysis) and the feedback collected during the first two design thinking sprints.

**Expected results/outcome:** The expected outcome of the adoption of the modified Scrum is the close and efficient collaboration of the CAPTAIN’s technical and pilot partners with the only Goal of delivering value to people in need of guidance and care due to age related conditions.

Scrum defines time-boxed (maximum duration) events on regular basis to minimize the need for not defined meetings. When the Sprint begins, its duration is fixed and cannot be shortened or lengthened (more information on the starting date and duration of the CAPTAIN sprints can be found in deliverable D7.1 Clinical Study Plan, Table 4-3 sub-phase breakdown of all sprints with proposed start and end dates and allocated responsibilities). The main events are presented in the following sub-sections.

#### 4.3.1 Scrum Events

##### 4.3.1.1 Sprint

It is the main event of Scrum. In software development last for one month or less within which a “Done” (functional) product increment is created. CAPTAIN sprint will last 1-2 months in order to counterbalance

the specific features of the project: (i) CAPTAIN technical partners are not in the same physical office (ii) each partner has to deliver different functionality (different tasks in WP4 and WP5) (iii) CAPTAIN is one of the few projects that adopts agile in such a structured way, trying to create an effective framework to be used by other projects in the future. At the end of each sprint, the technical partners must deliver to the CAPTAIN Stakeholder community (through the pilot/living lab partners) a functional sub-system of CAPTAIN, an MVP. Thus, each Sprint could be considered a project with no more than a 3-month horizon. And as a project, each Sprint must accomplish a goal, the Sprint Goal. However, the sprints cannot be canceled, this could only happen if the Goal becomes obsolete.

#### 4.3.1.2 Sprint Planning Meeting

The work to be performed in each Sprint is defined at the Sprint Planning. This plan is created by the collaborative work of all the involved technical and pilot partners. The basic aspects to be answered during this event are (i) what part of the CAPTAIN system in the next sprint, and (ii) how the partners will collaborate in order to deliver the Increment. Techniques and procedures like planning poker, which is a gamified approach for calculating the relevant time for a component to be delivered, described in 5.1.1 Creation of Product Backlog, will be used.

#### 4.3.1.3 Daily Scrum (Weekly Scrum)

The Daily Scrum is a 15-minute time-boxed event held every day among the Team members. The scope of this meeting is the optimization of the team's collaboration and performance by inspecting the work since the last Daily Scrum and forecasting upcoming Sprint work. To reduce complexity, the Daily Scrum is held at a predefined time and following the same process every time. In projects like CAPTAIN a daily 15-minute teleconference among all the technical partners would increase complexity and have the opposite results. As a consequence, the Daily Scrum in CAPTAIN agile framework becomes a Weekly Scrum. Every week all the technical partners will be participating in a 15-minute teleconference answering the 3 following questions:

- What did I do the last week that helped the consortium meet the Sprint Goal?
- What will I do the next week to help the consortium meet the Sprint Goal?
- Do I see any impediment that prevents me or the consortium from meeting the Sprint Goal?

#### 4.3.1.4 Sprint Review

The Sprint Review takes place at the end of the Sprint to inspect the Increment and adapt the Product Backlog (the list of user requirements initially presented in deliverable D2.1 First version of user requirement analysis) if needed. The Scrum Team and the CAPTAIN stakeholder's community members collaborate about what was done in the Sprint. In CAPTAIN, this event is held 4 times by the pilot and living lab partners and the CAPTAIN stakeholders' community and 4 times only with the CAPTAIN consortium without the participation of stakeholders' community.

The **meetings with the stakeholders' community** is already scheduled and living lab partners have previously discussed with the technical partners about how to get feedback and what needs to be specified (Sprint Pre-Review). The attendees of that meeting are the Living Lab partners and the CAPTAIN stakeholders' community. Although the Sprint Review is held by the Living Lab partners, it would be very beneficial that technical partners participate too. However, given the geographical distance between the technical and pilot partners as well as the big number of such meetings (six meetings) this is not feasible. During the meeting attendees collaborate on designing the next things to be done to optimize value of the CAPTAIN product and propose changes. The purpose of this meeting is the presentation of the

Increment to the end-users in order to elicit feedback and foster collaboration. Thus, CAPTAIN adapts the Scrum and adds 2 more events, one before (Sprint Pre-Review) and one after (Sprint Post-Review) to the Sprint Review, where the partners synchronize themselves by exchanging knowledge and information.

The Review **session without the participation of the stakeholders' community**, is held between the stakeholders' community meetings. In that Review CAPTAIN consortium gives feedback about the current Increment based on their knowledge and experience. The main purpose of these reviews is to deliver and integrate CAPTAIN components frequent enough and mitigate the foreseeable risk of large SCRUM duration. The Sprint Pre-Review and Sprint Post-Review will not be carried out before and after that Review.

#### 4.3.1.5 Sprint Pre-Review

A teleconference before the Sprint Review, only for the Review engaging CAPTAIN stakeholder community, allows the technical partners to explain what the increment of this Sprint is and what feedback should be sought to the Living Lab partners. The technical partners must have already circulated a brief and comprehensive document with the required feedback for the technical components delivered in the current sprint. During this meeting the pilot partners must clearly understand what needs to be experimented. The result of the Sprint Pre-Review is a document with clearly defined goals for the feedback to be collected in the Sprint Review. As mentioned above this meeting is not necessary for the Reviews held among the CAPTAIN consortium.

#### 4.3.1.6 Sprint Post-Review

After the Sprint Review, only for the Review engaging CAPTAIN stakeholder community, the pilot partners consolidate a document with the collected feedback, following any templates that have been circulated by the technical partners during the Sprint Pre-Review. The report is circulated with the technical partners and after a week the Sprint Post-Review teleconference is held. During this meeting the technical partners must clearly understand the feedback of the stakeholders. The result of the Sprint Post-Review is a revised prioritized user requirements list, the Product Backlog according to Scrum. As mentioned above this meeting is not necessary for the Reviews held among the CAPTAIN consortium.

#### 4.3.1.7 Sprint Retrospective

The Sprint Retrospective is an opportunity for the consortium to inspect the process and create a plan for improvements for the forthcoming Sprint. Before the Sprint Retrospective the pilot and technical partners will also create the actionable metrics report to track the progress of the Sprint. The meeting must be positive and productive to enable the CAPTAIN consortium work better in each new Sprint. During the Retrospective event, the consortium should identify improvements such as (i) improvements regarding the Sprint Review actual procedure (meeting the end-users) (ii) changes on the technical implementation plan (iii) proposal from pilot partners about the structure of the input information given by the technical partners (Sprint Pre-Review) (iv) instructions from the technical partners about the feedback document provided by the pilot partners (Sprint Post-Review).

#### 4.3.2 Scrum Artifacts

The Scrum's artifacts are work or value to provide transparency and opportunities for inspection and adaptation.

#### 4.3.2.1 Product Backlog

The Product Backlog is a prioritized list of all the things that need to be done for the CAPTAIN system. Being updated from the CAPTAIN Stakeholder community, it is the only source of requirements for any functionality and changes to be made to the CAPTAIN system. The first in the order items for development are the initially known and best-understood requirements that provide value to the end-users (*Figure 11 First view of user requirements considered for implementation* and *Table 7 First Backlog of CAPTAIN functional user requirements* in the deliverable D2.1 First version of user requirement analysis). Being as dynamic as possible in order to ensure an appropriate, competitive and useful CAPTAIN system, the Product Backlog constantly changes. The user requirements can range from functions, requirements, enhancements, fixes and any other feature that could be integrated in the CAPTAIN system's future releases. Each of the Product Backlog items must have a description, order, estimate (time needed to be implemented), and value (for the end-user). The items could also describe the tests, tools or evaluation methodologies that will be used (Sprint Review) to prove its completeness when "Done."

Requirements never stop changing and consequently the Product Backlog is a living artefact that exists as long as the product exist. The CAPTAIN's Product Backlog will be officially reflected to the living deliverable D2.4 Final version of user requirement analysis which will be initially based on the D2.1 Initial version of user requirement analysis.

#### 4.3.2.2 Sprint Backlog

The Sprint Backlog is the sub-set of CAPTAIN Product Backlog. It is selected for each Sprint along with a plan for delivering the product Increment and accomplishing the Sprint Goal. The Sprint Backlog is a forecast by the CAPTAIN technical partners about what functionality could be delivered as the next Increment. The technical partners modify the Sprint Backlog throughout the Sprint as they work through it and learn more about the work needed to accomplish the Sprint Goal. New required work can be added in the Sprint Backlog. Performed and completed work is updated and when elements of the plan are considered unnecessary, can be removed. The total remaining work can be summed at any point in a Sprint. The technical partners will track this remaining work at least for every Bi-Weekly Scrum to project the likelihood of achieving the Sprint Goal.

