THEME [ICT-2011.5.2]
[Virtual Physiological Human]

Grant agreement for: Collaborative project*

Annex I - "Description of Work"

Project acronym: MyHealthAvatar

Project full title: " A Demonstration of 4D Digital Avatar Infrastructure for Access of Complete Patient Information "

Grant agreement no: 600929

Version date: 2012-10-08

Table of Contents

Part A

Workplan Tables

A1:
Project summary

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per project

General information

Project title [3]	A Demonstration of 4D Digital Avatar Infrastructure for Access of Complete Patient Information		
Starting date [4]	01/03/2013		
Duration in months [5]	36		
Call (part) identifier [6]	FP7-ICT-2011-9		
Activity code(s) most relevant to your topic [7]	ICT-2011.5.2: Virtual Physiological Human		
Free keywords [8]		Digital Patients, Virtual Physiological Human, Data Repository, Model Repository, Predictive Models, Visual Analytics, Legal and IPR,	

Abstract [9]

Owing to the highly fragmented health systems in European countries, gaining access to a consistent record of individual citizens that involves cross-border activities is very difficult. MyHealthAvatar is an attempt at a proof of concept for the digital representation of patient health status. It is designed as a lifetime companion for individual citizens that will facilitate the collection of, and access to, long-term health-status information. This will be extremely valuable for clinical decisions and offer a promising approach to acquire population data to support clinical research, leading to strengthened multidisciplinary research excellence in supporting innovative medical care.

MyHealthAvatar will be built on the latest ICT technology with an aim of engaging public interest to achieve its targeted outcomes. In addition to data access, it is also an interface to access integrative models and analysis tools, utilizing resources already created by the VPH community. Overall, it will contribute to individualized disease prediction and prevention and support healthy lifestyles and independent living. It is expected to exert a major influence on the reshaping of future healthcare in the handling of increased life expectancy and the ageing population in Europe. This complies with the priority and strategy of FP7 ICT for healthcare, and constitutes a preparatory action aiming at the grand challenge on a “Digital Patient”, which is currently the subject of a roadmap in the VPH community.

MyHealthAvatar places a special emphasis on engaging the public. It has huge implications to the society both socially and economically. The initiative of designing a personal avatar can potentially change the way we think, communicate and search for information. Meanwhile, the acceptance of the avatars by the public will open opportunities for many industrial sectors, leading to the reinforced leadership of European industry.

A2:
List of Beneficiaries

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

List of Beneficiaries

No	Name	Short name	Country	Project entry month[10]	Project exit month
1	UNIVERSITY OF BEDFORDSHIRE	BED	United Kingdom	1	36
2	FOUNDATION FOR RESEARCH AND TECHNOLOGY HELLAS	FORTH	Greece	1	36
3	UNIVERSITAET DES SAARLANDES	USAAR	Germany	1	36
4	INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS	ICCS	Greece	1	36
5	GOTTFRIED WILHELM LEIBNIZ UNIVERSITAET HANNOVER	LUH	Germany	1	36
6	ASTRID RESEARCH KUTATASFEJLESZTESIKFT	ASTRID RESEARCH KFT	Hungary	1	36
7	ANSMART LTD	ANSMART LTD	United Kingdom	1	36
8	TECHNOLOGICAL EDUCATIONAL INSTITUTE OF CRETE	TEI-C	Greece	1	36
9	UNIVERSITY OF LINCOLN	LIN	United Kingdom	1	36

A3:
Budget Breakdown

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One Form per Project

Participant number in this project [11]	Participant short name	Fund. %[12]	Ind. costs[13]	Estimated eligible costs (whole duration of the project)					Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D	
1	BED	75.0	T	423,363.00	134,720.00	110,148.00	17,691.00	685,922.00	512,721.00
2	FORTH	75.0	A	384,123.00	108,712.00	9,476.00	9,476.00	511,787.00	361,400.00
3	USAAR	75.0	T	388,800.00	160,000.00	13,600.00	9,600.00	572,000.00	394,800.00
4	ICCS	75.0	T	365,344.00	89,600.00	13,028.00	54,171.00	522,143.00	386,007.00
5	LUH	75.0	T	357,600.00	45,600.00	9,600.00	9,600.00	422,400.00	310,200.00
6	ASTRID RESEARCH KFT	75.0	T	148,800.00	25,600.00	4,960.00	44,640.00	224,000.00	174,000.00
7	ANSMART LTD	75.0	T	131,200.00	49,600.00	8,640.00	12,960.00	202,400.00	144,800.00
8	TEI-C	75.0	T	70,080.00	10,720.00	2,000.00	2,000.00	84,800.00	61,920.00
9	LIN	75.0	T	97,536.00	27,200.00	7,200.00	7,200.00	139,136.00	101,152.00
Total				2,366,846.00	651,752.00	178,652.00	167,338.00	3,364,588.00	2,447,000.00

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

*** The following funding schemes are distinguished**

Collaborative Project (if a distinction is made in the call please state which type of Collaborative project is referred to: (i) Small of medium-scale focused research project, (ii) Large-scale integrating project, (iii) Project targeted to special groups such as SMEs and other smaller actors), Network of Excellence, Coordination Action, Support Action.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project, and it cannot be changed. The project number **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

2. Project acronym

Use the project acronym as indicated in the submitted proposal. It cannot be changed, unless agreed during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry info force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a detailed justification on a separate note.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Activity code

Select the activity code from the drop-down menu.

8. Free keywords

Use the free keywords from your original proposal; changes and additions are possible.

9. Abstract

10. The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

11. The number allocated by the Consortium to the participant for this project.

12. Include the funding % for RTD/Innovation – either 50% or 75%

13. Indirect cost model

A: Actual Costs
S: Actual Costs Simplified Method
T: Transitional Flat rate
F :Flat Rate

Workplan Tables

Project number

600929

Project title

MyHealthAvatar—A Demonstration of 4D Digital Avatar Infrastructure for Access of Complete Patient Information

Call (part) identifier

FP7-ICT-2011-9

Funding scheme

Collaborative project

WT1
List of work packages

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Type of activity [54]	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Project management	MGT	1	13.50	1	36
WP 2	User needs	RTD	3	13.00	1	9
WP 3	Architecture and integration	RTD	8	38.00	2	36
WP 4	Semantic interoperability	RTD	2	20.00	2	33
WP 5	Models & repositories	RTD	4	46.00	3	36
WP 6	Data & repositories	RTD	1	50.00	2	36
WP 7	Use cases (Scenarios)	RTD	3	9.00	10	18
WP 8	Avatar centred visual analytics	RTD	1	49.00	3	33
WP 9	Demonstration & evaluation	DEM	3	79.00	19	36
WP 10	Dissemination & exploitation	OTHER	4	22.00	1	36
WP 11	Ethical and IPR	RTD	5	37.00	1	36
			Total	376.50		

