
Information and Communication Technologies

Collaborative Project



Unobtrusive **S**mart **E**nvironments **F**or **I**ndependent **L**iving

USEFIL

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D8.10 EXPLOITATION ROADMAP AND EXPLOITATION PLAN

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Abstract: This document presents an analysis of the value chain which underlies the USEFIL system, possible services and clients for the USEFIL system and its components. Although there is no parallel service in the market, based on market analyses in D8.9 for the services developed in USEFIL project, we discuss the possible cost saving produced by the adopted solution for hospitalization, home care, social assistance, improved well-being and satisfaction of elderly people having adopted the application as well as the potential economic results for the companies involved in the value chain. This deliverable provides the plan for products development and marketing of the USEFIL system and its components as well as exploitation plan of the knowledge produced during the project. A roadmap to market will be constructed for exploitation by each of the partners and for the consortium as a whole. The activities that were done and/or are in process for exploitation and IPR rules will be presented as well as planned exploitation activities for exploitation.

Keywords: exploitation, roadmap, products, services

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**R – Report, P – Prototype, D – Demonstrator, O – Other.

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1 Introduction

The exploitation plan contains the strategy, the materials, the performed activities, responsibilities and a plan per partner within the exploitation effort of the USEFIL project, and exploitation implementation process that will leverage the collected information to create a realistic strategy to bring the products as a service to the market as well as exploitation plan for academic and end-users purposes.

The exploitation plan includes 3 phases that were developed in parallel to the product development:

1. **Research phase.** The primary goal of the research phase has been to evaluate the USEFIL system opportunities, gaps, paths and barriers to the market entry by assessing the global Healthcare market.

To achieve this goal a set of activities have been executed:

- Analysis of the global eHealthcare market.
- Definition of the preliminary list of project and product exploitation assets.
- Definition of the market oriented/commercial product exploitation assets and exploitation scenarios.
- Formulation of preliminary business models for USEFIL system as a service.

This stage was made in parallel to the design and concept\scenarios development at first stage of the project

The exploitation activities in the Research Phase have involved mainly generating and fostering USEFIL project and product visibility and interest through dissemination across the variety of target sectors, in particular healthcare in certain markets, scientific and research community.

2. **The Strategy Design and Implementation Phase** that aims to design and execute the exploitation strategies to promote the exploitation results (commercial and non-commercial) in certain markets and contexts.

The exploitation strategies and activities in this Phase focused on the execution of the promotion strategies of USEFIL commercial exploitation assets to generate their future adoption opportunities and potential customer base. The strategies for promotion of USEFIL non-commercial results were be also executed to promote USEFIL visibility and promote the knowledge assets adoption in other environments and contexts. The learning and knowledge acquired during the process of promotion in the target markets and contexts including the direct interactions with the target customers were used to enhance the product, business models and the overall exploitation strategy. In this stage, we performed the following activities:

- Definition of the overall exploitation strategies- models and strategies for commercialization as identified in first exploitation plan.
- Definition of the preliminary interest of the partners in the assets IP ownership or co-ownership, exploitation or shared exploitation.
- First contacts with potential clients as identified by the first Market analysis and exploitation plan.

This stage was made in parallel to the development of the USEFIL prototype during the second stage of the project. The exploitation activities in this phase have involved mainly generating USEFIL project and product visibility and interest through dissemination and executing the first steps of

exploitation plan presented at Y2 by contacting first clients proposing the USEFIL products and services.

3. **Final Exploitation Phase** that clearly identifies the ownership of the partners on the various exploitable innovative assets.

The aim is to perform final market analyses, valid at the time of the end of the project and define the exploitation plan and roadmap to market for the post-project phase. In this stage, we performed the following activities:

Definition of ownership of the USEFIL assets between the partners.

- Analyse the interest of the partners to commercialize and exploit USEFIL outcomes individually and in collaboration between partners.
- Define the possible products services that can be commercialized according to market analysis and maturity of the different USEFIL components.
- Definition of the market entry strategy and commercialization plan for market oriented project/commercial assets.
- Define the roadmap to market.

This stage was made in parallel to the implementation phase of the USEFIL prototype during the last stage of the project. The exploitation activities in this phase have involved mainly demonstrating, experiencing, and executing the first steps of exploitation plan presented by contacting first clients target for the USEFIL products and services.

Post Project Phase is also included in the plan to cater for alternative opportunities of project result(s) exploitation that might emerge during the project and/or might require consideration of other measures such as IPR management, partnership, further funding and developments before commercialization can be achieved

The exploitation plan is based on the market analysis of D8.9 and aims to establish a roadmap for implementation of the project results in the market. Detailed exploitation plans will be specified for the project consortium, as a whole, and for each partner individually, depending on its particular interests in the project. The exploitation plan outline the agreement between the partners at the end of the project regarding the way of exploitation, the steps that will be taken by the partners such as establishment of agreements between the partners for commercialization, selected exploitation strategies and an action plan formulated by individual partners. Joint ventures by the partners will set the ground for commercialization of the future product in the market. The exploitation plan evaluate the approach and potential market possibilities and survey the relevant stakeholders and the commercial service offerings that are offered to them, including potential advantages of the USEFIL approach compared to existing products in the market and compared to products in development process in other EU projects. It also reviews the contact with potential client in the markets made and planned. The partners in the consortium will continue to collaborate, performing commercialization activities. Since the USEFIL system combines many types of services that are operated through different sub-component of the system (some more mature than the others), we designed the exploitation plan in a way that enables exploitation in several phases, starting from the most mature components and arriving to the early developed one, that will reach the market at later stage. Further development by the consortium and efforts to raise additional funding for further development of the product. All partners join these efforts. In the next step, each partner will present the exploitation strategy for its country and organisation at an international level and will include individual exploitation strategies from all partners. After product development, the resulting

plan will be integrated with a full product presentation for promotion to Venture Capital networks, for secondary financing after the project ends, or to assess independent market testing.

The exploitation activities were considered from the beginning of the project. It was reflected at the work of requirements collection followed by design and development of the USEDIL product that was directed by user and market needs and followed by the exploitation activities made by the consortium partners along the project.

During the first Year of the project, research was done to identify the needs of the users. The information was derived mainly through observations, directed questionnaires, focus groups with patients and care providers from the 3 pilot countries and interviews. The outputs of these activities were combined to result in a set of scenarios – describing possible end use of the technology in order to assist in daily living – and describe in some detail the required specifications of different aspects of the USEFIL system. The market analysis presented in D8.9 includes the results of identification of needs of the target population of the USEFIL system, and estimation of market size, considering service structure. The market analysis also brings an overview about the volume of activity in this domain by the technological companies and use of services existing in the market today. It also suggests, based on the market analysis, some basic models for USEFIL services and additional services that can be offered in the future. In the exploitation plan we examine the assets of USEFIL projects, the uniqueness of the product compared to other in the market, the IPR of the partners in each asset produced in USEFIL project and we present the exploitation activities done in the last 3 years. We will also suggest a roadmap for future exploitation plan and marketing approach for the USEFIL product in different countries with identification of countries\markets that are more likely to adopt the USEFIL solution at short, medium and long term

2 USEFIL System: Approach Advantages and Uniqueness in the Market

2.1 Expected Users

As result of market analyses interviews and discussions with potential clients during the last year we assume that the target markets of USEFIL system and/or the expected users of the USEFIL system will be the end-users. In addition to the end users there are also potential users that will be interested in the sub-products of the USEFIL system such as data, analytical tools developed by the partners, developers platform and companies that will be interested to add products to the service and become part of the future services. The expected users of the USEFIL system are:

1. *Elderly people* - With age related dependencies elderly people will benefit from extension of independent living, and improve their safety and QoL The advancement of the proposed solution concern its ability to support different categories of elderly people with different needs and health/cognitive problems applying
2. *Non-formal care providers*- The system will increase the communication between end-users and their relatives and carers. For the carers it will help communicate and ensure better care to their elderly relatives therefore a large population of informal carers will be targeted .
3. *Healthcare organizations*- Which will expand their services and can offer more services to a wider community. In addition to the quality of care will be improved by using the USEFIL system. This will help create sustainable health.
4. *Independent doctors*- We expect independent doctors and doctors networks to use the system for monitoring of clinical parameters closely, diagnose of cognitive decline and immediate notification when adverse events happens. This will enable the doctors to provide better care and enlarge the patients' population while using less resource.
5. *Social care organizations*- Which will expand their services and can offer their services to a wider community. In addition the social care will be able to receive updated information regarding the patient's condition and improve management process by generating a prioritization process and intervention methodology. Social care organizations are slowly moving towards smart homes services and become more involved in remote care.
6. *Governments\ municipalities*- the system offer a support that allows people with age-related dependencies to live independently in the home for longer, with or without a caregiver .In some communities there is a community-based services and its aim to allow the elderly to live independently in their own homes for as long as possible, by offering an ADL detection and evaluation services. This will also help integrate services and resources between different stakeholders and improve integrated care, continuity of care and cost saving
7. *Insurance companies* - Which will expand and personalize their services according to the actual needs of their customers. In addition to the satisfaction of the customers the insurance companies will reduce loss of productive forces.
8. *Researchers/scientists* looking for open data – the system will be able to provide the academic society with high quality and quantity anonymised data that will be produced by the sensors from the installation in the house of the elderly users. Furthermore researchers will be able to use the APIs that will be delivered to produce their own apps that can be used for specific studies. For

example researchers could use the APIs and the messaging services to study adherence using the TV sets.