#### 4.3.2.3 Increment

The Increment is the sum of all the CAPTAIN Backlog components delivered in a Sprint. Each Sprint augments the current state of the Increment with new functionalities that add value to the CAPTAIN product. An Increment is inspected during the Sprint Review with the CAPTAIN Stakeholder community engagement and contribution. The Increment must be a functional product, ready to be used. Separate modules are not perceived as Increment. Thus, the developed features integrated in the CAPTAIN product consist the current Increment.

#### 4.3.2.4 Sprint Goal

A sprint goal is a short, one- or two-sentence, description of what the team plans to achieve during the sprint. It is written collaboratively by the technical partners' team and the technical coordinator. The Sprint Goal is also used to communicate and quick reporting to CAPTAIN stakeholder community the Sprint.

## 5 PRACTICAL ACTIVITIES AND TOOLS

The sub-phases of each sprint and the implementation were described in a previous CAPTAIN deliverable, D7.1 Clinical Study Plan. The sub-phases of each sprint are presented below:

Sprint sub-phase	Responsible/s:	Expected duration (weeks)	Notes
Sprint planning:	Technological partners	1	
Design of technology	Technological partners	2	
Development of technology	Technological partners	3	Not present in the first two sprints, since mainly devoted to Design thinking activities
Design of the co-creation/testing protocols	Technological partners	1	<p>Testing protocols not present in the first two sprints. The first two sprints (Design thinking sprints) are mainly devoted to co-creation activities, refinement of personas with stakeholders' network participants, needs elicitation. AUTH, as WP2 leader, is responsible for designing protocols of the design-thinking sprints.</p> <p>Starting from 3<sup>rd</sup> sprint, also testing activities can be planned during the stakeholders' sessions.</p> <p>The production of the protocols in written form is considered as achievement of the internal milestone.</p>
Laboratory technical assessment	UNITN	1	Not provided during the 1 <sup>st</sup> and 2 <sup>nd</sup> sprint. (start when technology became available)
Preparation of the living lab sessions	Living labs (no AMEN)	3	Required time is strongly depending on how much refined the testing protocol are (defined by technical partners). Moreover, re-consent could require ethical evaluation.
Technical field testing	AUTH	1	<p>Activities for this sub-phase are planned to consider unavailability of participants during holidays periods.</p> <p>This sub-phase will not be present in 1<sup>st</sup> and 2<sup>nd</sup> sprint (it will start when technology becomes available).</p>

Running creation/testing sessions	Co-	Living labs (no AMEN)	2	Should be considered as an internal milestone of the sprint, allowing synchronization among LLs. Activities for this sub-phase are planned to consider unavailability of participants during holidays periods.
Feedback synthesis		Living labs (no AMEN)	1	Based on sprint planning and assessment plan.  The production of the feedback synthesis in written form is considered as achievement of the internal milestone.
Review		Technological partners	1	

This deliverable defines, from a technical point of view, the framework of the SCRUM process during CAPTAIN project. The inputs and outputs as well as the interactions between processes and partners are defined. SCRUM is an empirically defined method and is susceptible to changes if considered needed. The technical name of each procedure is not in perfect match with D7.1 as the scope of each deliverable is different but the actual implementation is the same. Furthermore, D7.1 is referring to the Sprint that include the CAPTAIN community participation. For the better flow of the SCRUM process and the mitigation of any risk that may arise, the Sprint cycle process will be repeated every 1-1.5 month excluding the CAPTAIN stakeholders' community participation as well as the Pre-Review and Post-Review phases. These Sprint cycle will run between the Sprints described in D7.1 and their main scope and goal outcome is to facilitate the technical development. The living lab partners will contribute with their experience in the Sprint Review and Sprint Retrospective.

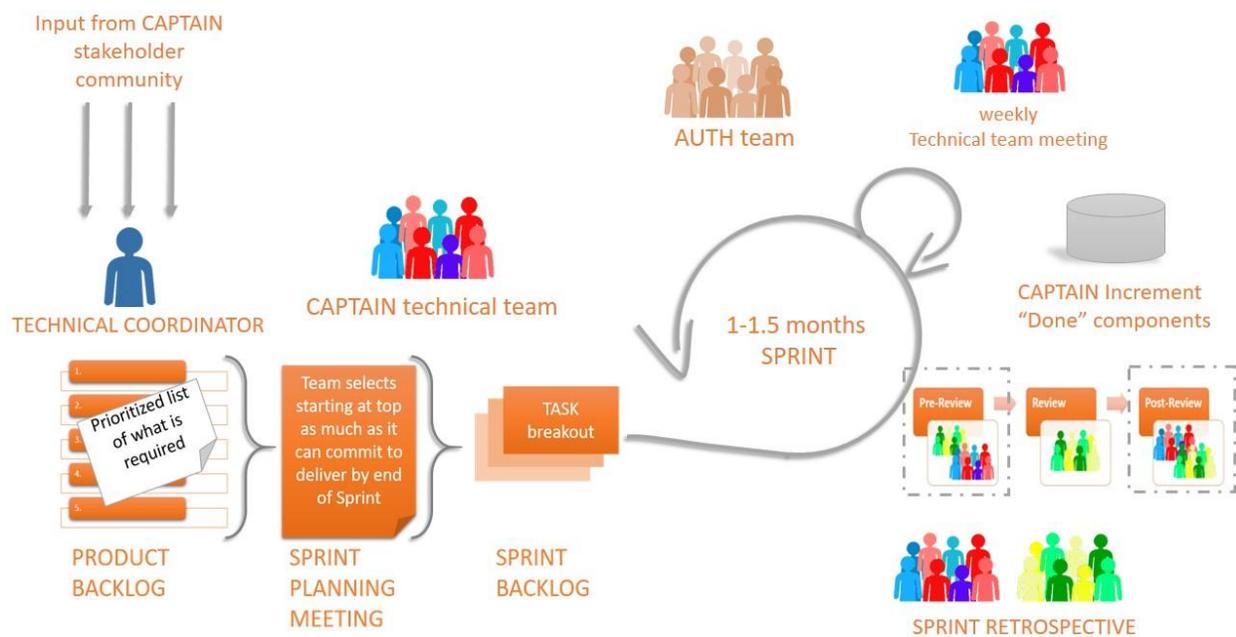


Figure 11 CAPTAIN modified SCRUM framework

## 5.1 SPRINT PLANNING

In the sprint planning session we will define the objective of the sprint, which technology should be developed/evaluated, which use-case should be satisfied and the data to be collected during testing. Identify the technological partners that are involved in the design and development of the technology. So, the Sprint planning sub-phase will include the creation of product backlog and the sprint planning meeting.

### 5.1.1 Creation of Product Backlog

#### Product Backlog

The product Backlog of the CAPTAIN project will be stored on trello.com. Trello is a web-based project management application which can support SCRUM processes. Inside trello environment you can create lists with different scope for each list, and each list contains a number of cards. The list for CAPTAIN project will be: Product Backlog, Sprint Backlog, In progress, To be tested, In testing, Done. The refined requirements will be placed in the right order in the CAPTAIN backlog board of Trello by the Technical coordinator after discussion with the team.

#### Prioritization and refinement

The input of the CAPTAIN stakeholder community has been gathered and the process of prioritization takes place in order to be placed into the product backlog. The requirements extracted are checked by the technical coordinator and placed into the shared folder of CAPTAIN consortium. Each partner (pilot and technical) has two days to rank the requirements based on:

- **Value** – the user’s benefit of any given requirement; the requirements that will return the greatest value are given the highest priority based on each partner’s professional knowledge and previous experience
- **Implementation risk** – How great is the risk for the requirement not to be satisfied due to the maturity of the technology or restrictions of the available technology. Highest value is given to the highest implementation risk

Parameter	Description	Levels
Value	How valuable will be for the user in case the requirement is implemented	High (3)
		Medium (2)
		Low (1)
Implementation risk	How great is the risk for the requirement not to be satisfied due to the maturity of the technology or restrictions of the available technology	High (3)
		Medium (2)
		Low (1)

The average of all the scores provided by each partner gives a value score and an implementation risk for each requirement. The prioritization is done based on the multiplication of the two values and the requirements are placed on the Product Backlog.