WT2:
List of Deliverables

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

List of Deliverables - to be submitted for review to EC

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	Interim management report I	1	1	2.00	R	CO	6
D1.2	Periodic report I	1	1	2.00	R	CO	12
D1.3	Interim management report II	1	1	2.00	R	CO	18
D1.4	Periodic report II	1	1	2.00	R	CO	24
D1.5	Interim management report III	1	1	2.00	R	CO	30
D1.6	Periodic report III	1	1	3.50	R	CO	36
D2.1	State of the art review related to the MyHealthAvatar environment	2	3	3.00	R	PU	9
D2.2	Scenario based user needs and requirements	2	3	3.00	R	PU	6
D2.3	Specification of the linkage to external sources and research projects	2	3	7.00	R	PU	9
D3.1	User requirments	3	2	3.00	R	PU	4
D3.2	Architecture design	3	8	6.00	R	PU	6
D3.3	Security measures and guidelines	3	8	6.00	R	PU	33
D3.4	Technical report on the links with external data resources	3	8	6.00	R	PU	33
D3.5	Report on local cloud infrastructure	3	1	4.00	R	PU	18
D3.6	Report on the review of open	3	1	5.00	R	PU	24

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	source APIs for MHA						
D3.7	Integrated platform with an evaluation report	3	8	8.00	R	PU	33
D4.1	Requirements analysis for semantic core ontology	4	2	4.00	R	PU	4
D4.2	Extension of the semantic core ontology	4	2	4.00	R	PU	24
D4.3	Technical evaluation report of ontology including ontology evolution and summarization	4	2	8.00	R	PU	33
D4.4	Semantic reasoning utilities for decision support	4	2	4.00	P	PU	33
D5.1	Model and clinical data repositories design	5	4	22.00	R	PU	12
D5.2	Model and clinical data repositories interfaces & evaluation report	5	4	24.00	R	PU	36
D6.1	A set of data collection utilities & evaluation report	6	1	8.00	R	PU	12
D6.2	Design for data and RDF repositories	6	1	8.00	R	PU	12
D6.3	Data & RDF repository & evaluation report	6	1	9.00	R	PU	36
D6.4	Data reasoning utilities for decision support & evaluation report	6	1	9.00	P	PU	33

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.5	Initial report on data collection methods and plans	6	2	8.00	R	PU	9
D6.6	Final comprehensive datasets	6	2	8.00	R	PU	18
D7.1	Description of scenarios and use cases for MyHealthAvatar	7	3	9.00	R	PU	18
D8.1	Display suite for avatars & evaluation report	8	1	16.00	R	PU	18
D8.2	Avatar-centred visual analytics suite & evaluation report	8	1	16.00	R	PU	33
D8.3	A multi-scale medical image analysis toolbox	8	9	17.00	R	PU	27
D9.1	Definition of the demos	9	3	14.00	R	PU	21
D9.2	Development of demonstrators	9	1	25.00	R	PU	36
D9.3	Report on the clinical acceptability and evaluation of MyHealthAvatar and future recommendation	9	3	20.00	R	PU	36
D9.4	Demonstration of MyHealthAvatar	9	3	20.00	R	PU	36
D10.1	External project website	10	4	4.00	O	PU	3
D10.2	Dissemination plan	10	4	4.00	R	PU	12
D10.3	Workshop for dissemination	10	1	4.00	O	PU	33
D10.4	Exploitation plan	10	6	5.00	R	PU	24
D10.5	Business plan	10	6	5.00	R	PU	36
D11.1	The ethical and legal	11	5	8.00	R	PU	24

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
	framework of MyHealthAvatar						
D11.2	Survey on strengths and weaknesses of related European data protection framework	11	5	9.00	R	PU	24
D11.3	Legal and IPR-related issues in patient centred solutions like MyHealthAvatar	11	5	10.00	R	PU	30
D11.4	Legal framework for the exploitation of MyHealthAvatar	11	5	10.00	R	PU	36
			Total	376.50			

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP1	Type of activity [54]	MGT
Work package title	Project management		
Start month	1		
End month	36		
Lead beneficiary number [55]	1		

Objectives

• to ensure that the project attains its goals effectively: on time, to the specifications contained within the contract, and within the budget defined
• to ensure timely submission of all contractual deliverables
• to organise project meetings
• to elaborate and enforce quality procedures

Description of work and role of partners

At the outset, a Project Management Office (PMO) will be established at BED. These staff will monitor the project throughout its duration and will be responsible for all non-research activities. Details of the management policies are reported in Section 2.1. Here we describe only the aspects related to the work plan.
T1.1: Administrative and Financial Management: PM1=>PM36 (Task Leader: BED)
The PMO will continuously monitor project activities in relation to the contractual work plan. The PMO will maintain the project Gantt chart, the risk analysis tool and other instruments that are necessary to ensure this level of monitoring, and update them, as required. In issues regarding risk monitoring and mitigation, the Project Co-ordinator will collaborate with the Risk Officer. By reporting potential management and other risks to the Risk Officer (confidentially, if necessary), all participants can support the project management activities.
The project status will be reviewed at meetings of the Steering Committee (SC), at which corrective actions will be adopted whenever necessary. The SC will also be concerned with quality management.
In the early months (PM1-3), the PMO will establish a detailed administrative management framework, in conjunction with other partners; this will include templates for reports, deliverables, etc.
Effort expended will be monitored on a six-monthly basis, in order to detect any significant deviations at an early stage.
Relevant details will be summarised formally by the PMO once per year in the Progress & Management Report (D1.2), which, complemented by the financial statements of each partner, will be submitted to the European Commission. There will also be a less formal report halfway through each project year, the Interim Progress Report (D1.1), by which the consortium and the Project Officer will be able gauge project progress.
T1.2 Consortium Management: PM1 => PM36 (Task Leader: BED)
In the early months (PM1-3), the PMO will establish, in consultation with all partners, precise descriptions of the procedures to be followed for reporting, dissemination, etc., so that all partners gain a common perspective and develop a common practice.
Consortium management will also include the organisation of consortium meetings (Steering Committee and General Assembly), including preparation of agendas, meeting chair, elaboration of meeting minutes, etc., and external meetings such the Annual Project Reviews.
The PMO will maintain regular communication with the VPH Network of Excellence (VPH-NoE) and will organise representation of the consortium at concertation meetings, workshops, etc., that it organises.