9. *External companies* that wish to easily implement their health care services using the infrastructure and the APIs that the USEFIL platform is providing. This will be done through the developers' platform which will provide to external entities the ability to easily implement their own specialized applications for elderly people. Furthermore, the USEFIL system proposes an integrated service enabling to connect different users and services. Once the service is implemented it will be easier to use the USEFIL platform as a basis for services implementation than offering a fragmented service that addresses one targeted client. Therefore we expect that the USEFIL system will leverage other companies and services and assist market penetration

10. *External private doctors* who wish to monitor their own patients. The USEFIL platform will enable them to easily integrate their own patients in the platform and monitor them through it.

11. *App developers*. Since we target an extensible system. There is potentially also a market for 3rd party app developers that want to offer an app within the USEFIL portal. These can be marketed as paying or freemium add-ons to the system. Of course there will still need to be a default "pack" when buying the basic system.

12. *Sensor device manufacturers*. Leveraging the above, the system could allow sensor device manufacturers to hook into and provide their data to the USEFIL system. These could replace the default sensors that come with USEFIL or extend the functionality. From their end, USEFIL could for example be co-sold with the device as a means to use their devices.

13. *Research organizations and industry* interested in big data and Internet of Things (IoT). The USEFIL service will create a basis for data collection and analyses. Services of big data for research use can be generated based on the service. This will open new line of services related to big data such as privacy, security, anonymisation tools, authentication and aggregation tools as well as storage, preservation, data search tools and analytical tools.

14. *Communication companies* providing services for population and organizations. The service requires communication tools that can be marketed with the services and enable extend the services that communication companies provides today.

2.2 Services that Will be Offered to Users

Based on the market analyses, identification of the possible end-users and the uniqueness of the product in the market we designed the services the USEFIL system will provide:

1. *Social communication* - to support the elderly in maintaining their social activities and increase the level of their social contacts: this service will include: Awareness-enhanced instant messaging service, and Depth-camera based body movement analysis.
2. *Medical service Monitoring of ADL*- A 24/7 Service Centre will offer assistance (both human and technological) in the activities of daily living (ADL), which is designed to compensate for age-related dependencies, including physical and cognitive impairments, eliminating the barriers to aging actively at home
3. *Monitoring of mental and behavioural condition*- Cognitive assessment and monitoring to detect long-term sustained trends in cognitive performance, hoping to provide early detection of cognitive decline.
4. *Monitoring of clinical parameters*- To promote elder adults' health through services and close monitoring when adverse health events.

5. *Fall detection*- Detection and prevention of falls in older people. Once event happened, immediate notification will be given
6. *Decision Support System (DSS)*- The project aims at building an innovative platform gathering various bits of data and provide a decision support tool able to integrate the results of the different sensors.
7. *Data Fusion Tool (DFT)* – Daily events derived from the Sensor Data Fusion are used to compute long-term trends and provide to the medical expert hints about future diagnosis of i.e. geriatric depression. The system accepts as input Low Level Events, by collecting sensor data which depict person’s status and recognizes HLEs of interest. These are subsequently sent to the global DB for use by USEFIL’s Decision Support System (DSS).
8. *Video Analysis*- Processing video streams coming from the video monitoring devices within the home, including “Facial analysis” and “Gait analysis”. Video analysis provides conclusions about detection of elderly, monitoring their movements and physical activities, detecting their ability of walking and dressing up.
9. *Audio Analysis*- In order to indicate the degree of independence in performing Activities of Daily Living (ADL), Audio Analysis Module provides audio cues that are related to bathing, eating and grooming. Inferences are also provided about speech detection related to monologue, speech arousal or speech rate.
10. *Medication ordering* – allows the users to automatically update the prescription of their monthly medicines.
11. *Medication reminder* – this application is informing the users that they have to take their medicines and also keeps them informed regarding all the events that they or their cares think as essential. This service will increase medication adherence.
12. *Consultation / Audio – Video communication* – Using this application the users can socialize with their family and friends in a lively and interactive way. The application can also be used from the health professional staff in order to consultate with their patients and provide them instant services and advices.
13. *Surveys* – This application is used in order to provide the system with information that cannot be approached unconstructively. The doctors can create surveys and prescribe them to their patients or submit them for them.
14. *Emergency* – this application is used by the elderly users to get in contact with their chosen contacts in case of emergency. The emergency application is attempting to access the contacts in any way available at the moment (e.g. email, SMS, chatting, video conference)
15. *Calendar* – this application can be used to keep track of the events that are important about the users. The calendar application is available to the individual users and the doctors and can be used to save appointments, reminders and medication related events in the calendar and accordingly be reminded about them.
16. *User data access* - the user data access application is used when the individual users want to have access to the data that are collected for them through the sensors and stored in the GlobalDB.
17. *Doctor data access* – the doctor data access application is the service used by the doctor to see the measurements and the HLE that are connected to his patients. Through this application the doctor can also add new treatments and diseases for his patients.
18. *Registration* - New users can be registered into USEFIL using this application. The registration procedure is conducted either by an administrator or by the user himself.

19. *Developers* – The developers’ community can contribute to the applications that are hosted within the USEFIL project. There is a site that provides them with all the needed information and allows them to upload the new external applications that they created.
20. *Global database service* - USEFIL Global DB is an off-house database server storing data on a number of elderly users. It is ‘global’ in the sense of being the single one for the whole USEFIL system deployment.
21. *Video Conference service* - This service is intended to be a reusable bi-directional communication channel, intended mostly for communication between an elderly user and his/her carer.
22. *Calendar service* - The USEFIL Calendar Service is a calendar management and scheduling system. It allows recording and managing timed events and tasks and it supports multiple users. The Calendar service is intended, first of all, for recording and reminding of treatments, such as medications and exercises, but can also be used for other, e.g. social, purposes.
23. *Server Web API* - provides a single controlled access point to the global database, which is made not accessible directly. Using the Server Web API the user can have access according to his access rights to all the data stored in the GlobalDB. The communication is encrypted (using HTTPS protocol) and username/password based authentication scheme is used.
24. *User authentication service* - A user needs to be registered to log into the USEFIL system. A single user registration procedure creates user accounts for all related servers (GlobalDB server, Calendar server, and XMPP server).
25. *InstantSurvey* as a stand-alone system. In addition to health applications, other domains are considered such as feedback collection, opinion polling, “citizen sensing”, smart home interaction, and other. This does not mean commercialization as a product, but exploitation in customer contract projects where a customer may be interested in adding this functionality into own systems
26. *WWU and associated services*. Device worn-state detection, heart-rate estimation, activity level detection, step count estimation and energy usage estimation. These services will complement the monitoring at home and behavioural pattern analyses services and will enable outdoor services, wearable and alerting tools.
27. *Integrated care platform* that enables connecting different stakeholders, organizational tools and workflows for better coordination of care and resources management. This platform can combine information and knowledge from different disciplines and provide tools for better care and cost saving.
28. *Applications and tools for service delivery using smart TV:*
 - a. Smart TV application User Interface (concept, architecture, design, initial implementation).
 - b. Development of necessary Smart TV firmware to facilitate operation in the USEFIL system.

The above services although developed in USEFIL project with specific devices can be used using variety of tools exists in the market. The approach of USEFIL enables flexibility in using the outcomes:

Tablet and smart watch application

Medical Devices Measurements – This application allows the users to take measurements using some medical devices (weight scale, blood pressure meter, glucometer etc.) and send the data to the

Local Database. The only thing the user has to do is to take the measurement using the medical device, and the data are instantly transferred to the Local DB via the tablet.

Services for external developers/companies/researchers/scientists

A developers' platform will be developed which after a successful registration an external entity gains access to information and developer tools for implementing and register his own application to the USEFIL portal. Examples, source code, API documentations, forum and support from USEFIL's developers allow a third party developer to create applications for their own needs. They can upload their applications to the developer's site and after a successful audit from platform's administrators the application is available through the platform's store.

May be

A "may be" stands for the lack of more precise information - does a device have such a sensor? Is the sensor accessible?

Offering communications capabilities of some kind:

Sony Smartwatch, Qualcomm Toq, Pebble Watch, WIMM One, MetaWatch Strata, Agent Smartwatch, Samsung Galaxy Gear, Kreyos Meteor, GEAK Watch, I'm Watch, HOT Watch, Z1, Fashion S9110, Generic Chinese wrist phone, Hands-Free-Bracelets, Pearl Android Smartwatch.

1. Meaningful assistance from a Service Center as well as monitoring of daily activities

This implies a video / audio channel in both directions:

Samsung Galaxy Gear, Z1, Pearl Android Smartwatch, maybe GEAK Watch, may be HOT Watch, maybe Kreyos Meteor.

2. Monitoring of mental and behavioural condition

Depends on the methods of detection. Assuming gesture recognition, the list looks as follows:

May be Sony Smartwatch, maybe Qualcomm Toq, Pebble Watch, WEDA, may be Martian Passport, maybe Sonostar, WIMM One, MetaWatch Strata, Agent Smartwatch, Samsung Galaxy Gear, Kreyos Meteor, GEAK Watch, maybe I'm Watch, maybe HOT Watch, Z1, Pearl Android Smartwatch.

3. Monitoring of clinical parameters.

Either the Smartwatch has an interface to connect to clinical sensors, or it offers Camera and similar sensors which we can use. Assuming this, the list looks as follows:

Samsung Galaxy Gear, Z1, Pearl Android Smartwatch, may be GEAK Watch, maybe HOT Watch, Kreyos Meteor Where the Kreyos is the only Smartwatch with an interface to connect to specialized sensors (ANT+).