The prioritization procedure will be followed by a technical partners meeting. During this meeting the technical partners are called to estimate the effort needed for each component using the **planning poker**

technique. Planning poker technique is a gamified approach for reliable and quick time and effort estimation combining expert opinion and analogy. The procedure is explained below:

At the start of planning poker, each participant (one or two representatives from each partner) has a deck of cards. Each card has written on it one number (0, 1, 2, 3, 5, 8, 13, 20, 40, and 100). The technical coordinator is the moderator of the procedure. For each user requirement to be estimated the moderator reads the description and gives specific details when needed. After partners' questions are answered, each participant privately selects a card representing his or her estimate. Cards are not shown until each estimator has made a selection. At that time, all cards are simultaneously turned over and shown so that all participants can see each estimate. The estimations are very likely to differ significantly so each estimator, especially those with maximum and minimum estimation, are called to justify their selection. The group can discuss the story and their estimates for a few more minutes. After the discussion, each one of the participants re-estimates by selecting a card. The goal is to converge on a single estimate that can be used for the requirement. If not, the procedure is repeated. The moderator can judge when and where the estimations converge at any iteration as the key point is not absolute precision but reasonableness. When the process ends, each requirement has been assigned with an estimated effort factor. Throughout the different sprints, the CAPTAIN team can measure its capacity in terms of effort that is able to deliver. This procedure can also assist the collaboration and understanding of the CAPTAIN system as a whole and the individual dependencies of each component.

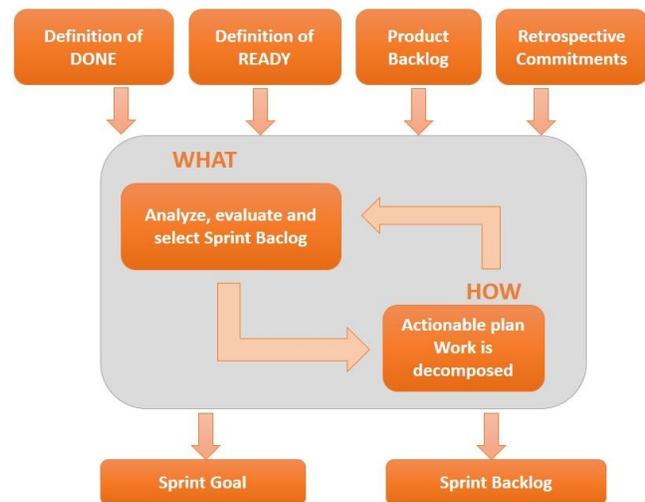


Figure 12 Inputs and outputs for the creation of Product backlog

### 5.1.2 Sprint Planning Meeting

The day after the planning poker procedure, the technical partners will run a Sprint Planning Meeting. During the sprint planning meeting, the product owner describes the highest priority features to the team. The team asks enough questions that they can turn a high-level user story of the product backlog into the more detailed tasks of the sprint backlog. There are two defined artifacts that result from a sprint planning meeting: (i) the Sprint Goal (ii) the Sprint Backlog. In order to decide which requirements will be moved to Sprint Backlog the team takes into account Definition of READY, the team's capacity and the Definition of Done. Possible dependencies between the requirements are clarified during this meeting.

During Sprint Planning the team must also define its "velocity" which is the rate of team's progress. It will be expressed in the amount of relevant time points, defined in poker planning, completed at the end of the iteration. After the first 2-3 Sprints the team's velocity will most likely be predictable and would allow quite accurate estimation about the time needed until all entries in the Scrum Product Backlog will be completed. A helpful representation is the burn down chart which is a graphical representation of work left to do versus relative time points. The ideal burn down chart is compared with the actual work to record the actual course of the team's work.

### 5.1.3 Creation of Sprint Backlog

#### **Sprint Backlog**

The Sprint Backlog is created during the Sprint Planning Meeting. Sprint Backlog contains each component that will be implemented in the current sprint and it is stored in the corresponding list in the Trello CAPTAIN board. It also includes technical instructions about how each component will be tested after the implementation. Given the different expertise of each technical partner, as well as the fact that partners are leading the development and implementation of various components, the Sprint Backlog cannot be created based only on what is higher in the Product Backlog but the speed and workload for each partner. For example, assuming that the CAPTAIN consortium can develop X features and the first X feature in the CAPTAIN Product backlog are to be developed by PARTNER Y. It cannot be that for this sprint only the PARTNER Y provides value. A portion of the X feature should be selected for the Sprint Backlog while a portion of the following features (following the first X features) should be included.

#### **Definition of READY**

An item from the Product Backlog is considered ready to be implemented and be placed in the Sprint backlog when:

1. All the components that it is dependent on, or may influence the implementation, are already defined as DONE.
2. Has high priority for implementation.
3. It is approved by the team and the technical coordinator during the Sprint Planning Meeting.

### 5.2 SPRINT

During this phase the technical team will define technological specification for hardware/software components to be developed and tested in that specific sprint. The actual technology development and deployment into the CAPTAIN product will be done in this phase, too. Processes that are included in the sprint are the Weekly SCRUM and the output is the CAPTAIN Increment. The Design of technology and Development of technology phases described in D7.1 are corresponding to the actions of the Sprint.

#### **Weekly SCRUM**

Refers to meetings, organized and moderated by AUTH, where each technical partner will report what it is done by that time and what they plan to do till the next SCRUM meeting. The minutes of these meeting are considered as commitments for implementation.

#### **Burndown Chart**

During the sprint, the Burndown chart is continuously updated to reflect the current status as well as the remaining effort required and a rough estimation of whether the team will manage to accomplish the Sprint Goal within time. The Burndown chart presents the remaining effort expressed in relative time points, as they were defined during the poker planning. For each feature of the Sprint Backlog that is Done, the corresponding relative time points are subtract from the remaining one. Following this, the team knows how many relative time points need to be Done, how many points they can handle per day and consequently if they are going to deliver the increment on time.

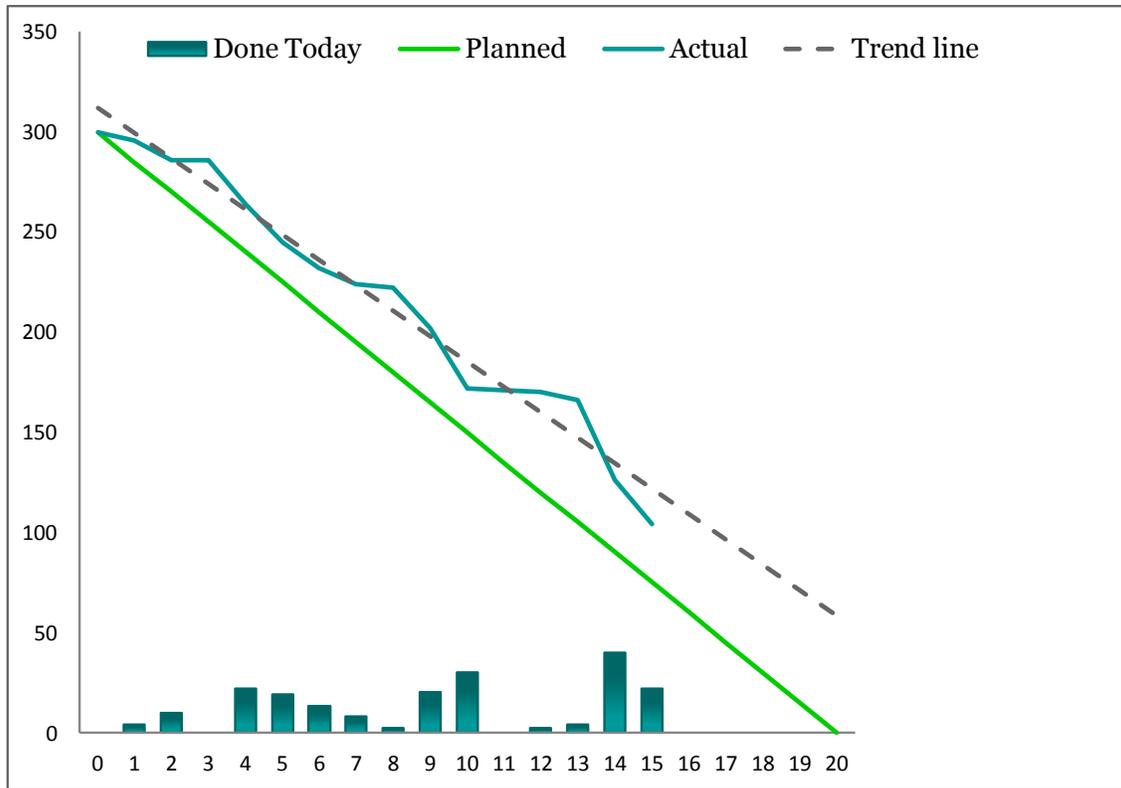


Figure 13 Burndown chart

Usually, the X axis displays the working days, the Y axis displays the remaining effort (expressed in time unit), and there is the Ideal effort as a guideline (planned light green line in Figure 13) and the real progress (Done Today dark green line in Figure 13 for tracking. Projecting the trend line, the team can estimate when the increment is going to be delivered as it was planned. The idea of this chart is to allow the team to learn its velocity (number of time points per sprint) and thus Improve the planning process and general performance under the specified methods during the sprint planning.