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BED	6.00
2	FORTH	1.00
3	USAAR	1.00
4	ICCS	1.00
5	LUH	1.00
6	ASTRID RESEARCH KFT	1.00
7	ANSMART LTD	1.00
8	TEI-C	0.50
9	LIN	1.00
	Total	13.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	Interim management report I	1	2.00	R	CO	6
D1.2	Periodic report I	1	2.00	R	CO	12
D1.3	Interim management report II	1	2.00	R	CO	18
D1.4	Periodic report II	1	2.00	R	CO	24
D1.5	Interim management report III	1	2.00	R	CO	30
D1.6	Periodic report III	1	3.50	R	CO	36
		Total	13.50			

Description of deliverables

D1.1) Interim management report I: [month 6]

D1.2) Periodic report I: [month 12]

D1.3) Interim management report II: [month 18]

D1.4) Periodic report II: [month 24]

D1.5) Interim management report III: [month 30]

D1.6) Periodic report III: [month 36]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS011	Kick off meeting	1	1	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP2	Type of activity [54]	RTD
Work package title	User needs		
Start month	1		
End month	9		
Lead beneficiary number [55]	3		

Objectives

This WP will elaborate on the user needs and requirements for the proposed technological and clinical research infrastructure to develop the 4D Digital Avatar. The specific objectives include:
• Understand the state of the art
• Understand the user requirements
• Investigate the linkages to external sources

Description of work and role of partners

T2.1: State of the art review: PM1=>PM9 (Task Leader: USAAR)
The WP will start with a review of existing frameworks, their interoperability and re-usage. It will provide the clinical perspective of the project and will take into account the state of the art, the state of research and the state of practice in the healthcare domains addressed. It will review current infrastructure systems, tools and software for the seamless integration of clinical care and basic research data, clinical trial guidelines, repositories of clinical, bio-molecular, and medication information, etc. under a legal and ethical framework that are able to be linked to a digital Avatar. As linkage to the 4D avatar is based on a lifelong timeline reflecting the citizen's life from birth, tools and infrastructures will be reviewed allowing secure storage over decades. The collection of the data and documents of each citizen serves as his/her individual health record. Interoperability issues with existing electronic health records (EHR), hospital information systems (HIS) and medical devices will be reviewed and established.
T2.2: User needs and requirements: PM1=>PM6 (Task Leader: USAAR)
This task will address the user needs and requirements for developing a seamless, secure and consistent integration of clinical care data provided by hospital information systems and clinical trials as well as clinical and basic research data. All these data will be linked to the 4D avatar. It will address the technological requirements (in conjunction with all other WPs) from the clinical application standpoint to build an environment facilitating VPH research by better aggregating medical data. As requirements will change during the evolution of the project the specification of user needs and requirements will continuously be updated.
The main points that will be investigated are user needs and requirements:
• for citizens to accept such an avatar
• for clinicians to show the benefits of such an avatar in routine clinical practice
• for IT people to develop the 4D avatar and the legal and ethical environment
• for basic researchers to strengthen VPH research
The techniques we will use during the requirements elicitation phase of the project include questionnaires and scenarios. The complexity of the domain, which is addressed by the project necessitated that a spiral process of requirements analysis, elicitation, documentation and validation is adopted. Specific techniques have also been selected for the elicitation, negotiation and agreement of requirements as well as their validation. These techniques are scenarios and prototyping. This task will define scenarios as detailed use cases, and provide the user requirements necessary to guide the activity in all the other work packages.
The questionnaire that will be developed will collect information from relevant stakeholders regarding acceptance, user needs and requirements of such a 4D avatar and the related infrastructure. Main stakeholders are citizens, clinicians, basic researchers and IT people. In this WP scenarios proposed by the clinical partners will be described, analysed and detailed into user requirements. Scenarios important for patient empowerment will be explicitly described and fostered in this task. Such scenarios might need tools, used by patients for analysing their own data.

T2.3: User requirements and specifications for the linkage to external sources such as social networks and for the collaboration with other existing research projects: PM1=>PM9 (Task Leader: FORTH)
Special care will be taken in order to ensure that progress and achievements from previous and running EU funded projects will be incorporated if possible. The VPH Toolkit and possible interactions with the P-Medicine environment and other research infrastructure projects and European networks will be addressed in this task. User needs and requirements for the linkage to social networks will be analysed and respective networks will be contacted and possible interactions defined and established. These social networks include patientslikeme.com as well.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
2	FORTH	4.00
3	USAAR	9.00
	Total	13.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.1	State of the art review related to the MyHealthAvatar environment	3	3.00	R	PU	9
D2.2	Scenario based user needs and requirements	3	3.00	R	PU	6
D2.3	Specification of the linkage to external sources and research projects	3	7.00	R	PU	9
		Total	13.00			

Description of deliverables

D2.1) State of the art review related to the MyHealthAvatar environment: [month 9]

D2.2) Scenario based user needs and requirements: [month 6]

D2.3) Specification of the linkage to external sources and research projects: [month 9]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS021	Scenario based user needs and requirements are defined	3	6	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP3	Type of activity [54]	RTD
Work package title	Architecture and integration		
Start month	2		
End month	36		
Lead beneficiary number [55]	8		

Objectives

• define the system's architecture and monitor its realization in the course of the project
• provide methodology for the integration with external sources such as hospital records, existing data and model warehouse, social network
• provide standards, guidelines and techniques in order to achieve the system integration
• investigate techniques to build a local cloud infrastructure to support data processing by utilizing resources within individual institutions.
• present a market review of open source APIs for MyHealthAvatar

Description of work and role of partners

T3.1 User requirement analysis :PM2=>PM4(Task Leader: FORTH)
This task reviews existing and emerging standards that are pertinent to the definition and building of the project's technological platform. The aim of this work is to feed the subsequent tasks and the building of the system by providing a range of important technologies, standards, etc with their evaluation as enabling blocks of the MyHealthAvatar's architecture.

T 3.2 Architecture definition and design: PM2=>PM6(Task Leader: TEI)
This task will provide the architecture's blueprint and will continually monitor its implementation, with emphasis put, on the one hand, on the adherence to the standards and the technologies chosen, and on the objectives of the system. We will follow the IEEE 1471 recommendation that defines an architecture as the fundamental organization of a system embodied in its components, their relationships to each other and to the environment and the principles guiding its design and evolution. The steps will be done by capturing stakeholder needs; making a series of architectural design decisions that result in a solution that meets these needs, assessing it against the stakeholder needs, and refining this solution until it is adequate and capturing the architectural design decisions in an Architectural Description. These activities form the core of the architecture definition process and will be performed iteratively.