4. Fall detection

Requires accelerometer and programmability:

May be Sony Smartwatch, maybe Qualcomm Toq, Pebble Watch, maybe WEDA, may be Martian Passport, maybe Sonostar, WIMM One, MetaWatch Strata, Agent Smartwatch, Samsung Galaxy Gear, Kreyos Meteor, GEAK Watch, maybe I'm Watch, maybe HOT Watch, Z1, Pearl Android Smartwatch.

5. DSS - requires programmability and at least some sensors.

May be Sony Smartwatch, maybe Qualcomm Toq, Pebble Watch, WEDA, may be Martian

Passport, WIMM One, MetaWatch Strata, Agent Smartwatch, Samsung Galaxy Gear, Kreyos Meteor, GEAK Watch, I'm Watch, HOT Watch, Z1, Pearl Android Smartwatch.

6. Alerting

As more complicated, alerting an external service is assumed, and the presence of a smartphone (which could run its own fall detection, for example) is not assumed:

Z1, Pearl Android Smartwatch. Assuming the presence of a smartphone to do the actual alerting of an external service, the list looks identical to 5. :

May be Sony Smartwatch, maybe Qualcomm Toq, Pebble Watch, maybe WEDA, maybe Martian Passport, may be Sonostar, WIMM One, MetaWatch Strata, Agent Smartwatch, Samsung Galaxy Gear, Kreyos Meteor, GEAK Watch, maybe I'm Watch, May be HOT Watch, Z1, Pearl Android Smartwatch. Assuming it's about alerting the wearer, every smartwatch has some way to make itself noted, like a buzzer or vibration. Even, or in particular, the Chinese hands-free-bracelets are capable to do exactly that.

2.3 USEFIL Compared to Other Projects

USEFIL project intends to cope with advanced but affordable in-home unobtrusive monitoring and web communication solutions by implementing a complete ICT platform to assist elderly people with their daily routine. The USEFIL project developing a reliable open platform able to provide different services to different groups of elderly with different health problems due to age within different geographical areas. The USEFIL objective is to go beyond the limited functionalities of the monitoring devices and to provide a more generic solution in terms of monitoring and combining several parameters. The project adopts a holistic approach in order to offer a solution addressing the majority of the core issues of people with ageing problems and living in their home environment. In order to evaluate the USEFIL system and service uniqueness in the market we compared the major characteristics of the system and main services that USEFIL will provide to other products under development in the EU projects:

Chronious

<http://www.chronious.eu/>

CHRONIOUS addresses a smart wearable platform, based on multi-parametric sensor data processing, for monitoring people suffering from chronic diseases in long-stay setting. It is constantly monitoring their activity using audio observation methods and activity sensors while at the same time tracking their medical condition via vital signs sensors. Any trait of abnormal health status and possible alerting incidents are detected by CHRONIOUS Intelligence. The system generates alerts in case of invalid medical data or if current activity and behaviour lay outside the well established activity patterns and locomotion behaviour.

Rempark

<http://www.rempark.eu/>

The specific and ultimate goal of the REMPARK project is to develop a Personal Health System (PHS) with closed loop detection, response and treatment capabilities for management of Parkinson's Disease (PD) patients at two levels:

- At the first level, the project will develop a wearable monitoring system able to identify in real time the motor status of the PD patients, and evaluating ON/OFF/Dyskinesia status in operation during ambulatory conditions and will also develop a gait guidance system able to help the patient in real time during their daily activities.
- At a second level, the intelligent analysis of data provided by the first level, supported with a disease management system will allow the neurologist in charge to access accurate and reliable information to decide about the treatment that best suits the patient, improving the management of their disease, in particular to adjust so called therapeutic window.

HELP-AAL

<http://www.aal-europe.eu/projects/help/>

The HELP Project consortium is designing a Health Monitoring System specifically targeted for the needs of Parkinson Disease (PD) patients. Without treatment, PD progresses over 5–10 years to a rigid, a kinetic state in which patients are incapable of caring for themselves. Death frequently results from complications of immobility, including aspiration pneumonia or pulmonary embolism. The availability of effective pharmacological treatment has altered radically the prognosis of PD; in most cases, good functional mobility can be maintained for many years, and the life expectancy increased substantially. Primarily, therapies are aimed at minimizing symptoms and maximizing function and quality of life.

ASSAM

<http://www.aal-europe.eu/projects/assam/>

The ASSAM project aims to compensate for declining physical and cognitive capabilities of elderly persons by user-centred development of modular navigation assistants for various mobility platforms, such as walker, wheelchair, and tricycle, enabling sustained everyday mobility and autonomy with seamless transition from indoors to outdoors in environments such as residential complexes, the neighbourhood quarter, or touristic areas. Modular assistance systems provide obstacle avoidance, navigational aid, cognitive assistance for visual impairment, and security by connection to a care centre in emergency situations.

SafeMove

<http://www.safemove-project.eu/project/objectives/#.VPRhDC5ZjOw>

The project aims to increase the mobility of the elderly, both in the vicinity of his home and on journeys. Currently elderly people often avoid leaving their home because they feel insecure outdoor. But the lack of motion results in health problems like arthrosis, osteoporosis, amyotrophia and cardiovascular diseases, additionally to depression and possible cognitive disorders. In consequence their reduced presence in normal daily life results in social isolation.

HealthWear@ALL

To cope with the demographic change both in Germany and in China, the Sino-German cooperation project HealthWear@AAL aims to build up the research foundations for supporting elderly people suffering from chronic diseases (in particular the Chronic Obstructive Pulmonary Disease COPD) in leading an independent life with more mobility, flexibility, and safety, by means of a distributed wearable computing system combined with an Adaptive Decision Support System for Individual Persons (ADSIP) for reliable home and outdoor health monitoring. The wearable computing system

will consist of novel unobtrusive Biomedical Clothing that integrates low-cost and energy efficient sensor strips for vital signs, movements, and physical activities monitoring, and a Control-and-Computing Unit (CCU) for sensor management, signal processing, temporary data storage, and data transmission. The decision support system ADSIP will have a distributed architecture to reduce the energy consumption and the consumption of computing and storage resources of the CCU.

The table below presents the main characteristics of the USEFIL system compared to other systems:

	USEFIL	Chronious	Rempark	HELP	ASSAM	SafeMove	HealthWear@ALL	DALIA	FallRisk	Cloud4All
<i>Holistic approach</i>	✓	✓	✓	✓	✓	✓		✓		✓
<i>Low Cost "off-the-shelf" technology developed</i>	✓		✓		✓	✓			✓	✓
<i>Social Connection to family friend, entertainment</i>	✓				✓	✓		✓	✓	
<i>Addressing Medical needs of elderly: prevent the consequences of adverse health events</i>	✓	✓	✓	✓				✓	✓	
<i>Analyses of behavioural patterns like depression, Improve users cognitive performance</i>	✓						✓		✓	
<i>Addressing Social care needs ADL evaluation</i>	✓				✓	✓		✓	✓	✓
<i>Family involvement- 1.tight link with family members2.Im mediate notification in abnormal situations</i>	✓	✓			✓	✓		✓	✓	
<i>Technology innovative sensors: for ADL detection evaluation</i>	✓				✓	✓			✓	
<i>Unobtrusive</i>	✓	✓			✓	✓	✓	✓	✓	✓
<i>Easy to use and user-</i>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

friendly										
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Table 1: USEFIL’s main characteristics and services in contrast with other products

As can be seen from the table the USEFIL system offers uniqueness and advantages in the market at several levels:

Holistic approach that combines the social and medical services connecting and providing services to formal and informal care providers.

Low cost service that enables organizations as well as large populations to connect the services.

Integrated care using different tools that addresses the behavioural as well as medical and social needs

Combining the above information with the information from market analyses detailing the existing services it is evident that the main uniqueness of the USEFIL system and service relies in the unique tools developed in the project to address the medical and social care needs as well as the combination of these services with sophisticated analytical tools for behavioural and clinical conditions. The USEFIL system enables monitoring, analysing, alerting to the relevant responder and still remain a system that offers the user easy to use, low cost entertainment system

The uniqueness of the system and proposed services in addition to the exploitable assets detailed above we examined the value chain of USEFIL system.

3 Basic Assumptions of the Exploitation Plan

There are some sectors that will benefit from the USEFIL project: elderly with age related diseases, carers; formal and non-formal, medical stuff, and indirect target groups such as Pharmaceuticals, Media Industry, ICT experts, public decision-makers, healthcare organizations and municipalities. The consortium partners have different markets in which they can exploit their benefits from the project and leverage the outcomes of the USEFIL project.

3.1 Consortium Partners

Each partner individually, depending on its particular interests in the project and the work they did in the project has an exploitation plan. In addition, the partners have interest to further advance the project results as a whole. We analyzed the benefits of each partners from the USEFIL project that will be exploit by them after the end of the project .

For the partners USEFIL will help participants to improve their position in a very competitive market, enhance their product portfolio with new features and expand the already recognized expertise in this area. Each partner is extremely interested in the exploitation of the results. In particular, the partners of the consortium are willing to commit to collaborate after the end of this project. The USEFIL project increased the member expertise and publicity as it will allow the development of new methodologies at European level. This project brought together a multidisciplinary consortium utilising expertise in: medicine, intelligent adaptive software for data modelling, mining and visualisation, state of the art communication hardware technology engineering , biomedical engineering for information extraction from physiological and behavioural recordings, etc., the collaboration enable all partners to bring their expertise and learn from other domains for the benefit of their own advantage

The specific benefits of the partners from the USEFIL project are mainly the know-how and the better understanding of the healthcare and its potential for each in their specific domain as follows:

Fraunhofer - the main benefits from the USEFIL project are Know-How and the development of software and algorithms for licensing

TP-Vision benefits are:

- a. Early input on the requirements of this type of ecosystem and expectations of other involved parties. Experience and knowledge acquisition in Smart Home and Home Healthcare alike environment. From this, we are able to improve our own product offering and services.
- b. Networking and exploration of business opportunities.