### 5.3 TECHNICAL ASSESSMENT

After the end of each Sprint the components delivered must be tested to ensure quality. This phase includes the Definition of DONE and the Quality Assurance.

#### Definition of DONE

Every component described in the Sprint Backlog is considered as DONE when the following are valid:

1. The technical partner responsible for the component has run all the appropriate tests described in the Sprint Backlog.
2. Quality Assurance: Technical assessment of the performance of the individual modules, covering the functional and operational requirements performed by UNITN.
3. Integration. DigiFlak integrates the component with the rest of the system and makes sure that there is no misfunction.
4. Acceptability assessment will be performed by AUTH living lab during the “field testing” described in the next sub-section (Pre-Review). A maximum of couple stakeholder will be invited to interact with the component. Once there is no major issue, the component is considered as DONE.

## **Quality Assurance**

This process will be moderated and run by UNITN based on the information defined during the Sprint Backlog creation. The debugging and testing will be performed in laboratory conditions by performing a set of trials and tests of the module functionalities. The measurements collected through this process will be analysed and help to optimize the technological modules and to minimize technical inconveniences during the subsequent testing session with stakeholders in LLs setting. Also, a report will be sent to AUTH team with the outputs for each component.

### **5.4 PRE-REVIEW**

The Pre-Review corresponds to Preparation of the living lab sessions and technical field testing phases described in D7.1. It will include the Pre-Review meeting, the definition of the living lab sessions procedure to be followed during the review and the field testing.

#### **Pre-Review meeting**

Pre-Review is a meeting involving both technical and pilot partners. The main input for this is the CAPTAIN Increment and the description for each component developed during the current Sprint. The description will be circulated before the Pre-Review meeting. Technical partners will also design a questionnaire regarding the input needed during the Review. During the Pre-Review meeting pilot partners must form a draft version with the description of the living lab session.

#### **Description of the living lab sessions**

After the Pre-Review meeting the living lab partners, with the contribution of the technical partners, will design the detailed procedure that will be followed during the Review session with the CAPTAIN community. The document includes all the questionnaires that may be used, schedule of each action and proposed ways of gathering the outputs. The first version of each sprint will be drafted during Pre-Review meeting and will be finalized with the contribution of all pilot partners. Every pilot partner has the obligation to read the description, contribute and clarify any vague points before the final circulation of the document.

#### **Field Testing**

Field testing is a procedure ran and moderated by AUTH. A small amount of stakeholders (2-3 people) will go through the Review session described in the previous phase. The goal of field testing is to indicate any nonfunctional parts or problems in the defined session procedure, before applying it to the big scale Review meetings involving all Living Lab partners. The final version for each review session methodology description is created including the feedback and refinements from field-testing.

### **5.5 REVIEW**

In the review process the CAPTAIN community stakeholders' will be involved in four Reviews and the rest will be only among the CAPTAIN consortium. CAPTAIN stakeholders, with emphasis on the older adults, will be visiting the partners' Living Labs, to interact and give feedback with all the Increments of CAPTAIN product. The Review session corresponds to running Co-creation/testing session phase described in D7.1. The session for each participant will last approx. 60-90 minutes. It may be group-based or on a personal basis, depending on the nature of functionality testing and data collection procedures. As Living Labs represent experimentation sites that include the testing and evaluation of technology in real-life environments, it might be the case that Review sessions will also take place in older adults' homes, if it is considered crucial for the development of CAPTAIN solution and older adults consent to this option. In

addition, participants' synthesis at each session may vary, since groups of stakeholders may participate either on their own or in mixed groups, e.g. older adults will participate in interactive technology sessions, while healthcare professionals may participate in discussing at focus groups centered in the adoption of CAPTAIN services to current practice. The Living Labs personnel, consisting of healthcare professionals/caregivers will collect information through structured interviews and questionnaires (as these will be defined in WP7), as well as nonverbal feedback according to the facilitators discretion, just after the pilot trial.

A detailed description of each session has been created and circulated during the Pre-Review phase. This description should provide detailed step-by-step scenarios of interaction in the form of scripts and anticipated feedback/data collection. Equipment needed to facilitate the process of conducting the pilots and collecting data should also be defined prior to the review process. Depending on the scope of each review session, Living Lab partners will facilitate the session as unobtrusively as possible, providing the end-users the floor to express themselves in an open and constructive way. In the case that piloting the technology is taking place at older adults' homes, Living Lab staff should keep a constant communication channel with end-users and be prepared to provide assistance when required. The CAPTAIN Increment will also be sent to the living labs by the partner that is responsible for each Increment. The review week could be announced as a CAPTAIN Event with a social media kick-off day and will open for new stakeholders to join. After the stakeholders' meeting, CAPTAIN pilot partners facilitators and stakeholders involved in the session have to fill the evaluation tools (6. Evaluation tools) questionnaire.

Apparently, the timing of the review process should be the same for all the living labs. The review event is 1 week and thus it is easier for all the living labs to synchronize. However, in case a living lab cannot follow a sprint, for any unexpected reason, the review process for this living lab cannot be postponed as the review analysis of the other living labs will have to move on. Therefore, it is clear how important is the good synchronization of all the technical and pilot partners. However, given that every problem could be an opportunity too, CAPTAIN's dissemination and public awareness activities will get benefit of the review week to disseminate as much as possible the "open" events of CAPTAIN in 4 European countries.

### 5.6 POST-REVIEW

The post review is actually the Feedback synthesis phase from D7.1. It is also a meeting with engagement of both technical and pilot partners. Pilot partners consolidate the feedback of the Review session so as to confront with the demands of the technical partners that were discussed and agreed during the Pre-Review. The feedback documents are circulated prior to the Post-Review meeting. Throughout the meeting the pilot partners introduce the feedback gathered and technical partners clarify any aspects that may arise. The output of the Post-Review should be a set of user stories that are either new ones or refined version of the existing Product Backlog requirements.

### 5.7 RETROSPECTIVE

During the Sprint Retrospective which is the Review part in D7.1, the team will discuss about the defects that come out during the process. The actionable metrics measured after the Review session will be the major input for the Retrospective. If at any time (during retrospective) the team realizes that the methodology presented in this deliverable needs to change in order to be improved, the amendments will be reflected to this document for the convenience of all the partners, even though this deliverable has no forthcoming version and will be submitted only once. The agreed changes for each Sprint will be reflected in the new Sprint planning.

## 6 EVALUATION TOOLS

Given the innovation of the proposed adaptation of SCRUM framework for the CAPTAIN needs, it is necessary to evaluate the whole process. This could be done with the use of actionable metrics, which could be used to detect improvements and differences in each sprint and constantly develop and improve the procedure. Actionable metrics will not provide an absolute value about the value of the work of each partner but will be considered as indicators of improvement of the whole team and a way to quantify the procedure. The metrics that would be captured are described below:

### 6.1 TECHNICAL PARTNERS EVALUATION

**Cycle time** is the time taken for each task of the backlog to be defined as “Done”. The shorter the cycle time, the more things are getting done in a given timebox. We measure this from when work starts to when the feature is defined as “Done”. Also the technical team will measure the **Escaped defects**. This is depicted in the number of problems (bugs, defects, etc.) found in the product once it has been delivered to the user. This metric can provide input for improvements for the definition of “Done” in our framework. With a high escaped defect rate the definition of “Done” is failing in some points and the end-users will not be satisfied. We measure this by the number of defects found during the Sprint Review. **Planned-to-Done Ratio** metric is a way to measure predictability. If a team commits to thirty stories and only delivers nine, the end-users have about a 30 percent chance of getting what they want. If, on the other hand, the team commits to ten stories and delivers nine, the end-users have roughly a 90 percent chance of getting what they want. Measuring is a simple exercise of documenting how much work the team commits to do at the start of the sprint versus how much they have completed at the end of the sprint. Last but not least is the **Happiness** metric. This is the team "health" metric. If all the other metrics are perfect and happiness is low, then the team is probably getting burned out, fast. This is built into our sprint retrospectives. In the beginning of every retrospective the technical team writes their happiness scores regarding the work done during the Sprint. These numbers will be tracked from sprint to sprint to see the trends.