T3.3 Architecture platform build, maintenance and security: PM2=>PM36(Task Leader: TEI)
This task will build and maintain the structure of the architecture platform by investigating a number of key issues in infrastructure, resource management, data access and federation, computing resource (possible links with external HPC). It will deal with all the security aspects of the technological platform, ranging from user authentication, authorization, and auditing, to data integrity and privacy, to pseudo anonymization and re identification of patient data. MyHealthAvatar will encourage interoperability by building as much as possible upon widely accepted security standards (e.g. SAML, Liberty-Alliance, WS-*, PKIX, XACML, etc). This will facilitate the integration with existing systems and will allow the functional interoperability with 3rd party systems. The security tools and policies that will be developed in this task will ensure and enforce the legal and regulatory compliance and will encompass the appropriate auditing mechanisms that are needed by the legislation.
We expect the architecture supports multiple platforms, including Windows, Linux, iPhones, Android, etc.

T3.4 Methodologies to support link with external data sources: PM2=>PM33(Task Leader: FORTH)
This task will consider the architecture to support the link of the 4D avatar with the external sources as an interface to extract data and information. These will include
1) Social network. This will investigate the infrastructure of the links to social networks. The 4D avatar is superimposed over the social graph of the patients. This task will provide social web mechanisms and

encourage the patients to adopt those in order to define their digital avatar. This requires integration with the social web accounts that the patients maintain already and the extraction of the social graph and other information from there.
2) External data warehouse. To increase the interoperability and accessibility, the links to other public databases and data warehouses will be considered.
3) Hospital records. This will look into the feasibility of the links to the hospital systems to allow the exportation of the health related data of the patients from the linked hospital systems. The predominant issues in this task relate to the security and the transformation of the data followed by the proper annotation in order to be compliant with the syntactic and semantic principles of the system. Notably, we do not expect to realise the physical link in the duration of this project due to complex legal issues. This will present as a feasibility study on the technical side, which will be in conjunction with the work on the legal side in WP11. A simulated database can be built to allow the investigation.
Notably, standardization and interoperability issues will be considered [EHR, HL7, OpenEHR] to allow data exchange. Also, the task will be carried out in conjunction with Taks 6.1, in which data collection utilities will be developed to allow information extraction from the social network using Twitter and Facebook APIs.

T3.5 Investigation of local cloud PM7=>PM18 (Task Leader: BED)
The main approach is to work on a locally-deployed cloud infrastructure which can utilise local computing power as well as maintain the ability to outsource the infrastructure to commercial cloud computing facilities (e.g. Amazon EC2). This could be potentially used by the organizations that host the data as the architecture to perform data storage and analysis services to provide information for remote users without transferring the data out.
This task will focus on providing infrastructure services and investigating distributed programming models, such as MapReduce, that can enable scalable data management and processing conducted in WP5, efficient visual analytics conducted in WP8. This cloud environment will also assist demonstrations conducted in WP9.

T3.6 Market review of open source APIs for MyHealthAvatar PM19=>PM24 (Task Leader: BED)
This task will investigate the proof of market of having open source APIs for the MyHealthAvatar. This purpose is to increase public engagement in the avatars, given the success of many open source platforms and toolkits nowadays.

T3.7 Platform integration. PM13=>PM33 (Task Leader: FORTH)
This task will address the integration of tools and services that support the 4D digital avatar. More specifically, the infrastructure needs to support the integration of data/model utilities, the ICT toolboxes and the model/data repository, and demonstrate capacities of linking towards the external data resource. The integration will provide a front-end web interface for users to access the system, e.g. use of the avatar toolboxes; and a back-end workflow mechanism that manages data access and storage, model processing, and model composition. The integration will pay special attend to the systems that reside in different geographic area and using different implementation platforms, which mimic the real systems deployments. Also, links to computing clusters and supercomputing facilities will also be integrated to support the computing demands of the avatar, e.g. running of the simulation models.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BED	8.00
2	FORTH	9.00
3	USAAR	3.00
4	ICCS	2.00
6	ASTRID RESEARCH KFT	4.00
7	ANSMART LTD	2.00
8	TEI-C	10.00
	Total	38.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D3.1	User requirments	2	3.00	R	PU	4
D3.2	Architecture design	8	6.00	R	PU	6
D3.3	Security measures and guidelines	8	6.00	R	PU	33
D3.4	Technical report on the links with external data resources	8	6.00	R	PU	33
D3.5	Report on local cloud infrastructure	1	4.00	R	PU	18
D3.6	Report on the review of open source APIs for MHA	1	5.00	R	PU	24
D3.7	Integrated platform with an evaluation report	8	8.00	R	PU	33
		Total	38.00			

Description of deliverables

D3.1) User requirments: [month 4]

D3.2) Architecture design: [month 6]

D3.3) Security measures and guidelines: [month 33]

D3.4) Technical report on the links with external data resources: [month 33]

D3.5) Report on local cloud infrastructure: [month 18]

D3.6) Report on the review of open source APIs for MHA: [month 24]

D3.7) Integrated platform with an evaluation report: [month 33]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS031	First deployment of the architecture platform	8	9	
MS032	Simulated database to experiment links with hospitals	2	12	
MS033	Deployment of a local cloud	1	18	
MS034	Web interface for toolbox	8	24	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP4	Type of activity [54]	RTD
Work package title	Semantic interoperability		
Start month	2		
End month	33		
Lead beneficiary number [55]	2		

Objectives

The objective of this WP is to establish and formally specify the semantics-based conceptual substrate of the overall information system. More specifically the objectives of this work package are the following:
• Specification of a core Ontology describing multi-scale medical data, social activity and models.
• Specification of a mapping formalism to allow data extraction and integration.
• Specification of the algorithms & methodology for data and query translation.
• Ontology summarization and evolution
• Semantic Reasoning for Decision Support

Description of work and role of partners

T4.1: Semantic Core Ontology PM2=>PM24(Task Leader FORTH)
In this task, we will extract for each domain of focus a well defined set of domain concepts that sufficiently describe the semantics of a) the chosen clinical domain; b) the social activity of the users and that c) will allow the semantic enrichment of the models.
As already mentioned the focus of this task is to identify case-relevant ontologies and to re-use or merge them. The Semantic Core Ontology will be defined in a modular, scalable and extensible way and special attention will be given on the temporal aspect of the information.
T4.2: Mapping formalism PM2=>PM24(Task Leader FORTH)
In this task, we intend to identify the requirements for mappings that bridge the Semantic Core Ontology with the information models representing the external information sources. The proposed mapping formalism should be able to mitigate the foreseen structural and contextual differences between the Semantic Core Ontology and the external information sources. We will use this formalism to instantiate the necessary schema-level mappings that will be executed by the algorithms in T4.3 during the data extraction or information linking process.
T4.3: Semantic Integration Methodology PM2=>PM24(Task Leader FORTH)
This task will take as input the mapping format and methodology established in task T4.2 and will define the necessary algorithms for data translation or query rewriting. These algorithms and the proof-of-concept modules will be implemented.
T4.4: Ontology Evolution and Semantic Summarization PM13=>PM33(Task Leader FORTH)
The realization of the “knowledge on demand” vision presupposes the ability to produce a concise representation of a state of affairs that includes only the elements of a domain that are necessary and adequate for fulfilling a particular task. This task will produce semantic summaries that will constitute such adequate representations and will include anchors to complete ontological descriptions. These anchors that will also function as indices in the knowledge space will support the expansion of minimal information into complete ontological descriptions on demand.
Moreover, since the 4D avatar is indented to be a lifelong companion of a citizen, the core ontology might have to change to depict the new knowledge that is acquired. So, the appropriate mechanisms for the evolution of ontology and the incremental update of queries or data relying on it should be devised and implemented.
T4.5: Semantic Reasoning for Decision Support PM13=>PM33(Task Leader FORTH)
The task will produce the reasoning mechanisms that will enable semantic-based decision support. These will exploit the concise representation of knowledge along with context-related information in order to support the efficient knowledge interpretation according to specific goals. This task will provide the necessary reasoning tools to enable the data analysis in WP6 and WP8