VTT gained better understanding of the healthcare domain and of the potential of 'Internet of Things' technologies in it.

Warwick- Development of the WWU which can be used in other projects. Knowledge and best practice around wearable device development and algorithm design for wearable activity sensing from single device setups

NCSR: Acquired new known-how through USEFIL multidisciplinary collaboration and knowledge that will enable them to provide consultancy services to public bodies and private companies. At the business level NCSR acquired the know how and IPRs that will be acquired through the established Spin Off company Syndesis as referred to the Consortium Agreement.

AUTH: AUTH as development partner, integration leader and clinical trials' partner received benefits to its know-how and development base in the following areas:

- *AI and Machine Learning* for deriving meaningful interventions in the life of an elderly as this is described from the sensor based input. This was the main research effort that led to the development of USEFIL's Decision Support System (DSS)
- *Semantic Sensor Network Technologies* for translating raw sensor input into machine inferable user input. This was a research effort for creating a semantic infrastructure for the integrated wellness and cognitive preservation platform of FitForAll.
- *Core ICT* for integrating sensors input into a highly modular environment and for integrating highly modular ICT ecosystems in coherent systems. This was the effort for producing the Kinect Sharing CAC framework as well as the USEFIL global installer for deploying the integrated USEFIL software home end.
- *Ambient Assisted Living ecological validity and technology obtrusiveness*. This led to the conception and deployment of the Living Labs AAL testing environment in AUTH's premises.
- *Optimal delivery and assessment methods* for effective and efficient trials of AAL systems on elderly user cohorts.

Maccabi Healthcare services benefits are in:

- a. service development for its members. We added the ADL detection to our system for integrated care and when validated and ready to market we can implement it.
- b. know how – the potential of the developed technologies such as social service and smart TV service for healthcare
- c. tools for care provider for better understanding and management of large scale elderly population

3.2 Who will Benefit from USEFIL

3.2.1 Industry, Academy

The above benefits are expressed in the individual exploitation plans of the partners and USEFIL consortium exploitation plan.

As described in the market analyses the industrial and academic partners can benefit from the global trends and developments in AAL, sensors, services IoT, smart home, gaming, communication as well as from research and education domain that becomes very active and will continue to grow in different directions such as education tools for the end users, research that advance the global trends and multidisciplinary research and developments that will advance products and implementation of systems such as the USEFIL system.

UoB: The artificial intelligence research group of UoB with about forty research scientists does among others research in the wearable intelligence with lectures on undergraduate and graduate level. Also PhD theses have related topics of machine learning and wearable computing and it is expected that beside at least three graduation theses also one PhD thesis will profit of the research performed in the USEFIL context. This will influence the courses given and the students will profit of the findings. Due to the close international cooperation with companies and Universities a part of UoB' exploitation strategy is also the exchange of PhD students with those partners in research and industry. We expect a remarkable impact from USEFIL.

Furthermore the involved research group of UoB runs a demonstration centre with annually approximately about 500 visitors from industry, research, politics and education. This demonstration centre is a part of UoB's technology transfer strategy driven by TZI (Centre of Computing and Communication Technologies) that enables in average each year one spin-off

company based on successful research projects. UoB has in the domain with the neusta mobile solutions GmbH a joint venture with a large software company (team neusta GmbH) for the direct commercialisation of research results.

Fraunhofer: Our general approach to exploitation is that we – as a not for profit organization – can offer after the project's end only licenses and further R&D services.

What we want to make available that way is

- A messaging and awareness system consisting of

- the tablet app,
- sensor data analyzer software for PCs and
- our self-developed XMPP HubService,

The messaging system can be used as stand-alone system, but it cannot be commercialized by Fraunhofer itself, only licensed.

- Bundled with open source server software for messaging, calendar and database management.

- Software and algorithms for licensing this whole bundle can be used in assisted living and healthcare scenarios as in USEFIL, but also by any group of people in business or private life maintaining or requiring some amount of informal communication, e.g. neighbourhood organizations, clubs, charities and so on.

TPVision: We are focused on bringing a SmartTV platform to the market that offers the capabilities that will enable useful and innovative applications to be developed on top of it. The Smart Home ecosystem is evolving and quickly growing in importance. USEFIL provides valuable input towards requirements of future platforms and an initial application for deployment. The USEFIL project provided opportunities for early input on the requirements of this type of ecosystem and expectations of other involved parties. As well as networking and exploration of business opportunities.

TP-Vision's product is the Smart TV platform. This can be sold as a stand-alone product, but the value is determined also by available applications.

TPVision will be able to offer TV and Smart TV infrastructure (including server side infrastructure), which can enable pre-loading of USEFIL applications, bundled sales with other parts of the system, or B2B sales to a company that offers the USEFIL platform as a whole to care organizations and/or end consumers.

NCSR: as a not for profit organization will promote

multidisciplinary collaboration, Provide consultancy services to public bodies and private companies and can use the know-how and IPRs that will be acquired through the established Spin Off company Syndesis as referred to the Consortium Agreement.

NCSR and its Spin Off company intends to actively lead the commercialisation of the developed USEFIL services and apps. So NCSR intends not only to exploit its own developments and IPRs. There are modules that can be exploit as a stand-alone products by nature such as *Social communication, Monitoring of clinical parameters, Data Fusion Tool (DFT) and Video Analysis*. All the other modules listed below, although they are part of the whole USEFIL platform they have adopted a modular architecture design approach and thus can be sold as "stand alone products" if necessary. The list of modules:

Audio Analysis Medication ordering, Medication reminder, Surveys ,Emergency, User data access, Doctor data access ,Registration, Developers, Global database service, Video Conference service, Calendar service, Server Web API, User authentication service

Additional option is to licence IPRs from the other partners and thus form a complete platform that will target all the identified target groups in D8.9. Have to be mentioned that NCSR is committed to actively promote the developed services and thus intends to further expand the USEFIL applications by hosting external developers and services.

VTT: VTT has developed for USEFIL components responsible for in-house data management, communication, and security. *InstantSurvey* system for performing short user surveys over instant messaging (includes the backend and the Android app) is another development that can be exploited as a stand-alone system in other domains.

Warwick: Development of the WWU which can be used in other projects. Knowledge and best practice around wearable device development and algorithm design for wearable activity sensing from single device setups.

AUTH: Development and specific exploits include:

- *Hybrid Clinical Decision support system* utilizing advances in knowledge-based formalisms such as Fuzzy Cognitive Maps, trend analysis, time-series forecasting tools.
- *Semantically enriched* version of the wellness and mental preservation platform FitForAll.
- *Platform independent, web based solutions* of the previously existing wellness and mental preservation platform FitForAll.
- *CAC Service* for sharing contemporary controller data across several requesting modules.
- *USEFIL Global installer* with relevant know-how of how to manipulate shared sensors software and integrating modular software in a coherent whole.
- *LivingLabs*, an Active & Healthy Aging Lab created with sound ecological validity and sensor obtrusiveness considerations to be used as a AAL prototype and testing environment. Created during the pre-pilots of the project, it received a non-trivial number of elderly who became the first ambassadors of the AAL approach in Thessaloniki. Through their participation and their involvement as “external testers” of the platform they considered themselves as part of this technological innovation and became advocates of this approach to elderly care. Additionally through this elderly involvement the LivingLabs environment became an awareness hub for increasing visibility for the USEFIL in a wide part of society.
- *Human Interactions Video Enriched Archive*. A large video and skeleton archive (>1TB), >125 hours of 3 axis time stamped acceleration recordings, 30 hours of game recordings. Video annotated with human interactions (an, at the moment ad-hoc, but generalized and more abstract superset of ADLs). These are data that were gathered during the USEFIL LivingLabs pre-trials and were enriched for discoverability and query for eventual on-demand streaming to interested AAL research and development parties.

Maccabi healthcare services: Can use the USEFIL project outcome in various ways, industrial, research and as end user (see below section 4.2.2) . The unique opportunity USEFIL brought to combine behavioural, social and clinical data and implement it in healthcare environment suggests new opportunities for healthcare. At the research level Maccabi research institute can advance the research about the potential use of this data, big data research (which is already part of Maccabi's activities) and research of service models that can be implemented in healthcare for sustainable health considering regulatory and ethical constrains. At the industrial domain, development of

analytical tools for healthcare using heterogeneous data, further develop Maccabi's tools for care provider (integrated care platform) and commercialize the products through its R&D company Nevet Ltd.

3.2.2 End Users: Healthcare organizations, Governments and Municipalities

Different end users will benefit from the USEFIL system. Analysing the various players and the USEFIL project assets and outcomes we identified the added value for each of the identified end user.