### 6.2 LIVING LAB PARTNERS AND CAPTAIN STAKEHOLDER COMMUNITY EVALUTATION

The first metric to be measured for the Sprint Review implementation is **Retention**. It is crucial to know if the participants are coming back which indicates the satisfaction they feel about the procedure followed. We measure that by calculating the ratio of attended CAPTAIN community events to total events done and the number of new participants and dropouts in each Sprint Review. Another important metric is the **Referral**. The **Referral** can be an indication of a well-established processes that keeps the users engaged and an indication for interest towards the CAPTAIN product. We will measure how many people each living have contacted versus how many they responded in the first place, how many of them called their friends and relatives and how many friends responded at the end. Moreover, we will ask from each participant at the end of each Sprint Review to answer in the question “*How likely is it that you would recommend CAPTAIN/these meetings to a friend or colleague?*” in order to calculate the Net Promoter Score®. The answer is given in a scale from zero to 10 and help us compare the intension of referral with the actual promoters. **Happiness** metric is also very important. The measurement of subjective happiness will be done by a simple vote at the end of each session where each participant has to choose one of 5 emoticons representing different emotions. The **Participation** metric refers to how much each participant contributed to the overall session and discussion. It is not about judging the participants but assuring that each person feels free to express his/her own opinion. It will be measured by a score that is assigned to every participant by the facilitator based on the participation rate of each participant. Last but not least, a significant point in keeping people engaged is to deliver what they ask for. So, the **Delivered to Discussed**

ratio metric is a score from zero to 10 representing how satisfied they are about the fulfillment of their demands.

The proposed questionnaires to be used are presented in the Annex. The questionnaires are simple enough in order not to burden the participants further after the Review session. There were designed two kinds of questionnaires. The one is addressed to technical partners regarding the technical development procedure, the second is addressed to living lab partners and CAPTAIN stakeholders' community regarding their experience during the Review session.

Another important aspect is to compare the agile methodology designed in that document with the regularly used waterfall methodology. This comparison will be in terms of partners' approval and satisfaction of the overall process. Also, given their experience, the CAPTAIN consortium can testify their overall opinion of the effectiveness of SCRUM for EU projects. This will be assessed using the questionnaire presented in Annex.

## 7 EXPERIMENTAL DATASETS

The living labs methodology is also devoted to accommodating the production of experimental datasets for speeding up algorithms development through small scale pilot trials early enough in the project. A set of activities are indeed propaedeutic to the software development and implementation activities of WP4 (Non-invasive user and environment sensing) and WP5 (CAPTAIN Coach behavior design and AI algorithms). The existence of non-artificial data is mandatory for the effective development and the subsequent fine-tuning of software-related components.

Moreover, the need for data is further augmented by the fact that only limited publicly available corpora exist, incorporating data capturing and rendering methods that are unsuitable for CAPTAIN. As a result, it is crucial for software development to capture and have access to raw data and original datasets, in order to efficiently implement the software solutions.

### 7.1 AIM

Although only limited publicly available datasets exist, a recognition among CAPTAIN partners evidenced that a sufficient body of sensor-related datasets is already available within the CAPTAIN consortium. On the contrary, the consortium has identified the need to collect new datasets for better describing several dimensions of older adult's life (habits) that can be improved by CAPTAIN coaching. According to WP4 and WP5, the following dimensions should be part of the CAPTAIN coaching objectives:

- **Nutrition:** is the intake of food in relation to the body's dietary needs. A good nutrition should be assessed both in terms of quantity and quality of nutritional habits and should be balanced with the physical needs of the person. A poor nutrition can lead to health problems, physical and mental.
- **Social interactions:** is a social exchange between two or more individuals, is the way people talk and act with each other, face to face, via telephone or internet etc. Lack of social interaction could lead to health problems and poor perception of satisfaction and quality of life.
- **Physical activity:** any form of physical exercise, any movement of the body that requires energy expenditure. Physical activity includes exercise and other activities, which involve bodily movement such as walking, running, playing, working, house chores, climbing stairs, etc.

- **Activities of daily living (ADLs):** a series of basic activities performed by individuals on a daily basis for self-care, such as eating, bathing, dressing, doing housework, and leisure, like shopping or meeting with friends/family.

Following several interactions among project partners involved in T7.3, the decision to focus the T7.3 activities primarily on collecting data regarding nutrition, social interactions, physical activity and ADLs has been made. T7.3 will remain open to the possibility of evaluating the collection of any other dataset the technological partners may come up to need, assessing the feasibility of that in terms of time and ethical constraints.

According to the CAPTAIN architecture defined in D2.2 (First version of system specification), two consolidated and reliable technologies (Hololamp and Mentorage®) will be used as platform for start developing respectively the CAPTAIN box and the CAPTAIN satellites. This choice allows the use of several sensors that have already been thoroughly tested by HOL and NIVELY and reduce the needs for acquiring new datasets from sensing technologies. The aim of T7.3 has been therefore revised and the collection of experimental datasets will focus on creating a library of case studies describing older adults' habits across a relatively long period of time (e.g. some months) in order to properly develop and train artificial intelligence algorithms required for the CAPTAIN coaching. Questionnaires and self-reporting tools (e.g. diaries for reporting personal data on nutrition, social interactions, etc.) will be employed in a prospective cohort observational study.

## 7.2 TIMING

The partial redefinition of the objective of T7.3 required a rescheduling of the subtask activities and an extension of the duration of the task, with an expected ending date by end of M19. This is mainly due to the need of carefully defining the items to be introduced in questionnaires and diaries and the need for collecting data above a minimum period of 5 months (including seasonal variations that could influence senior's habits, e.g., winter-spring physical exercise variations according to changes in environmental conditions).

The list of questionnaires and items to be included in the diaries are to be defined in collaboration between technological partners involved in WP4 and WP5 activities and the APSS living lab by the end of M10. The definition of the prospective observational study for the experimental datasets collection will require ethical interrogation and participants' informed consent before subjects' recruitment.

Participants will be recruited among the stakeholders' network of the AUSILIA living labs of APSS in Trento province, Italy. The study approval from the local competent Ethical Committee is expected by the end of M14. Subjects' recruitment should start from M15 and the experimental dataset collection on seniors' habits will cover a 5 months period from M15 to M19.

## 7.3 METHODOLOGY

As indicated in D7.1 (Study plan), the acquisition procedure to be used in T7.3 can consist in both small scale recording sessions and/or self-reporting through diary keeping, interview or structured questionnaires. Relevant subjects to be involved in experimental dataset collection can range from healthy older adults to older adults with minor mental or physical impairments. Personas profile (as defined by AUTH within T2.2 and further elaborated by the consortium using feedback provided by stakeholders participating to LLS) could be also a source of information for identifying participant characteristics and inclusion-exclusion criteria. Possibly, the list of participants will be selected among the list of stakeholders identified in Task 2.1.

According to the aim of the T7.3, data collection through self-reporting tools (diaries) has been identified as the most promising and effective strategy. Interview and/or structured questionnaires could be used as additional tools to profile the participants at enrollment and investigate if major events occurred during the enrollment period.

A list of questionnaires (including validated questionnaires) has been identified as primary source of possible items to be considered for generating a multidimensional tool to assess senior's habits targeted by CAPTAIN coach (Table 4). Questionnaires were retrieved from literature, medical associations, or previous research experiences conducted by CAPTAIN partners.

Table 4 Questionnaires to be considered as source of items for participant's questionnaires and diaries.

<b>(Acronym) NAME OF QUESTIONNAIRE</b>	<b>REFERENCE OR LINK</b>	<b>NOTES</b>
(CGA) Comprehensive Geriatric Assessment	Parker S .G., P. McCue, K. Phelps, A. McCleod, S. Arora, K. Nockels, S. Kennedy, H. Roberts, S. Conroy, Age and Ageing, Vol. 47, Issue 1, 2018, p. 149–155	It is a multidimensional holistic assessment of an older person which considers medical conditions, mental health, functional capacity and social circumstances.
(PAR-Q) Physical Activity Readiness Questionnaire	Chisholm DM, Collis ML, Kulak LL, Davenport W, Gruber N. Physical activity readiness. B C Med J 1975;17:375–378.	It assesses physical activity and the needs to consult a physician before engaging in physical activity
(TFI) Tilburg Frailty Indicator	<a href="https://www.tilburguniversity.edu/upload/ac3c1079-6188-4bea-b4af-8f552c07a1d2_tfieng.pdf">https://www.tilburguniversity.edu/upload/ac3c1079-6188-4bea-b4af-8f552c07a1d2_tfieng.pdf</a>  Gobbens RJJ, van Assen MALM, Luijckx KG, Wijnen-Sponselee MTh, Schols JMGA. The Tilburg Frailty Indicator: psychometric properties. J Am Med Dir Assoc 2010; 11(5):344-355.	It assesses frailty based on determinants and components of frailty Self-completion.
(P7Q) PRISMA 7 Questionnaire	<a href="https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/frailty-prisma7.pdf">https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/frailty-prisma7.pdf</a>	Self-completion
(PASE) Physical Activity Scale for the Elderly	Washburn R.A., McAuley E., Katula J., Mihalko S.L., Boileau R.A. The Physical Activity Scale for the Elderly (PASE): Development and evaluation. J. Clin. Epidemiol. 1993;46:153–162 [PubMed]	It combines information on leisure, household and occupational activity.
(GFI) Groningen Frailty Index	<a href="http://www.bgs.org.uk/pdfs/assessment/gfi.pdf">http://www.bgs.org.uk/pdfs/assessment/gfi.pdf</a>  Steverink N, Slaets JPJ, Schuurmans H, van Lis M. Measuring frailty: Development and testing of the Groningen Frailty Indicator (GFI)	It assesses frailty