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
2	FORTH	18.00
3	USAAR	2.00
	Total	20.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.1	Requirements analysis for semantic core ontology	2	4.00	R	PU	4
D4.2	Extension of the semantic core ontology	2	4.00	R	PU	24
D4.3	Technical evaluation report of ontology including ontology evolution and summarization	2	8.00	R	PU	33
D4.4	Semantic reasoning utilities for decision support	2	4.00	P	PU	33
		Total	20.00			

Description of deliverables

D4.1) Requirements analysis for semantic core ontology: [month 4]

D4.2) Extension of the semantic core ontology: [month 24]

D4.3) Technical evaluation report of ontology including ontology evolution and summarization: [month 33]

D4.4) Semantic reasoning utilities for decision support: [month 33]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS041	Initial proposal for the semantic core ontology	2	8	
MS042	Definition of the mapping formalism	2	12	
MS043	Query rewriting and data translation	2	12	
MS044	Ontology evolution & summarization (Initial version & evaluation)	2	19	
MS045	Semantic reasoning utilities for decision support (initial version)	2	15	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP5	Type of activity [54]	RTD
Work package title	Models & repositories		
Start month	3		
End month	36		
Lead beneficiary number [55]	4		

Objectives

This work package focuses on the development of clinically-oriented repositories that will cover the needs of the MyHealthAvatar project. This involves the development of:
a repository of models of special biomechanisms and tumour growth and response to treatment.
a data repository of multiscale data exploitable by the models.The aforementioned repositories will be tailored to the needs of the project. At the same time they will be generic enough to be usable by several different medical scenarios.

Description of work and role of partners

T5.1 Development of the model repository: PM3=>PM36 (Task Leader: ICCS)
The MyHealthAvatar model repository will be built based on the experience already accumulated during the implementation of the Tumor (Transatlantic TUmour MOdel Repositories) project.
The aforementioned model repository will permanently host models and tools developed within the framework of other EC funded research projects, such as ACGT (Advancing Clinicogenomic Trials on Cancer), ContraCancrum (Clinically Oriented Cancer Multilevel Modeling), Tumor and P-Medicine (From data sharing and integration via VPH models to personalized medicine), which will be adapted and extended as necessary
For each model the model repository will contain all the related information, including: descriptive information, input and output parameters, different versions of binaries depending on the target computational environment etc.
T5.2 A data repository for models: PM3=>PM36 (Task Leader: ICCS)
A data repository will be built to support the model repository, based on the experience already accumulated during the implementation of other data repositories, such as the ones developed within the framework of p-Medicine and ContraCancrum. This data repository will be used to support the multiscale cancer models stored in the model repository. The work will be carried out in conjunction with USAAR, who will provide clinical data (e.g. nephroblastoma), BED, who is responsible for providing the data collection utilities, and FORTH, who provides the architectural support. In addition, the commercial experience of ASTRID will be valuable for the preparation of future exploitation.
The repository will permanently host all the model-related medical data produced or collected by the project. This data will not be derived directly from the clinical environment, and they will have passed though the necessary de-identification and (pheudo)-anonymization processes.
The relevant medical data for each citizen/patient include clinical data, imaging data, histological data, therapy data etc. The involved data types will be imaging data (DICOM etc), descriptive/structural data (age, sex etc), values (blood glucose etc.), documents (diagnoses etc.), other files (histological reports) etc.
T5.3 Integration with the security framework: PM7=>PM36 (Task Leader: ICCS)
In order to ensure that only authorized persons have access to the content of the data and the model repositories, appropriate authentication and authorisation mechanisms will be implemented, according to the directives of WP3.
These mechanisms are required for a) the secure storage of data and models and their associated information into the MyHealthAvatar repositories and b) the secure retrieval of this information by the MyHealthAvatar platform.

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BED	2.00
2	FORTH	2.00
3	USAAR	5.00
4	ICCS	29.00
5	LUH	2.00
6	ASTRID RESEARCH KFT	6.00
	Total	46.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.1	Model and clinical data repositories design	4	22.00	R	PU	12
D5.2	Model and clinical data repositories interfaces & evaluation report	4	24.00	R	PU	36
		Total	46.00			

Description of deliverables

D5.1) Model and clinical data repositories design: [month 12]

D5.2) Model and clinical data repositories interfaces & evaluation report: [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS051	Model and clinical data repository schema	4	12	
MS052	Web services for the model and the clinical data repositories	4	24	
MS053	Security of the model and the clinical data repositories	4	30	
MS054	Final integration of the model and the clinical data repositories	4	32	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP6	Type of activity [54]	RTD
Work package title	Data & repositories		
Start month	2		
End month	36		
Lead beneficiary number [55]	1		

Objectives

• to develop data collection utilities for support data contribution from users with minimal input
• to build a data repository to store health related data of individual citizens collected from the web and mobile apps.
• to experiment the Linked Data approach to facilitate the flourish and reuse of data, including data search and reasoning.

Description of work and role of partners

T6.1 Data collection utilities PM2=>PM12 (Task Leader: BED)
This task will investigate a number of data collection utilities which will collect information of individual patients without requiring a major effort from the patients themselves. We will particularly target the collection of data that holds the environmental information of the patients' life styles, diet, and other clinical related information by developing a number of tailored information extraction tools for the web and mobile apps.
More specifically, we will target information extraction from social network, which falls in the category of information extraction. We will look into existing approaches and open sources, such as ANNIE (GATE) toolkit or Apache Lucene, W4F and DEByE, etc..
Mobile apps with wearable sensors will also be developed by ANS to support the collection of health data such as blood pressure, body temperature, etc
A unified user friendly web portal (e.g. in a style of web forum) will be built as part of the integrated system for users to input these data, and the same interface will also be used for users to manage the data and also used as a forum. It will support the users to include information such as: Personal information (contacts, providers, ID on social network, etc.); Personal, family information; Personal health summary; Medications (over the counter drugs, herbals, etc.); Comments on the drug taken, Allergies and immunizations.