Healthcare organizations: In recent years, healthcare organizations adopted various technological solutions for monitoring and remotely treating patients. However the information and treatment approach is focused on disease and provide only disease specific information. Maccabi Healthcare Services has implemented a telemedicine service and developed a proactive approach for comprehensive multidisciplinary integrated care. still the treatment relies on healthcare professional-patient channel of communication. The advantage of the USEFIL system is the ease of technology use for elderly users, and the ability of the user, caregivers/family, and care providers to be connected in such a way as to maximize the impact of the system and empower the patients and families that will become members of the caring team. The usefil system enables to enlarge the scope and integrate care with the non-formal care provider and with social care organization by using the ADL assessment tool. This opens new opportunities for integrated care, continuity of care and new management approach that will improve care and will be cost saving. For example, the ADL assessment tool provides ongoing monitoring and alerting system that not only enables to obtain the total Barthel score but also the assessment of each of the assessed questions. This provide the source of problem such as if the person has a problem in bathing, eating or incontinence. The information can be channeled to the healthcare in cases of clinical problem such as incontinence and to other organizations in other cases such as family member. This will make the system more efficient and help reduce cost.

Furthermore USEFIL system brings additional sensors that do not exist in the market and will improve the ability of the organization to detect evaluate and intervene on time before patient deterioration while extending services to wider communities

Social care organizations: today social care services relies on home care that is provided according to functional evaluation of the patient made usually once. There is no follow up and the process of adapting the care according to changing needs is slow and not efficient. Also there is a redundancy in care with healthcare and the quality of care suffers from shortage in care professionals. The USEFIL system will enable the social services to improve care, make priorities in care according to patient's condition and use their resources more efficiently- improve care and reduce cost

Governments and municipalities: for governments and municipalities the system provided a tool for implementation of new models of care that will enable more interactive, integrated and effective care in lower cost. Healthy active ageing is the focus of all governments today seeking for solutions for better care in the growing elderly populations with higher quality of life. Advancing solutions such as USEFIL system and help scaling up these types of solutions will help managing the services for large ageing populations.

Service providers companies: the USEFIL system opens many opportunities for service providers since it provides a platform for different services. The services that can be provided via the USEFIL system can be for communication, safety, emergency, smart home services as well as entertainment and education.

At the infrastructure level communication, smart TV, gaming and big data service can be provided. More detailed information in D8.9

3.2.3 End Users: Elderly citizens, Families, Society

USEFIL technology will be able to provide de-humanisation of care and equality of access to good quality services for the majority of elderly people since it will be based in common devices. The use of web technologies will provide information sharing and social services as well. For the families it will allow link with family members and immediate notification in abnormal situations- therefore increase elderly safety and family Sense of security and peace.

The USEFIL technology will provide the elderly population a holistic solution. Today there are many services that can be purchased but they are fragmented, each developed on different systems, and required installation and maintenance separately. It required subscription to many companies and as a result the quality of services and cost are very high. By providing a platform that is built in a modular way and that can bring different services as needed including add services that will emerge the client will be able to have "one stop shop" for all services and receive a comprehensive solution in lower cost.

We expect the USEFIL system to bring added value to these population that will make the a possible clients in addition to governmental and health entities

3.3 Business Considerations in the Implementation of USEFIL

The business considerations of the implementation of the USEFIL system will be based on the following decisions: what will be the first services to be provided and who will be the first customers. Based on these assumptions the team will create the implementation process and roadmap.

The USEFIL Vision is: to provide low-cost ICT solutions for monitoring physical health, cognitive health, and emotional status of elderly (65+ years old) with age related disabilities at their homes – to assess their ability of independent living and to detect deteriorations when they occur.

Moreover, USEFIL deployment will:

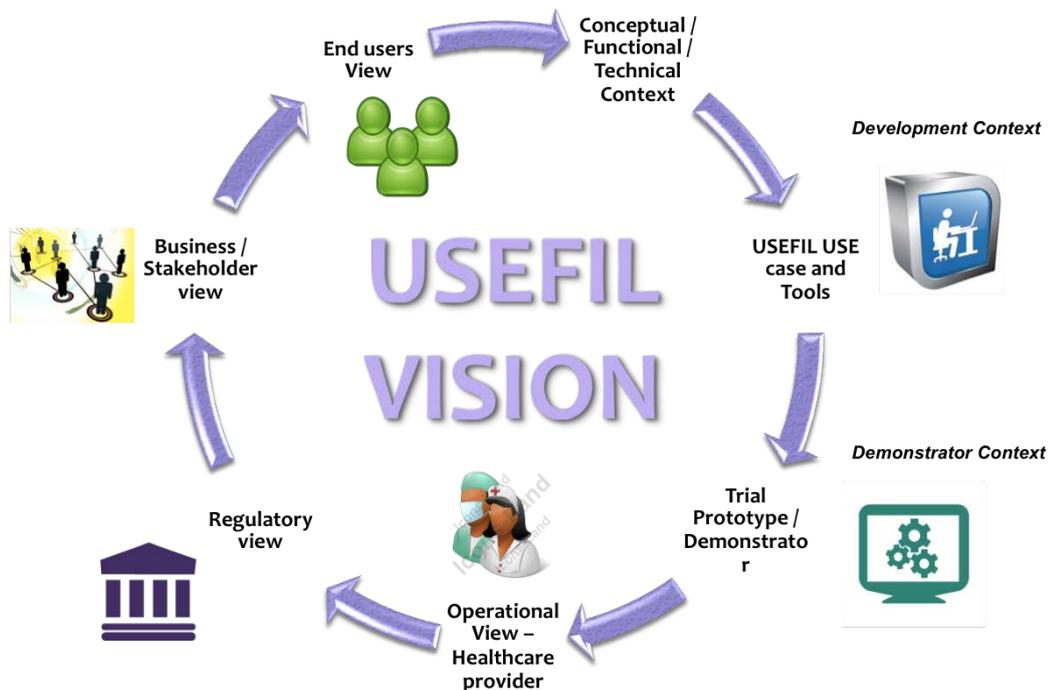
- Give elderly / healthcare professionals a diverse range of low cost healthcare personalized services – seamlessly supported by the underlying technology via a robust user friendly interface
- Empower stakeholders to develop new business activities and provide profitable services in an integrated environment
- To support first responders, carers, family, and healthcare service providers in assessing the health status of an elderly person and providing the appropriate level of care.
- To promote “ageing well” and prevention concepts and to reduce both costs and time for carers by introducing automated decision-support (health assessment and prediction) services.

Based on the above, and the maturity of the various exploitable elements at this stage, the end of the USEFIL project, there are two ways to approach the market

1. **First adopters will be the healthcare organizations** providing healthcare services to their patient and enabling additional tools for monitoring, alerting and preservation of the person condition using the system (such as cognitive games).
In this case the first users will be patients. The second users will be health ageing people and the third target population will be young users that will connect the service for follow up and treatment. The third group of users can also come from using the system connecting their parents or elderly relatives that wants to have additional services for themselves. This model will require adoption by healthcare organizations and overcoming regulatory constrains of using heterogeneous data for DSS, liability and permission to market and commercialize entertainment and services in addition to health services however if successful it will ensure large scale deployment and advance towards sustainable health.
2. **First adopters will be the private client** using entertainment tools via the smart TV and awareness system (tablet) connecting their families and at second stage their doctors and health services. This model will enable revenues at earlier stages however the implementation of the system in healthcare will be slower.

3.4 Value Chain Underlying the USEFIL System

As described in the market analysis, the following picture depicts the USEFIL Ecosystem



Although there is no parallel service in the market, It is evident that there is a possible cost saving produced by the adopted solution for hospitalization, home care, social assistance, improved well-being and satisfaction of elderly people having adopted the application as well as the economic results for the companies involved in the value chain.

The USEFIL system proposes the various players in the ecosystem opportunity for cost saving, increase in income, efficiency in management and better use of resources and tools for better treatment.

For the end user it offers better service, higher QoL, holistic solution with one stop shop

The USEFIL system will enhance the market in the following domains:

- Communication companies- internet, tablets, mobile phones, smart TV. The services are based on communication. This will assist opening the market to implementation of services to large communities that are not prone to use these services today such as low income and aged populations
- Healthcare- health consumers will be connected to the healthcare provider and this will bring an opportunity for health promotion services. Also when connected and providing more services it will bring healthcare to provide additional services and increase income. Using remote systems will help priorities the cases for treatment and will prevent deterioration and hospitalizations
- Social care can provide better care and reduce cost by better use of resources. By using the same system used by the healthcare a redundancy in services and care providers can be achieved
- Manufacturers of hardware, software and sensors
- Application developers
- Analytics
- Big data
- Education
- Gaming
- Smart home
- Security services
- Data security
- Research
- Economic models- new economic models will be generated for combining the multidisciplinary services and enable sustainable health

Cost saving can be achieved by integrating and coordinating care:

Healthcare can achieve better outcomes with cost saving by increasing the care in the community, keeping people in their home will promote health and will reduce hospitalization. For example, in Maccabi a multidisciplinary centre for chronic patients was established and the results after 2 years of operations show that there is a remarkable improvement in clinical outcomes, healthy behaviour and slow trend towards reduction in hospitalization and life prolongation. The level of saving and improvement depends on the treated population. For the diabetic patients that are unbalanced the improvement is evident within 3-6 month while for the most CHF and COPD patient it is slower but evident. In all patients there is an increase in visits to GP as well as compliance and adherence to treatment. USEFIL system offers service to wide range of populations from healthy to very ill therefore it is expected to have an overall economic impact in the medium-long range

Society- government-management as well as social care will reduce cost and increase quality of care by using coordinated care between social care and healthcare- there is no working service that can demonstrate it but there is a willingness of all parties to establish integrated care and it became one of the leading goals in developing services in the EU and worldwide.