	Gerontologist. 2001;41(special issue 1):236–237.	
(CLL) Cantril's Ladder of Life	Cantril, H. (1965). The pattern of human concerns. New Brunswick, NJ: Rutgers University Press. <a href="https://www.oecd-ilibrary.org/docserver/9789264191655-9-en.pdf?expires=1532515012&amp;id=id&amp;accname=guest&amp;checksum=01295EFB7A4AA340110AD4B109B68294">https://www.oecd-ilibrary.org/docserver/9789264191655-9-en.pdf?expires=1532515012&amp;id=id&amp;accname=guest&amp;checksum=01295EFB7A4AA340110AD4B109B68294</a>	It assesses life satisfaction
(IM) INTERMED Interdisciplinary Medicine Instrument	<a href="http://www.intermedconsortium.com/publications/">http://www.intermedconsortium.com/publications/</a>	It assesses complexity, defined as the presence of coexisting conditions (biological, psychological, social, or related to the healthcare system) that interfere with standard care and require a shift from standard care to individualized care.
(IM-E) INTERMED for Elderly	<a href="http://www.intermedconsortium.com/wp-content/uploads/2015/08/IMSA_englishPDF_coloured.pdf">http://www.intermedconsortium.com/wp-content/uploads/2015/08/IMSA_englishPDF_coloured.pdf</a>  Wild B, Lechner S, Herzog W, Maatouk I, Wesche D, Raum E, et al. Reliable integrative assessment of health care needs in elderly persons: the INTERMED for the elderly (IM-E). J Psychosom Res 2011;70:169–78.	It is a reliable integrative assessment of health care needs in elderly persons
(IM-E-SA) INTERMED for Elderly, for Self-Assessment	<a href="http://www.intermedconsortium.com/wp-content/uploads/2015/04/INTERMED-Elderly-Self-Assessment-english-version-1.0.0.pdf">http://www.intermedconsortium.com/wp-content/uploads/2015/04/INTERMED-Elderly-Self-Assessment-english-version-1.0.0.pdf</a>	Self-completion. It assesses the health care needs in elderly persons based on 4 dimensions: biological, psychological, social, health care.
(CARS) Community Assessment Risk Screen	Paul Shelton, EdD; Mark A. Sager, MD; Cheryl Schraeder, PhD, The Community Assessment Risk Screen (CARS): Identifying Elderly Persons at Risk for Hospitalization or Emergency Department Visit, The American Journal of Managed Care,2000	It detects people at risk of hospitalization or having an Emergency Department encounter during the subsequent 12 months.
(TRST) Triage Risk Screening Tool	Meldon SW, Mion LC, Palmer RM, Drew BL, Connor JT, Lewicki LJ, et al. A brief risk-stratification tool to predict repeat emergency department visits and hospitalizations in older patients	It identifies patients at risk for Emergency Department (ED) revisits, hospitalization, or nursing home (NH) placement within 30 and 120 days following ED discharge.

	discharged from the emergency department. Academic emergency medici[PubMed]	
(MNA) Mini Nutritional Assessment	<p><a href="http://www.mna-elderly.com/forms/MNA_english.pdf">http://www.mna-elderly.com/forms/MNA_english.pdf</a></p> <p>Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). <i>J. Geront.</i> 2001; 56A: M366-377</p>	It provides a single, rapid assessment of nutritional status in elderly patients in outpatient clinics, hospitals, and nursing homes.
(LEQ) Lifetime Experiences Questionnaire	<a href="http://rng.org.au/wp-content/uploads/2012/06/LEQ.pdf">http://rng.org.au/wp-content/uploads/2012/06/LEQ.pdf</a> (Australian version)	It determines both the current mental activity level and how active the person has been over his/her lifetime.
(STAI) State-Trait Anxiety Inventory	Spielberger, C.D., with R.L. Gorsuch, R. Lushene, P.R. Vagg, and G.A. Jacobs, State-Trait Anxiety Inventory for Adults. Sampler Set. Manual, Instrument and Scoring Guide, Mind Garden, 1983 (p.73-76)	It can be useful as a baseline and to be used repeatedly to track progress
How healthy is your diet? Questionnaire	<a href="https://www.bhf.org.uk/~media/files/publications/health-at-work/health-at-work-how-healthy-is-your-diet-questionnaire.pdf">https://www.bhf.org.uk/~media/files/publications/health-at-work/health-at-work-how-healthy-is-your-diet-questionnaire.pdf</a>	Questionnaire from the British Heart Foundation. Designed to allow assessing the nutritional value of diet. Some of the questions can be used to identify bad habits and advice on them.
(AEBQ) Adult Eating Behaviour Questionnaire	<p><a href="http://www.ucl.ac.uk/iehc/research/behavioural-science-health/resources/questionnaires/pdf/aebq_vs041017">http://www.ucl.ac.uk/iehc/research/behavioural-science-health/resources/questionnaires/pdf/aebq_vs041017</a></p> <p>Hunot C, Fildes A, Croker H, Llewellyn CH, Wardle J, Beeken RJ. Appetitive traits and relationships with BMI in adults: development of the adult Eating Behaviour Questionnaire. <i>Appetite</i> 105, 2016, 356-363.</p>	AEBQ is a self-report measure of appetitive traits in adults, is a reliable instrument, and provides a comprehensive, convenient, and easy-to-use measure of an adult's appetite.
(EQ-5D) Euro QoL Five Dimensions questionnaire on Health-related Quality of Life	Gusi N., Olivares P.R., Rajendram R. (2010) The EQ-5D Health-Related Quality of Life Questionnaire. In: Preedy V.R., Watson R.R. (eds) <i>Handbook of Disease Burdens and Quality of Life Measures</i> . Springer, New York, NY	Health-related quality of life (HRQOL) is an individual's or a group's perceived physical and mental health over time.

(TUG) Time up and Go test	<a href="https://www.cdc.gov/steady/pdf/TUG_Test-print.pdf">https://www.cdc.gov/steady/pdf/TUG_Test-print.pdf</a>	Fast, widely used measure for testing mobility. Performance in TUG test has been widely related to risk for falls. A video here: <a href="https://www.youtube.com/watch?v=j77QU_MPTnEQ">https://www.youtube.com/watch?v=j77QU_MPTnEQ</a>
(IADL) Lawton's Instrumental Activities of Daily Living scale	Lawton, M.P., & Brody, E.M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. <i>The Gerontologist</i> , 9(3), 179-186.	It is an appropriate instrument to assess independent living skills.
(ECQ) Everyday Competence Questionnaire	Kalisch, T., Richter, J., Lenz, M., Kattenstroth, J.-C., Kolankowska, I., Tegenthoff, M., & Dinse, H. R. (2011). Questionnaire-based evaluation of everyday competence in older adults. <i>Clinical Interventions in Aging</i> , 6, 37–46. <a href="http://doi.org/10.2147/CIA.S15433">http://doi.org/10.2147/CIA.S15433</a>	It is designed to assess healthy older adults' everyday competence. ECQ includes 17 items, covering housekeeping, leisure activities, sports, daily routines, manual skills, subjective well-being, and general linguistic usage.
(MoCA) Montreal Cognitive Assessment.	<a href="https://www.parkinsons.va.gov/resources/MOCA-Test-English.pdf">https://www.parkinsons.va.gov/resources/MOCA-Test-English.pdf</a>	There are versions of the tests in every language required in the consortium. Instructions for the Montreal Cognitive Assessment are available here: <a href="https://www.parkinsons.va.gov/resources/MOCA-Instructions-English.pdf">https://www.parkinsons.va.gov/resources/MOCA-Instructions-English.pdf</a> It can be complemented with: <a href="http://apps.usd.edu/coglab/schieber/psyc423/pdf/IowaTrailMaking.pdf">http://apps.usd.edu/coglab/schieber/psyc423/pdf/IowaTrailMaking.pdf</a>
(MCS) Memory Complaint Scale	<a href="http://www.demneuropsy.com.br/imagBank/pdf/v6n4a04.pdf">http://www.demneuropsy.com.br/imagBank/pdf/v6n4a04.pdf</a>	MCS is an instrument for actively searching for memory complaints and to investigate its utility for discriminating demented from cognitively normal elderly.
(PSQI) Pittsburgh Sleep Quality Index	<a href="http://uacc.arizona.edu/sites/default/files/psqi_sleep_questionnaire_1_pg.pdf">http://uacc.arizona.edu/sites/default/files/psqi_sleep_questionnaire_1_pg.pdf</a>	PSQI is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping

		medications, and daytime dysfunction over the last month
(ICIQ) Urinary Incontinence form	<a href="http://www.iciq.net/ICIQ-UIshortform.html">http://www.iciq.net/ICIQ-UIshortform.html</a> <a href="https://www.baus.org.uk/_userfiles/pages/files/Patients/Leaflets/ICIQ-UI.pdf">https://www.baus.org.uk/_userfiles/pages/files/Patients/Leaflets/ICIQ-UI.pdf</a>	ICIQ form provides a brief and robust measure to assess the impact of symptoms of incontinence on quality of life and outcome of treatment

In addition to the four domains of interest (nutrition, social interactions, physical activity and activities of daily living) a personal health profile of the subjects enrolled in the study should be collected in order to check representativeness of participants with CAPTAIN personas.