T6.2 Data collection from online patient diary PM13=>PM33 (Task Leader: BED)
This task will collect data from online patient diary using the utilities provided by T6.1. Volunteers will be organised to participate the research in this task. The task will continue towards the end of the project, leading to a considerable collection of information from the participants. The data will be used to demonstrate the functions of visual data analysis in WP8. As a backup plan, we have also budgeted the purchase of social media data in just case the volume of the collected data does not reach the expected level. In that case, the purchased social media data will still allow the demonstrate to take place.
We will choose two different websites and monitor each site for a period of 100 days (can be extend to 6 months if scenario requires) to collect citizen's life style, environment and activities related data. The number of data records depends on the scenario we will choose for the project. At the current stage, we aim at 20 volunteers on each web site. We will also use mobile phones to collect data (such as blood pressure, temperature and heart beat); we will use the same group of people for the same time period. By doing so, the project can demonstrate the potential of capturing large and meaningful datasets from rich resources via modern ICT technology.
We have also built into budget for the purchase of data from social networks. We expect to get data from a similar population as above however the exact number depends on the pricing on market upon purchase.

T6.3 Data repository for health information PM7=>PM36 (Task Leader: BED)
This task will build a data repository to hold health related information of individual citizens collected from T6.3, including their environmental data(life style, diet, geography environment, etc.), activities, family histories and

other risk factors, which may hold the key to the development and treatment to a lot of disease and thus highly valuable to the clinics.

T6.4 RDF data repository PM7=>PM36 (Task Leader: BED)
In this task we will build a semantic data repository based on the Linked Data approach.The existences of the links will help the data searching and processing when the users – citizen, clinician, and researchers, need them. To support the flourish of the contents in these repositories, the linked data concept will be used to organise the data. The data will be annotated using ontology defined in WP 4.

T6.5 Data reasoning PM7=>PM33 (Task Leader: BED)
This task deals with data reasoning based on the linked data in the RDF data repository. The ultimate goal of data collection is to make use of data. The linked data can help to discover inexplicit relationships between data. The data reasoning provide necessary supporting data for clinicians in diagnosis process and citizens in decision making for health related issues.
Together with semantic reasoning, the work can be linked visual data analytics in WP8 to show the usage of the data in decision supporting process. The effectiveness of these methods will be evaluation in clinical context through the demos.

T6.6 Integration with the security framework (PM7-PM36) (Task Leader: BED)
In order to ensure that only authorized persons have access to the content of the data and repositories, appropriate authentication and authorisation mechanisms will be implemented, according to the directives of WP3.

T6.7 Collection of multiscale datasets PM3=>PM24(Task Leader: FORTH)
A small but adequate for experimentation number of full scale and comprehensive datasets (images) will be collected, which will cover a range of cancer diseases, such as lung cancer, rectal cancer, endometrial and cervical cancer, etc. We will also look into the possibility of collecting perfusion imaging (T2*/T1) of brain gliomas, as well as the The value of diffusion MR imaging in histological classification of soft tissue sarcomas. We will also carry out genomic analysis of the above patients based both on blood by completing genotyping snp6 (1 million snps) for predisposition and working on targeted genotyping for predisposition re drug metabolism, and on tissues by generating gene expression profiling- afymetrix and cancer molecular mutation profiling.
This task is associated to two deliverables of data at month 9 and month 18, respectively.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BED	18.00
2	FORTH	6.00
3	USAAR	5.00
4	ICCS	4.00
5	LUH	2.00
6	ASTRID RESEARCH KFT	6.00
7	ANSMART LTD	9.00
	Total	50.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.1	A set of data collection utilities & evaluation report	1	8.00	R	PU	12
D6.2	Design for data and RDF repositories	1	8.00	R	PU	12
D6.3	Data & RDF repository & evaluation report	1	9.00	R	PU	36
D6.4	Data reasoning utilities for decision support & evaluation report	1	9.00	P	PU	33
D6.5	Initial report on data collection methods and plans	2	8.00	R	PU	9
D6.6	Final comprehensive datasets	2	8.00	R	PU	18
		Total	50.00			

Description of deliverables

D6.1) A set of data collection utilities & evaluation report: [month 12]

D6.2) Design for data and RDF repositories: [month 12]

D6.3) Data & RDF repository & evaluation report: [month 36]

D6.4) Data reasoning utilities for decision support & evaluation report: [month 33]

D6.5) Initial report on data collection methods and plans: [month 9]

D6.6) Final comprehensive datasets: [month 18]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS061	Initial collection of data	1	9	
MS062	data & RDF repository schema	1	12	
MS063	Data reasoning utilities for decision support(initial version)	1	15	
MS064	Web services for data & RDF repositories	1	24	
MS065	Security of the data repository	1	30	
MS066	Final integration of the data repository	1	32	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP7	Type of activity [54]	RTD
Work package title	Use cases (Scenarios)		
Start month	10		
End month	18		
Lead beneficiary number [55]	3		

Objectives

The objective of this WP is to build scenarios and use cases based on the user needs identified in WP2.

Description of work and role of partners

T7.1: Scenarios and use cases for MyHealthAvatar: PM10=>PM18 (Task Leader: USAAR)
This task will describe scenarios and use cases that are relevant for MyHealthAvatar. As scenarios are based on the results of WP2, this task starts at month 10 after the finalization of WP2. According to the different stakeholders (citizens, clinicians, basic researchers and IT people) scenarios and use cases will be provided for each of them.
In addition to scenarios based on WP2 and to basic scenarios as mentioned above, scenarios will be described that deal with the linkage to external sources such as social networks and research infrastructures. All scenarios and use cases will be developed in an interactive process between all beneficiaries of the project and described in a standardized way. Interoperability issues will be taken into account to allow a seamless interaction between different scenarios and to guarantee data sharing. Tools that need to be developed in those scenarios will be prioritized according to the user needs and requirements under a clinical perspective. Criteria for prioritization will be developed at the beginning of this task. This task will also define the timeframe for realization of selected scenarios within MyHealthAvatar.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
3	USAAR	9.00
	Total	9.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.1	Description of scenarios and use cases for MyHealthAvatar	3	9.00	R	PU	18
		Total	9.00			

Description of deliverables

D7.1) Description of scenarios and use cases for MyHealthAvatar: [month 18]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP8	Type of activity [54]	RTD
Work package title	Avatar centred visual analytics		
Start month	3		
End month	33		
Lead beneficiary number [55]	1		

Objectives

• To provide a set of visual analytics tools to support avatar-centred analysis
• To provide a set of display functionalities for avatar rendering

Description of work and role of partners

Task 8.1 Avatar modelling and rendering suite PM3=>PM18 (Task Leader: BED)
This task is to construct a generic avatar. The human geometry model should include a number of layers to portray human anatomy. High-resolution anatomy data from the third party will be used to build the geometric model. Also, a software suite will be provided to change the appearance by users, such as anthropometric scaling of the generic avatar, change of colours, etc..