Cost saving in health and social care are achieved only in the long term and there are no services in the world at this point that can show long term operation. The only service operating more than 2 years as a large scale service for 10,000 patients is in Maccabi healthcare services. The cost saving is

a long term outcome. At this moment we achieve clinical outcomes that are known to result in economic outcomes in the long range.

Furthermore, the growing problem in treating the large population of ageing people and the complexity of care, as well as growing cost, shortage in healthcare professional and care providers requires an innovative approach and development of solutions that can be easily implemented in the existing workflows and will enable to provide and receive care.

The USEFIL system aim to meet the challenges, and propose a way and solutions that can help the system cope with the challenges in the short, medium and long period . Therefore the reasons of organizations to adopt the solutions do not depend only on cost saving but also on growing need in a solution that will help provide care.

4 Exploitation plan: Short Term, Long Term

The USEFIL system combines many types of services that are operated through different sub-component of the system and at this stage, as reflected from WP7 results, some of it more mature than the others. Therefore, we designed the exploitation plan in a way that enables exploitation in several phases, starting from the most mature components and arriving to the early developed one, that will reach the market at later stage. In order to use the USEFIL project outcomes we also need to establish the ownership between partners. We also analysed the technical knowledge obtained in USEFIL and may be used for future developments. The exploitation plan and activities of the individual partners is presented as well as the USEFIL consortium exploitation plan and activities. From these and the maturity of the various products we designed the roadmap to market.

The USEFIL system was developed combining many technologies, some of them already exists and owned by the partners and some developed by partners together and individually. In order to establish the IPR between partners we analysed the assets acquired in the USEFIL project and the ownership of each of these assets.

4.1 Intellectual Property Rights

4.1.1 Project Partners' Developments

In order to establish the IPR ownership we first analysed the innovation developments made in the USEFIL project by each of the partners:

Warwick: The development of a custom app for a smartwatch that is capable of gathering and processing acceleration data to extract the measurements outlined above. Innovation mostly around the algorithms to derive the measurements and the fact that this performs from a single sensor system.

Fraunhofer: Since Fraunhofer developed software and algorithms for licensing innovation can only happen through collaboration with potential licensee

TP-Vision developed:

- Mechanism to provide messages from an application on top of broadcast viewing (eg. to give medication reminders to a user while he/she is watching TV).
- End user Smart TV Portal interface, focused on simplified interaction
- Skype/Video Communication applications
- Home networking standards
- Smart TV architecture and platform evolution

AUTH developed:

- **Hybrid Clinical Decision support system** utilizing advances in knowledge-based formalisms such as Fuzzy Cognitive Maps, trend analysis, time-series forecasting tools.
- **Semantically enriched** version of the wellness and mental preservation platform FitForAll.
- **Platform independent, web based solutions** of the previously existing wellness and mental preservation platforms FitForAll.
- **CAC Service** for sharing contemporary controller data across several requesting modules.

- **USEFIL Global installer** with relevant know-how of how to manipulate shared sensors software and integrating modular software in a coherent whole.

Additionally AUTH created the following added value infrastructures:

- **LivingLabs**, an Active & Healthy Aging Lab created with sound ecological validity and sensor obtrusiveness considerations to be used as a AAL prototype and testing environment. Created during the pre-pilots of the project, it received a non-trivial number of elderly who became the first ambassadors of the AAL approach in Thessaloniki. Through their participation and their involvement as “external testers” of the platform they considered themselves as part of this technological innovation and became advocates of this approach to elderly care. Additionally through this elderly involvement the LivingLabs environment became an awareness hub for increasing visibility for the USEFIL in a wide part of society.
- **Human Interactions Video Enriched Archive**. A large video and skeleton archive (>1TB), >125 hours of 3 axis time stamped acceleration recordings, 30 hours of game recordings. Video annotated with human interactions (an, at the moment ad-hoc, but generalized and more abstract superset of ADLs). These are data that were gathered during the USEFIL LivingLabs pre-trials and were enriched for discoverability and query for eventual on-demand streaming to interested AAL research and development parties.

NCSR innovative developments are:

- **Video and Audio Analysis** - The innovative video and audio analysis algorithms and processes that have been developed and tested within USEFIL project are described in detail in D4.1_Software_Tools_for_Monitoring_v3.0.pdf deliverable.
- **Global database service**- USEFIL Global DB is a database server storing data on a number of end users. USEFIL Global DB is a relational database server built based on SQL schemas but it has been designed so to be easily adapted to non-sql schemas.
- **Server Web API**- Due to security considerations, Global DB is made not accessible directly (i.e. for running SQL queries) for other components of the system, except for Server Web API service. Therefore, Server Web API provides a single controlled access point to the database. Server Web API is also responsible for user registration between the Calendar, the Messaging and the USEFIL portal services. Using the registration method on the Server Web API, a user automatically gets registered in all the above mentioned USEFIL services. Then the user providing the same credentials can login in all the services available. The state of the art of the above module concerns the “flexible combination” of different modules and the single sign on service for different architectures and technologies. Furthermore Server Web API also utilizes relationships between users for enforcing access rights: which users can read or write data for other users. The protocol used by Server Web API is based simultaneously on both SOAP and REST protocols.

Maccabi Healthcare services provided the scenarios and clinical knowledge for the developments of the face detection module developed by NCSR and ADL module. Maccabi developed ADL assessment module with AUTH. The methodology and the rules for decision, methodology and knowledge for the DSS and its implementation in clinical practice were provided by Maccabi. This module was connected to the DMA platform developed by Maccabi and combined the process of the DSS to the DMA. Namely, receiving the DSS results, adding data from DMA and re-analyzing for total score.

VTT has developed for USEFIL components responsible for in-house data management, communication, and security. Also, the *InstantSurvey* system is for performing short user surveys over instant messaging (includes the backend and the Android app).

4.1.2 Technical Knowledge Acquired

In addition to the innovative development the USEFIL partners gained technological knowledge that may be used for future developments:

VTT :

- XMPP instant messaging protocol and its potential uses.
- Improved Android programming expertise.
- Improved knowledge of Internet of Things security issues and mechanisms.

Warwick :

Knowledge around the design and implementation of algorithms and data gathering techniques in the android environment. Experience and knowledge relating to design and implementation of algorithms for extracting health indicators from single-site accelerometer systems

AUTH :

- Applied know-how for deriving meaningful interventions in the life of an elderly as this is described from the sensor based input distilled in the development of USEFIL's Decision Support System (DSS)
- Applied know-how into translating raw sensor input into machine inferable user input. This was a research effort for creating a semantic infrastructure for the integrated wellness and cognitive preservation platform FitForAll.
- Applied expertise for integrating sensors input into a highly modular environment and for integrating highly modular ICT ecosystems in coherent systems leading to the production of the Kinect Sharing CAC framework as well as the USEFIL global installer for deploying the integrated USEFIL software home end.
- Applied expertise in ecological validity leading to the conception and deployment of the Living Labs AAL testing environment.

Fraunhofer :

Development of mobile applications; algorithms for behaviour detection

TP-Vision :

- Platform featuring and performance needs for applications in this context.
- Design input for messaging and reminder system.
- Changes required compared to current mechanism for proper functioning and usability.
- IOT/Smart Home

NCSR :

Technical knowledge acquired in many fields like JSON REST protocols, non-SQL schemas, video and audio analysis algorithms, security frameworks, application level and many others.

4.1.3 Shared IPR

Each of the partners specified his role in developments that was shared with other partners:

VTT - Nothing significant (only source code for interaction with Local DB).

WARWICK – None.

Fraunhofer - None.

TP-Vision- None.

NCSR participated and provided the following modules in the development of the WWU application, tablet application and the DMA gateway module:

For the WWU Application, NCSR provided source code for the following components which were integrated to the WWU app.

- Emergency (Emergency app)
- Monitoring of clinical parameters (Glucometer app)
- Emergency (Emergency app)

Tablet Application

- Monitoring of clinical parameters (Medical Devices app)
- User authentication service (Remote login app)
- Emergency (Emergency app)

DMA gateway module

USEFIL Server Web API

AUTH as integration lead has contributed iterative development effort in every module for incorporating them to the of the integrated USEFIL platform. Furthermore it has developed the:

- Kinect Sharing CAC framework for seamless integration of the sensor to the various software modules that require its input.
- The USEFIL global installer for deploying all home end software to the local pc gateway.
- The Server Web API, where AUTH provided sound design patterns and know-how to NCSR for its development
- The scientific knowledge behind the rules development of the DFT, developed by NCSR.
- The AudioAnalysis Tool – providing code bug fixes.
- The ClothesChangeDetectionTool – providing code bug fixes.
- AUTH has contributed and offered guidance on the USEFIL services Web API with regard to the web API service (originally intended to be based on Joomla - according to Anna Bakouli in D3.1). The contribution was also established with the circulation, from AUTH side, of the LLM WEB SERVICE SOAP API Developer Reference template. See also background IPRs of AUTH in Consortium Agreement Document.

Maccabi contributed to:

- The face detection module developed by NCSR

- The DFT and DSS for ADL developed by NCSR, AUTH

At this stage, **None of the partners submitted patent application** as a result of the work in USEFIL project.

NCSR expressed the intension to submit a patent application in due time for the mirror system which includes among the others the video and audio analysis modules

NCSR has major reservations on the following AUTHs and Maccabi's IPR claims:

AUTH

- The Server Web API, where AUTH provided sound design patterns and know-how to NCSR for its development.
- AUTH has contributed and offered guidance on the USEFIL services Web API with regard to the web API service (originally intended to be based on Joomla - according to Anna Bakouli in D3.1). The contribution was also established with the circulation, from AUTH side, of the LLM WEB SERVICE SOAP API Developer Reference template. See also background IPRs of AUTH in Consortium Agreement Document.