The screening and review of the questionnaires reported in Table 4 allowed to identify several subdomains that could be investigated during the T7.3 study. Table 5 indicates the possible questionnaires that can be used as source for items to be included in diaries in order to address specific subdomains.

Table 5 Possible source questionnaires according to domains and subdomains of interest.

DOMAIN	SUBDOMAIN	POSSIBLE SOURCE QUESTIONNAIRES
NUTRITION	food	MNA AEBQ How healthy is your diet?
	weight	CGA, IAIQ
	appetite	CGA
	swallow	CGA
SOCIAL INTERACTION	leisure activities	LEQ
	social engagement	CGA
	care support	CGA, TRST, P7Q, IAIQ
	psychosocial and emotional	GFI, STAI, CGA, TFI, IM, IAIQ, CLL
	social history	IM
	current social state	IM
	restriction in social integration	IM-E-SA
	social dysfunction	IM-E-SA
	residential instability	IM-E-SA
communication	CGA, GFI	
PHYSICAL ACTIVITY	mobility and risk for falls	TUG, TFI, CGA, GFI, P7Q, PAR-Q
	balance	CGA
	access to care	TFI, P7Q, IAIQ,
COGNITIVE	memory	memory complaint scale, Subjective Memory Complaints Questionnaire
	inventory functioning	ADEXI

ADL & IADL	eating and drinking	CGA
	bathing	CGA
	dressing	CGA
	iadl	ECQ, IADL, PASE
PERSONAL HEALTH PROFILE	cognition	MoCA, MCS, CGA, GFI, TRST
	sleep	PSQI
	elimination	CGA
	health-related quality of life	EQ-5D
	physical component	TFI, P7Q, GFI, P7Q, IAIQ
	access to care	TFI, P7Q, GFI, P7Q, IAIQ
	biology	IM, IM-E-SA
	health care treatment experience	IM, CARS, TRST
	medication and comorbidity	TRST, IAIQ, IAIQ
	functional state and independence	IAIQ

The list of the items to be included in the diaries will be defined with the collaboration among AUTH, NIVELY, VICOMTECH, SALUMEDIA (having the role of WP4 and WP5 leader or relevant technical partners) and SIT (WP7 leader), UNITN (Study plan coordinator) and APSS (T7.3 leader and responsible of AUSILIA living lab). The following constrains will be also considered for finalizing the diaries items:

- Maximum daily time spent by the participant for filling the diary should be limited for guaranteeing subject compliance (e.g.: about 10 min/day).
- Collect preferably semi-quantitative or quantitative information (e.g.: no narrative reporting).
- Plain language use (e.g.: limit technical or medical term to the minimum).
- Maximum time span for data collection is six months.
- Clear identification of the frequency required for items re-assessment during the recruiting period (e.g.: once, daily, weekly and monthly).
- Expected number of participants available for recruitment (e.g. about 10 participants).

Self-administered questionnaires, structured interviews and questionnaires administered by a professional caregiver are other possible tools for gathering information about seniors' habits and lifestyle, participant health profile and physical or cognitive impairment. A set of essential questionnaires will be administered at enrollment with the aim of profiling the study participant and his/her affinity to CAPTAIN personas.

The personal health profile will be also assessed by a set of questionnaires (self-administered or administered by a caregiver) at enrollment time. A second set of questionnaires will be administered just before subject discharge, at the end of the study period, in order to register any relevant changes in the health profile during the monitored timeframe. The selection of the specific questionnaires to be used for the subject health profiling will be defined with the collaboration among AUTH, NIVELY, VICOMTECH, SALUMEDIA, DCU, MU, SIT, UNITN and APSS.

Review of the data collection tools (questionnaires and diaries) by the Ethical committee before subject enrollment will guarantee the respect of the ethical principles as stated in the Ethical and safety manual (D1.2).

The use of a smartphone and a mobile application could be considered for data self-reporting. AUTH has identified a list of possible applications that will be assessed for their suitability in self-reporting by participants (Table 6). Usability of the listed applications for an effective collection of the data on nutrition, social interactions, physical activity and activities of daily living for a five months period will be assessed by technological partners that should also provide any required customization to the software to be properly used in the study. APSS will also address feasibility of applying smartphone application for data collection based on the knowledge of average IT literacy of the potential participants. Safety aspects related to data storage and transfer by using mobile apps will be also taken into account. Eventually, compliance of enrolled elderly in using these tools for diary keeping will be considered and diary annotations on paper or interviews could be considered as an alternative.

Table 6 Possible applications for experimental datasets collection by self-reporting.

Name Link	Description	Cost	Platform	Data availability	Language	Comments
<a href="http://www.indeemo.com">www.indeemo.com</a>	provides software capturing and analyzing customer preferences/trend/behaviors/motivations etc. through longitudinal diary studies, customizable by the researchers	n/a	android	offers tools for analysis / researcher dashboard	programmable	-
<a href="http://pielsurvey.org">pielsurvey.org</a>	designed to gather survey data from people in their daily lives, customizable by researchers	Free / not open source	iOS	at the end of the survey a csv file is exported	programmable	do not have daily reports
<a href="http://www.awareframework.com">http://www.awareframework.com</a>	gives access to tools/sensors from mobile phone use, questionnaires designed by researchers	free / open source	android /iOS	available	n/a	researchers can define the questions/actions to be reported
<a href="http://daylio.com">Daylio daylio.com</a> <a href="http://bflow.io">bflow.io</a>	easy to use diary with activities and moods	Free / not open source	android /iOS	only for premium for 3.99 euro	a lot of languages (including italian and english)	activities added without writing
<a href="http://timetune.center">TimeTune timetune.center</a>	time management app, report your everyday activities	Free / not open source	android	exports database , can also be done manually	a lot of languages (including italian and english)	-

Experience Sampler <a href="http://www.experiencesampler.com/index.html">http://www.experiencesampler.com/index.html</a>	designed specifically for experience sampling studies	free / open source	android /iOS	can send data to a server when user is logged in wifi	programmable	fully customizable , is a platform for creating your own study, describes costs only for an iOS Enterprise Developer Membership (\$299 USD/year) and a server to store your data.
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#### 7.4 MONITORING AND COMPLIANCE MEASUREMENTS

Monitoring of the participants compliance in filling diaries will be performed by professional caregivers at APSS. A bi-weekly interaction with the participant (e.g. via phone call, text message, e-mail, e-calendar) will be realized to maintain engagement of the enrolled participants and provide any support they could need in reporting their habits. On a monthly basis, participants will be asked to provide collected data to their reference study contact person (e.g. through an interview).

Gathered data will be checked for consistency and the percentage of missing information will be calculated in order to monitor subject compliance in reporting activities. If the percentage of missing information exceeds 10%, the subject will be promptly re-contacted by the reference person in order to identify strategies for maximizing reporting performance.

In case a relevant number of participants show limited compliance, alternative collection tools will be evaluated and implemented in order to guarantee the quality of the collected data from a sufficient number of participants, based on the partners’ needs.

### 8 ANNEXES

#### 8.1 ANNEX 1 TECHNICAL PARTNERS EVALUATION

Task/Requirement Evaluation tool

Requirement Code	
Sprint	
Date development started	
Date development ended	
Escaped defects	

Planned-to-Done Ratio per Partner per Sprint

PARTNER								
Sprint	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>	8 <sup>th</sup>	..	
Items committed								

Items delivered								
-----------------	--	--	--	--	--	--	--	--

HAPINESS OF THE TEAM

Assign a score from 1-5 in each Sprint:



AUTH								
Sprint	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>				
How do you feel about the amount of work assigned to you in this Sprint?								
How do you feel about the amount of work you did in this Sprint?								
How do you feel about the quality/value of work you did in this Sprint?								

What would you change?

(free text response)

What did you like more?

(free text response)

8.2 ANNEX 2 EVALUATION ISFROM STAKEHOLDER’S COMMUNITY

Sprint: .....