Task 8.2 Key techniques of visual analytics for avatars PM4=>PM33 (Task Leader: BED)
Key techniques will be investigated to support visual analytics include:
1) Data/model dimension ordering techniques for the data within the avatars - the order of dimensions for high dimensional data plays a key role in visualization, which is relevant to a number of visualization techniques, such as parallel views, matrix views. A proper order of data dimensions leads to clear visual data patterns and hence supports interactive data/model pattern exploration.
2) Subspace clustering techniques for the data in avatars – data patterns often exist within a subset of the full dimension. Subspace clustering helps identify meaningful data patterns within relevant dimensions, avoiding the interference from irrelevant dimensions. An effective subspace clustering is often interactive, which allows user interaction during the search of the data patterns.
3) Feature analysis technique for the data in avatars– this plays a key role in avoiding over-plotting. It may happen spatially or temporally. Here we will be particularly interested in the uncertainty involved in the analysis. It is expected that a proper measure and visual presentation of the features will help users enhance their understanding of data structures.
4) Data fusion techniques - since the data accessible from the avatars are expected to come from different sources, combining the information from these data sets often lead to new discovery of knowledge and patterns. An appropriate visual portrayal of these heterogeneous data will offer valuable information in this aspect.

Task 8.3 A visual analytics suite for the avatars PM19=>PM33 (Task Leader: BED)
This task will focus on the work of building a visual analytics suite to support data analysis in an avatar centric view around the avatar models. The suite should support interactive data analysis through a number of visualization means:
• Data selection schemes that select relevant data according to user queries,
• Curves and histograms can be used to display data patterns,
• Parallel coordinates can be used to visualize the data attributes in high dimensions. With proper arrangements of the order of the data attribute, patterns can be explored visually.
• Matrix views can also be used to visualize data patterns,
• Couple with dimension reduction and multidimensional scaling(MDS), scatter plots can show data patterns through their distributions within the features space.
• Graph techniques and visualization will be used to explore the links between the data and their attributes. Graph processing and analysis techniques, including graph filtering and highlighting to show the subset of

interest; graph aggregation that presents the structures with hierarchical levels of details; clustering and analysis of sub-structures; identification of key nodes; analysis of nodes connections, etc.
• Coordinated views or side by side views will be used to allow comparison, for example, the data between different patients.

User interaction constitutes the key for a user centred data exploratory. Standard interaction techniques will be implemented, including selection, panning, highlighting & brushing, zoom in/out(e.g. focus & context), which will be incorporated with a number of data analysis techniques (filtering, aggregation). The focus here should be on the user, i.e. how to develop the most effective interaction techniques to support user interaction and knowledge exploration from the data.

Task 8.4: Multi-scale medical image analysis PM6=>PM27 (Task Leader: LIN)
This task will focus on developing a software toolbox that supports the analysis of multiscale medical images associated with the avatars. Overall, the toolbox will offer a range of facilities to detect and measure abnormal growths(e.g. tumours) , which will subsequently support clinically meaningful analysis, e.g. follow-up studies to evaluate the tumour response to therapy, etc.. Key techniques will be investigated to cover accurate analysis and reliable detection of a range of cancer diseases through the information available at different scales. We expect that the availability of such information will help solve many uncertain cases caused by the ambiguity of data that is often seen at a single scale. For example, the analysis of histology images will provide significant measures to reach more trustworthy decisions for the detection of abnormal structures from the images at the organ level.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BED	16.00
3	USAAR	3.00
4	ICCS	2.00
6	ASTRID RESEARCH KFT	8.00
7	ANSMART LTD	3.00
8	TEI-C	5.00
9	LIN	12.00
	Total	49.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.1	Display suite for avatars & evaluation report	1	16.00	R	PU	18
D8.2	Avatar-centred visual analytics suite & evaluation report	1	16.00	R	PU	33
D8.3	A multi-scale medical image analysis toolbox	9	17.00	R	PU	27
		Total	49.00			

Description of deliverables

WT3:
Work package description

D8.1) Display suite for avatars & evaluation report: [month 18]

D8.2) Avatar-centred visual analytics suite & evaluation report: [month 33]

D8.3) A multi-scale medical image analysis toolbox: [month 27]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS081	Avatar rendering (initial version)	1	12	
MS082	Key techniques for visual analytics (initial version)	1	18	
MS083	Visual data analysis suite (initial version)	1	24	
MS084	Key techniques for multi-scale analysis	1	15	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP9	Type of activity [54]	DEM
Work package title	Demonstration & evaluation		
Start month	19		
End month	36		
Lead beneficiary number [55]	3		

Objectives

This WP will guide the project in a way that the scenarios and use cases specified in WP7 can be demonstrated at the end of the project. This includes the following objectives:
• to describe and to the developmental process
• to test and evaluate demonstrators at each level of the development
• to demonstrate MyHealthAvatar at the end of the project at a conference

Description of work and role of partners

T9.1: Definition of demos PM19->PM21(Task Leader USAAR)
This task will define a number of demos that based on the use cases specified in WP7. These demos will need to exhibit the following factors:
1. Display of the Digital Avatar and the information (data) together with the Avatar
2. Building of the legal and ethical environment (based on WP3 and WP11)
a. Including a portal with a roles and rights management
b. Addressing Interoperability issues
c. Taking into account state of the art developments (based on WP2)
3. Realising specific scenarios for data access and collection
a. The use of the data collection utilities (i.e information extraction, mobile apps)
b. Linkage to external data/model repositories
c. Linkage to external hospital systems (e.g. EHRs).
d. Linkage to social network
4. Realising specific scenarios for clinical applications
a. Usage of the web toolbox to carry out simulation via accessing models from the model repository
b. Usage of the web toolbox to perform visual analytics tools to the data in the data repository
c. … further scenarios defined in WP7
Each demo maybe associated to a specific application or a specific tool. They will be defined within clinical context. The demos will prove the concept of MyHealthAvatar by demonstrating a clear benefits through well-defined the clinical applications.
The task will develop a flow diagram for every tool that is developed along a timeline. This diagram specifies responsibilities and timeframes for each step of development. There will be a close cooperation with task 9.2 to get feedback for the development at each step according to the results of usability and evaluation.
T9.2: Developmental process of demonstrators: PM19=>PM36 (Task Leader: BED)
This task will develop all the defined demos from T9.1 based on the technical outcomes from WP3,4,5,6,8. Also, the outcome of WP11 will ensure a legal and ethical environment of the Avatar. From an IT perspective the development of the environment including the 4D Avatar and tools as results of scenarios and use cases need to adhere to typical standard procedures:
1. Development of Mock-ups
2. Evaluation of Mock-ups by end-users according to usability criteria
3. Feedback to IT developers and change of Mock-ups in an iterative process
4. Development of the tools
5. Testing and evaluation of tools by end-users in an iterative way
T9.3: Usability and evaluation of scenarios and use cases to be realized: PM25=>PM36 (Task Leader: USAAR)