Server web API is coming from background IPR –Tilleipokratis and Internet platforms where relevant documents and minutes as well as presentations exist within the official documents- and within USEFIL this API has been slightly updated. NCSR could release the extra lines of code that concern a couple of additional tables to host extra events that developed within USEFIL after agreement with interested partners. Furthermore, AUTH claim of contribution is not supported by development activity in the relevant WPs in the DoW or written amendments for such kind of work.

Maccabi

- The face detection module developed by NCSR
Not sure how this contribution came out and within which Task and after which agreement.

4.1.4 Commercial Agreements

In order to identify the commercialization phase of the USEFIL product\ we analyzed the individual exploitation plan of each partner, also looking if any commercial agreements are signed or planned by the partners at this stage. It should be noted that not all partners have interest in commercialization and their exploitation plan includes knowledge use educational and\or research exploitation plans.

At this stage none of the partners has signed or is in the process of signing any commercial agreement with clients as a result of the USEFIL project. The only partners that contacted and started discussion with potential clients are Maccabi who initiated discussion about USEFIL product as part of the discussion regarding commercialization of its platform (developed before USEFIL project) and possible commercialization of the ADL module. And NCSR that reported to have many open discussions

Some partners expressed interest to further collaborate with USEFIL partners in future developments based on the work done in the USEFIL project and showed interest to advance the product closer to the market:

VTT expressed interest to collaborate with the industry partners: Maccabi and TPVision.

Warwick expressed interest to collaborate in research and development projects, dependent on a suitable proposal and consortium being proposed

Fraunhofer expressed interest to collaborate with individual partners as well as the consortium as a whole

TPVvision is willing to consider opportunities for future collaborations.

NCSR and its Spin Off company Syndesis Ltd are positive to licence IPRs to the other partners. Have to be mentioned that NCSR is committed to actively promote the developed services and thus intends to further expand the USEFIL applications by hosting external developers and services. TPVvision is considered a suitable partner for NCSR to work together in exploiting the relevant platform based on the detail business model exists in D8.9

AUTH is willing and actively exploring collaboration opportunities. Current efforts focus on building cross-project synergies utilizing AUTH's exploits from USEFIL. Extending these exploits through the STHENOS project and leveraging them through the DISCOVER and UNCAP projects is one of the avenues through which additional sustainable ties are expected to be built and mature to commercial collaborations.

Maccabi has interest to collaborate with industrial and research partners in various developments. Collaboration with TP vision in development of services in healthcare, with AUTH and Warwick university for R&D of intelligent systems for behaviour and health including further develop the ADL into a product. Maccabi also has interest in further research and development with other partners according to projects and funding opportunities in domains related to those researched in USEFIL project such as social interaction smart home and monitoring

4.2 Individual Exploitation Plans

The exploitation plan for USEFIL outcomes includes individual exploitation plan and USEFIL consortium exploitation plan.

The individual exploitation plan aim to advance the sub components of the USEFIL system and hopefully in the future enable through collaboration to advance the whole system into market. In parallel, exploitation plan and activities for the commercialization of the system will be done by the consortium members even after the end of the project.

VTT

Plans to commercialize the InstantSurvey idea to potential customers (companies).

VTT try to exploit InstantSurvey as a stand-alone system. In addition to health applications, other domains are considered such as feedback collection, opinion polling, "citizen sensing", smart home interaction, and other. This does not mean commercialization as a product, but exploitation in customer contract projects where a customer may be interested in adding this functionality into own systems.

Warwick

WWU could be commercialized as a standalone product with some more work around the device hardware and user interface (particularly in terms of data visualization and backend work). It Could be commercialized as a sensor product for use in other integrated systems or as a research tool.

WWU has some potential for interoperability with other partners due to the use of the LocalDB which could also be used by other products

As a result of the above, short-term plan is to continue development of the WWU and similar devices. Medium to long term plan is commercialization.

Fraunhofer

Plans to search licensees for messaging system (short range) and conduct further R&D projects extending on USEFIL

TP-Vision-

Short term exploitation plan are to make some changes are taken along within TV/Smart TV offering.

For the mid and long term, we learned that the previous platform offering based on Linux and JointSpace had a number of limitations in the context of Smart Home and Home Healthcare that could be resolved by moving to another platform such as Android. This applies to both technical and non-technical aspects. Such a move is actively being pursued for the near future

NCSR

At the academic level, NCSR will exploit the results through academic conferences, journals , papers and further research projects.

At the commercial level NCSR is waiting for IPR agreements between partners to start exploitation \commercialization

UoB

We conducted a course 'Wearable computing' for both bachelor and Master students. We supported PhD thesis, Master thesis, Bachelor thesis and student projects within the USEFIL. We also organized a workshop for scientific dissemination evaluation.

Maccabi Healthcare Services

Maccabi plans to further develop the ADL system and further explore other functionalities that were partially developed in USEFIL and may have potential to be implemented in healthcare services such as social awareness, application of smart TV and smart home and integrated care functionalities.

Maccabi developed an integrated care platform which is in stage of commercializing and was connected to the USEFIL system. Our exploitation plan is to commercialize the outcomes of USEFIL system within the effort of commercializing our product once the USEFIL product is ready to market. In the short term, there is development that has to be done to bring the outcomes of USEFIL to product stage. In the medium range Maccabi is interested to implement the outcomes in the organization for large scale pilot and scaling up of the services. At the long range, we intend to commercialize the package for healthcare organizations.

From the above, it is evident that the outcomes of USEFIL project are partially ready to market and therefore the exploitation plan at the short range has to focus on exploitation of ready to market sub-components and further development of the immature subcomponents until ready for market.

4.3 Exploitation Activities During the USEFIL Project

The individual exploitation activities made by the consortium partners comes from the exploitation strategy and plan designed in the Dow and from discussion and decisions made by the consortium along the project. The exploitation efforts at this stage aimed to create initial contacts with potential partners and client and understand the level of interest in the market for future commercialization.

VTT

InstantSurvey system has been integrated with another VTT software system called DataBearings (developed in the Finnish National *Internet of Things* project, focused on heterogeneous data integration). DataBearings+InstantSurvey were used to implement a smart home pilot system to be used as a demonstrator and in marketing of both. The pilot is briefly described here: <https://www.linkedin.com/pulse/my-smart-home-head-cloud-artem-katsonov>

Warwick

None

Fraunhofer

None. Development still continued

TP-Vision

Towards usability, support for pointer navigation and control was extended to more parts of the interface, rather than purely in app support.

NCSR

NCSR and Syndesis Ltd to secure the sustainability of the services that have been produced within the USEFIL project by NCSR and its own services that have been produced within previous projects and been used in the project (background IPRs) did many contacts with relevant stakeholders in and outside Greece. Many relevant companies, content providers, municipalities, medical providers and others are among those that have been contacted and expressed interest to further discuss potential cooperation after the IPRs will be clarified.

Within this realm the following have been achieved up to now:

- Syndesis Ltd is in process to set up its marketing activities for USEFIL services that have developed by NCSR as described in D8.10 and after the close of all pending issues of the project. Demonstrations have been conducted with multi specialty-clinics, insurance companies and Hospitals. Agreements to develop customized applications based on USEFIL services are under consideration after the close of all issues of the project.

- NCSR has signed LoI with a company in Athens to include the measurement of vital signs like BP within a pilot study that is running. Demonstrations to the relevant doctors have been conducted.
- Within May NCSR will organize a workshop/event in Thessaloniki to demonstrate the next generation of the USEFIL services (Android versions of the monitoring of vital signs and extra services that are under development within other projects such as monitoring of room environmental conditions) to key stakeholders in North Greece such as municipalities, Prefectures and Governmental bodies. Invitations will be released within April.
- First contacts with Chinese representatives of a prefecture have been done and demonstration of the “USEFIL web based platform” philosophy and the “developers part” has been conducted.
- NCSR has provided for those services that are coming from its own background IPRs (for monitoring of vital signs BP, weight, SPO2) offers for tentative tenders.
- NCSR and Syndesis Ltd have secured funding to further develop their own services that have been used within USEFIL (monitoring of vital signs such as BP, SPO2, weight etc) and to further develop android versions of these services and extra services such as to monitor environmental data of the house and incorporate these services in a smart home technological platform of a running EU funded project. Within September 2015 Syndesis Ltd is planning pilots with 60 users in the broader area of North Greece to validate those services.
- Contacts are ongoing with US based companies (LoI are expected to be signed to further facilitate the discussions) to complement their services with NCSRs’ services that have been used within USEFIL (monitoring of vital signs) and the developers platform and vice versa.

AUTH

AUTH, through previous and ongoing projects has a significant portfolio of stakeholders that have extended positive responses to contacts for exploitation. Municipal elderly centers, NGO backed elderly care facilities and private elderly care providers have expressed interest into exploiting AAL services and products that are going to result from the USEFIL project. AUTH’s spin off company LLMCare is also committed in exploiting these outcomes and aims to bring its own customer portfolio in contact with USEFIL products and services.