1. How likely is it that you would recommend these meeting to a friend or colleague to attend?

0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

Not at all likely

Extremely likely

2. How do you feel about this session/meeting?

					
<b>RATING SCORE</b>	1	2	3	4	5
<b>USER MOOD</b>	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very Satisfied

3. Were you with us in our previous meeting? YES  NO

4. If YES, in a scale from 0 to 10 how many of the discussed features we have delivered?

0	1	2	3	4	5	6	7	8	9	10
---	---	---	---	---	---	---	---	---	---	----

None Half All

5. Is there anything you want to propose as a possible improvement?

.....

.....

.....

.....

.....

Information from each participant  
(provided by the session facilitator)

Name	
Age	
Sprint	
Coming for first time	
How he/she learn about CAPTAIN	
Has a stakeholder community member invited him/her	
Has he/she invited any stakeholder community member	
Participation score (1-10 scale)	

8.3 OVERALL SATISFACTION OF CAPTAIN CONSORTIUM

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
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I feel encouraged to come up with new and better ways of doing things.					
I have the tools needed to accomplish my tasks					
I have the information needed to accomplish my tasks.					
Regarding the work I have to do during CAPTAIN, I have clearly defined quality goals.					
I was fully aware of the procedure to be followed during the project.					
I feel that the methodology followed during CAPTAIN is innovative.					
I have not been involved in a project following same or similar methodology before.					
How satisfied are you with your involvement in decisions that affect your work/task?					
Considering everything, how satisfied are you with your job during CAPTAIN?					

What suggestions do you have for the improvement of the CAPTAIN SCRUM procedure?

(free text response)

What other issues not included in this survey need to be addressed in the CAPTAIN SCRUM procedure?

(free text response)

#### 8.4 ANNEX 2 INVESTIGATION ON THE RECRUITMENT OF THE CAPTAIN COMMUNITY STAKHOLDER NETWORK

### **Early investigation on the recruitment of the CAPTAIN community stakeholder network**

#### **General**

The purpose of this guide is to explain shortly the methodology and the steps that could be followed towards getting early feedback from stakeholders (CAPTAIN's target group: older adults, family members, caregivers, doctors, researchers, healthcare technology/service providers), concerning their potential participation in the CAPTAIN Stakeholder community (recruitment). The main objective of this process is to get a better insight on their willingness to participate, their initial or major concerns as well as how they envisage their participation in such a community. Such information would allow CAPTAIN to prepare better and more effectively the recruitment procedure as well as the conductance of the pilot sprints during the lifecycle of the project.

### **Context**

It is important to be mentioned here that the elicitation of the required information should be done in the context of an informal and friendly discussion, where stakeholders will feel comfortable to pose any arguments or disagreements, rather than a structured or formal interview. To be more effective, the partner can go through this document a couple of times, and then, during the discussion with the stakeholder he will be able to direct the discussion accordingly, trying to remember the participants responses. After the discussion, the partner keeps notes of the findings and fills in the attached report "Feedback Report".



### **Objectives**

- Willingness to participate in our study (6 sprint pilot trials)
- Incentive for participation
- Benefits of the participation
- Major concerns
- Participation in a group or individually
- How long should a trial last each time.
- Role in the CAPTAIN community stakeholder
- What they would expect from such a project

### **Communicating the project**

CAPTAIN is a project that attempts to design the future smart home for people over 55. By smart-home, it is meant a home that will help people perform their daily activities as well as interact and use new devices and services. But, to do so, we need to design it with you. So many projects, over the last years, have been designed but never used, because the real users, you, were not there. We would like you to help us in designing this by participating in 3 or 4 meetings each year for the next 2-3 years. Every time, you will be presented with new technologies that we have created experimentally, and you will be judging and transforming it, according to your likes and dislikes. In every meeting we will have a discussion, trying to understand what you really need in your daily life.

### **Questions that we could raise during our discussion**

1. Would you be willing to become a member of a group that will have access to prototype technologies developed by university scientists and comment on them?

2. Would you be willing to visit our lab every 2 or 3 months for a period of 2 years, to see what we have designed and let us know what you think?
3. Would you be flexible to participate in morning/afternoon/evening meetings?
4. How long would you expect each of your visits to last?
5. Is there a time of the year that would be difficult for you to participate, or specific months that you are not available?
6. Would you prefer to participate in a group, or alone?
7. If there was a possibility for one of our team members to visit you at your home to show you what we have designed, instead of you coming here, would you prefer that?
8. What would you expect at the end of this? Would you expect benefits in kind?
9. Would you be interested in taking the leading role of a small group (with your friends).
10. Can you think of other people (among your friends and relatives above 55) that would be willing to participate in such a group?
11. What is the biggest barrier to your participation?
12. What did you dislike of what I presented to you?

### **FAQ the stakeholders may have**

1. It will not be convenient for me to visit your place so often

You tell her/him that the meetings will take place every two months, so it will not be a problem.

You tell her/him that the project could cover the taxi cost.

You tell her/him that someone of the partners can serve him.

2. What's in it for me?

S/he will be the designer of the future

S/he will be helping a lot the research that strive to find solution for elderly people

S/he will meet new people and friends

3. What if I cannot participate in a meeting?

The meetings will be scheduled in advance and according to your own preferences

You will have to choose a day within two weeks that you will visit us

No worries if you cannot participate in one of the six meetings.

4. I am not familiar with modern technologies. Do you still consider me suitable for your work?

Yes, of course. Technology literacy is not a prerequisite factor

Most people with your profile are not familiar with modern technologies.

We want to design solutions for people who are not familiar with modern technologies.

5. Can you give me an example of a visit?

In every visit we will have implemented some components that we have discussed in the former meetings. We may show you pictures, videos or the technology itself and discuss about your opinion. We will try every meeting to be entertaining and help you learn something while you help us create the technology you want to use. We will be with you to guide you and support you in every meeting.

6. Will I be able to use the technology after the end of the project?

This is why we need you. To design it in a way that you will be able to use it from now on.

Our intention is to have you as a partner from now on for all the forthcoming projects and ideas that we may or you may have. A community or people, having you as ambassador, will be created, which will be providing solutions for projects, ideas and local community challenges.

### Scenarios of discussion:

**Vicky (CAPTAIN):** Good morning Mr John! How are you?

**John (older adult):** Oh, Good morning! I'm fine, you?

**Vicky:** I'm fine, too. It's 3 months since our last discussion.

**John:** Indeed! What can I do for you this time? Is it about a project again?

**Vicky:** Actually, it is more than that. We want to design the future smart home, and we think that this is not possible, unless you help us. So many projects, over the last years, have been designed but never used, because the real users, you, were not there. We would like you to help us in designing this by participating in 3 or 4 meetings each year for the next 2-3 years.

**John:** Just a moment; do you mean 4 times per year to come to your lab? To do what?

**Vicky:** Every time, you will be presented with what we have done and you will be judging and transforming it, according to your likes and dislikes. Do you remember when you told us that you couldn't see the "Exit" button of the puzzle game?

**John:** Yes, because it had the same color with the background. Have you changed that?

**Vicky:** Exactly. And by the way, the button's color has been changed because of your suggestions. Thank you, a lot, for this.

**John:** And what do you mean by future smart home? Auto curtains, etc.?

**Vicky:** I would ask you the same. What the future smart home is for you? Let's design it together. If you agree on participating, after every visit we will be discussing together, trying to understand if you liked or not what we have designed and how would you like this to be.

**John:** And what if I cannot participate in a meeting? You know that during summer it is difficult for me to stay in Thessaloniki.

**Vicky:** You shouldn't worry about this as the meetings will be scheduled well in advance and based on your availability. Each meeting will last for about 1-2 hours and you will have to choose a date within a 2 weeks period.

**John:** Am I going to get a tablet or something as it was done in the previous project.

**Vicky:** I am afraid not in this study. We will cover your commute for the pilot days and you will have priority to get this system to your home for free, if you like to. You can also invite your friends to come with you, or even better, you can be the leader of your friends group. What do you think?

**John:** What do you mean leader?

**Vicky:** Contacting them and organizing the visits to our lab as well as representing the group in different events that you could participate.

**John:** Sounds interesting. When do you start these meetings? Shall I contact you or you will call me back again?

**Vicky:** I will call you in 3 weeks again. We can also meet any time to give you some more details about this.

**John:** Thank you Vicky. More details would be useful. Do you have a leaflet explaining this?

**Vicky:** Sure! I will bring some to you. Bye!

**John:** Bye

**Feedback Report**

Pilot Partner:

Number of stakeholders: number of elderly persons, number of formal caregiver

Please provide the overall feedback from all the participants (aggregated), highlighting more the common findings.

***Willingness to participate in our study (6 sprint pilot trials)***

***Incentive for participation***

***Benefits of the participation***

***Major concerns***

***Participation in a group or individually***

***How long should a trial last each time.***

***Role in the CAPTAIN community stakeholder***

***What they would expect from such a project***