Maccabi

Maccabi contacted many potential partners in various ways:

- Guests visiting Maccabi- We host many delegations from healthcare organizations, governments and commercial companies visiting Maccabi for learning about the advanced systems and services provided to our members. We presented the future innovation of USEFIL as potential product along with our existing products. Maccabi, as a strategy develop and implement innovation as services for its members and is capable not only implementing innovative services but also demonstrate implementation process in healthcare organization and create evidence base for the system.
- Proactively contacted potential clients such as the social services in Israel. The system was presented to the CEO and following this presentation he initiated a process of collaboration in order to define the route for integrated care between social and healthcare in Israel.
- Bait Balev and Assuta medical centres are companies of Maccabi healthcare. We presented the potential product and we are now in a process of design of implementation of integrated care system based on the DMA system that was connected to the USEFIL system and can be deployed once ready to market

- Private emergency services that are interested to expand their services. We are working with another daughter companies of Maccabi- Maccabi management and enterprises and the R&D company Nevet Ltd to design and commercialize a package of services that will be offered to service providers in Israel at first stage and world-wide at later phases
- Maccabi is in process of marketing the DMA platform. The outcomes from USEFIL system are presented as part of the functionalities and service that will be able to provide in the future.
- Demonstrating the system to partners already collaborating with Maccabi.

4.4 Market Strategies: First Products/Services and Customers

4.4.1 General

According to market analyses and maturity of the sub-components of the USEFIL system at this stage the partners view is that the first services to be provided will be the most stable / accessible parts of the system. These include Tablet, Smart Watch, Smart TV and the DMA, as services it will include:

- Elderly ADL monitoring.
- WWU related services
- Health data measurement upload
- EHR-access and games
- The applications themselves, without the devices where possible, to reduce initial cost.

The first customers of USEFIL system are likely to be either healthy, relatively young users who are looking for assistive technology to age with, rather than those users with an existing need, due to the technological barrier to entry. Healthcare organizations such as Maccabi or IT companies such as System integrators, gearing solutions towards the institutional market.

The partners also believe that additional developments are required for the USEFIL system commercialization and implementation:

- Interaction of the end user with the system could be further improved by adding speech recognition
- For ADL monitoring, need to extend the range of combined data providers, as each single data provider is not precise and reliable enough. Data providers may include a smart watch and a Kinect, as in current system, but also motion detectors and other smart home sensors, and even subjective observations (direct questions asked in an easy-to-answer way).
- Further integration testing and system level optimization.
- Homogenization and improving of user-interface elements.
- Extensive user-level testing and adjustment of information flow and processing to meet end user-needs.
- Streamlining of technology footprint to reduce technology load on users
- Tighter integration of the messaging system with doctor's schedule/practice times/availability for consultation.
- Further testing and maybe new HCI developments may be needed. Also new external apps and new devices that will make use of the platform should be developed.

Therefore, the various services that will be proposed to the user in several stages as follows:

1. 1st stage
 - Monitoring and alerting, remote treatment and intervention
 - Social activity
 - Connection to the healthcare organization and to Pharmacies, private doctors
 - games for physical, cognitive training
2. 2nd stage

Once the system will reach maturity stage that enables commercialization as a whole system\product it will be presented to the market.

4.4.2 Intricacies of the Greek Market

In attempting to identify a roadmap for exploitation of USEFIL’s outcomes AUTH has considered the exploitation of its specific outcomes in the realities of the Greek Market, especially the divide between Greece’s urban center and the more decentralized at places rural areas. This divide, translated into an equally deep technology acceptance divide led AUTH to explore the intricacies of the Greek market. As a first step the following SWOT analysis was made (Table 1).

Table 2. SWOT analysis for the Greek market

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> ▪ Modular platform, off-the-shelf components facilitates procurement and support ▪ Non-exotic, off the shelf technological solutions more acceptable to the Greek elderly. ▪ Mixed methods approach to AAL (ICT with human interaction) alleviates elderly fears of isolation. ▪ Living Lab test-bed and on-site ICT team facilitating rapid response and prototyping to shifting market needs. 	<ul style="list-style-type: none"> ▪ Research exploits require polish and additional stability testing increasing reliable product’s time to market. ▪ Initial cost still prohibitive for wide spread proliferation. ▪ Research consortium dependencies need to be incorporated into a viable business entity.
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> ▪ The increase in aging of the Greek population and the subsequent expected increase in identified and age related healthcare challenges. ▪ Other Digital inclusion initiatives targeting elderlies or their environment (AUTH’s DISCOVER project for training carers of the elderly) provide synergies for market penetration 	<ul style="list-style-type: none"> ▪ Increased societal technophobia especially amongst the elderly still prevalent in Greece expressed as fear of isolation ▪ General crisis situation with a severe impact on Individual and Organisations budgets makes marketability a challenge ▪ Shifting needs and expectations as Greece’s elderly population is at exactly the shifting point from technological illiteracy to

- | | |
|--|--|
| <ul style="list-style-type: none">▪ Existing presence in the elderly healthcare sector with the LLMCARE spin-off.▪ Medically ready. AUTH is carrying the full support of an academic medical institution (AUTH's Medical School). Ethical and clinical considerations are able to be tackled without resorting to external parties. | <ul style="list-style-type: none">▪ increased technology acceptance.▪ Still a large percentage of user distrust towards the efficacy of technology as a healthcare facilitator. |
|--|--|

From this analysis it becomes evident that the strategic exploitation challenge for AUTH, or any Greek stakeholder, regarding USEFIL as an AAL platform is the maturation of this, still research heavy, project to a market ready platform in a shifting Greek society with shifting elderly perceptions and needs.

5 Roadmap for Exploitation Plan

The roadmap for exploitation plan was designed in 4 phases. The first is the research phase that was performed in parallel to the system design during the first year. This included reviews and focus groups with target groups in 3 countries representing the target population of the USEFIL system. In addition an extensive review of existing services, products and needs were performed. As a result the consortium designed the USEFIL product but also the dissemination and the exploitation activities performed and reported by the consortium on year 1 of the project. The second phase was performed during Year 2 in parallel to the development of the prototype. In this phase we performed first market analysis for the USEFIL product and designed the first draft for exploitation plan. This plan was presented in Year 2 of the project. The third phase of the exploitation plan was performed during Year 3 of the project in which we implemented and pilot the USEFIL system in real life environment. We designed and executed the 3rd phase of the plan and performed analyses of the product, its subcomponent, the maturity of each subcomponent and the system as a whole and clarified the ownership and exploitation plan of each of the partners regarding their own component developed in USEFIL system and willingness\interest to continue development and collaboration for development between partners of the consortium in the 4th phase of the exploitation plan- the post project phase.

From this analysis, we designed the strategy to market and the roadmap to market:

Market analysis- The market analysis presented in D8.9 describe the market potential of USEFIL. Since there is no parallel service and system we analysed the existing market of its subcomponent. The analysis show a huge growing market for the smart TV, smart watch and smart home services and applications, increase in consuming and usability by older populations and the growing use of these technologies by healthcare organizations. Therefore the readiness of the market is growing also as result of growing need for integrated care and shortage of care providers for the elderly population. Therefore, as concluded there are two strategies to go to market; one approach is through the healthcare\social care organizations and the second through the private market increasing awareness and provide services through smart TV and tablets and closing the gap to organizational adoption at second stage. The first approach can be led by collaboration between healthcare organization such as Maccabi and technical partner. The second approach can be led by industrial companies such as TP-vision

From the analyses of technical maturity of the USEFIL system and its components it is evident that some parts can be commercialized at this stage while some needs more development as well as the USEFIL system as a whole. Since some of the components are more mature than the others commercialization of part of the components included in already started. For example, Maccabi started commercializing activities for the platform for medical professionals. Further developments related to the USEFIL services will be offered as a package when they are ready to market. As presented, each of the partners has individual exploitation plan that will be carried out after the end of the project. Furthermore there are only few components that have shared ownership. These partners will discuss the agreements between them and will decide how they continue to develop and commercialize the shared component. For example Maccabi and AUTH already started discussion regarding continuation of development of the ADL module and opportunities for future implementation and commercialization. Additionally AUTH as the developer and TPVision as a SmartTV manufacturer are exploring collaboration towards incorporating webFitForAll and VideoGrade in the Philips App Gallery with an appropriate pricing policy. Discussions will continue regarding collaborations between partners for future development and commercialization of the various parts of the USEFIL system.

Further development by the consortium partners is already discussed and some of the partners submitted proposals for funding. Other funding opportunities will be discussed according to opportunities.

Specific Market analysis will be made by each partners for individual component commercialization. Maccabi made a market analysis for its platform for integrated care and is now approaching the market in parallel to implementation in Maccabi and its daughter companies. TP-vision performed market analysis for the health applications on smart TV and are approaching the market. This way the partners will have the opportunity to finalize development, bring the USEFIL system to product level and collaborate with the partners that are already in the market for commercialization of the USEFIL system. As discussed before, joint ventures by the partners - The joint ventures will set the ground for commercialization of the future product. The partners in the consortium will continue to collaborate with this approach, performing commercialization activities.

6 Conclusions

This document is based on the market analysis and aim to analyse the assets, innovations and possible exploitation activities as a result of USEFIL project.

The document review the different phases of the exploitation plan developments and activities along the project, the presents an analysis IPR, know-how and possible products and " packages " that can be commercialized and the value chain which underlies the USEFIL system.

Presently, there is no parallel service in the market, also, not all parts of the system are ready to market therefore we conclude that the way to market have to be based on partial services at first stage, mainly integrated care system for healthcare (Maccabi) and smart TV services (TPvision) and integrating the additional services at later stages. From this an exploitation plan was designed for the USEFIL product and individual's partner's plan. It is evident that since the USEFIL system has benefits at the health, social and wellbeing level this system is innovative and has large market potential however the road to market has to be gradual.

The document presents the exploitation activities, IPR sharing between partners analysis and activities that were done and/or are in process for exploitation.