This task will deal with the usability and evaluation of scenarios and use cases developed for MyHealthAvatar. From a user perspective usability of the environment and the scenarios/use cases is of utmost importance. According to the developmental process as elaborated in task 9.1 demonstrators will be shown at every step of the developmental process. At the end of the project those scenarios that are defined in WP7 will be demonstrated in a full functioning version (Task 9.3). Considering the user needs as described in WP2 this task will define evaluation criteria and monitoring procedures to be executed by specific user groups. Specific workshops will be held for usability tests at each step of development.

T9.4: Demonstration of MyHealthAvatar: PM31=>PM36 (Task Leader: USAAR)
At the end of the project MyHealthAvatar will be demonstrated at a conference for the public. This task will closely cooperate with WP10 (Dissemination & Exploitation) and will organize the above-mentioned conference. Stakeholders from patient groups, clinical societies, basic research, legal and ethical communities, industry and politics will be invited.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BED	17.00
2	FORTH	12.00
3	USAAR	18.00
4	ICCS	10.00
5	LUH	5.00
6	ASTRID RESEARCH KFT	5.00
7	ANSMART LTD	6.00
8	TEI-C	2.00
9	LIN	4.00
	Total	79.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D9.1	Definition of the demos	3	14.00	R	PU	21
D9.2	Development of demonstrators	1	25.00	R	PU	36
D9.3	Report on the clinical acceptability and evaluation of MyHealthAvatar and future recommendation	3	20.00	R	PU	36
D9.4	Demonstration of MyHealthAvatar	3	20.00	R	PU	36
		Total	79.00			

Description of deliverables

D9.1) Definition of the demos: [month 21]

D9.2) Development of demonstrators: [month 36]

D9.3) Report on the clinical acceptability and evaluation of MyHealthAvatar and future recommendation: [month 36]

D9.4) Demonstration of MyHealthAvatar: [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS091	Demo of MyHealthAvatar (initial version)	1	30	

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP10	Type of activity [54]	OTHER
Work package title	Dissemination & exploitation		
Start month	1		
End month	36		
Lead beneficiary number [55]	4		

Objectives

• to inform all internal and external stakeholders about the project results and the implications that these results might have for the research, clinical and industrial users;
• to communicate the availability of the technology to potential users and to import the technology into suitable application domains.

Description of work and role of partners

T10.1 MyHealthAVATAR Web-site and dissemination materials: PM1=>PM36 (Task Leader: ICCS)
During the first months of the project, a project web presence will be designed and created. It will form part of Biomed Town, which already plays host to a significant number of VPH projects. The website will be continually updated during the project and will serve as the first point of information for the research community on the objectives, approaches and results of MyHealthAvatar.
The Dissemination Committee will co-ordinate a “Dissemination Toolkit” which will include the project logo, some illustrative images and movies free of copyright, a popular science description of the project results, a project flyer, PowerPoint presentations and any other material that could be useful for dissemination. This material will be regularly updated throughout the project and the latest version will always be accessible to partners on a private part of the MyHealthAvatar website. These generic dissemination resources will be complemented by materials aimed at specific dissemination targets related to research, clinical practice and industrial applications. By the end of the project, we expect to have a dissemination portfolio that can address issues relevant to all key stakeholders worldwide.
T10.2 Publications: PM1=>PM36 (Task Leader: ICCS)
All participants will regularly take part in international scientific discussions. The results will be relevant to technological, scientific and clinical journals and conferences and to trade magazines.
All partners will help to select events and channels through which the project will be disseminated and will contribute to a Dissemination Plan, the first draft of which will be produced at PM12. This will continue to be revisited and updated under the leadership of the Dissemination Committee for the remainder of the project. It will be the duty of the Dissemination Committee to promote within the consortium specific actions that should be targeted jointly by several participants.
The Dissemination Committee will also regularly post news, announcements and events related to MyHealthAvatar on the main Biomed Town pages and will transmit such information to the VPH-NoE for inclusion in their dissemination channels. They will also organise press releases at appropriate points in the project.
T10.3 workshop: PM25=>PM36 (Task Leader: BED)
We fully recognise that the best way of convincing application scientists to adopt the technology is to provide them with an opportunity to try it and see what performance benefits, the adoption of the MyHealthAvatar outcomes can bring.
In the later stages of the project, early versions of the software will be made available to selected scientists with relevant specialisms, who may be interested in using it. We will also run a workshop which will provide training and an opportunity for scientists to investigate the My Health Avatar benefits for themselves. Our preference would be to run this within the annual VPH conference organised by the VPH-NoE (subject to the agreement of the organisers).
T10.4 Exploitation: PM19=>PM36 (Task Leader: ASTRID)

Partner 6 (ASTRID) will co-ordinate the activities on exploitation, and will work closely with all partners to identify, as early as possible, any exploitation scenarios, additional to those mentioned in this proposal, that may emerge during the project. A Consortium Agreement will be drawn up and agreed before the start of the project, and this will specify the procedures and IPR management strategies to be followed to ensure maximum exploitation of the project outcomes.
A preliminary exploitation planning report will be prepared, circulated within the consortium for comment. The first formal version is delivered at PM24. Exploitation will continue to receive attention throughout the final year of the project, including possible identification of possible early adopters or third parties that may be necessary in a deployment scenario, culminating in a Business Plan to be delivered in PM36, following the circulation of drafts amongst the partners during months (PM25-PM36).
The exploitation activities will also be carried out by through the utilisation of projects results to create new projects of the industrial partners.
In addition, some basic intellectual property rights (IPR) can be established:
• The contributing member owns the IPR, with respect to any existing intellectual property (background IP) brought into the project.
• If background IP is required to exploit new knowledge generated in the framework of the project, the interested parties may negotiate for commercial rights to the background IP.
• The IPR regarding any new knowledge, generated in the framework of the project as a result of cooperative activity, is jointly owned by the members contributing to this knowledge.
IPR may be secured through patenting by the members responsible for the invention.
Notably, both exploitation and IPR issues will be supported by the research in WP11.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BED	1.00
2	FORTH	1.00
3	USAAR	1.00
4	ICCS	6.00
5	LUH	1.00
6	ASTRID RESEARCH KFT	9.00
7	ANSMART LTD	1.50
8	TEI-C	0.50
9	LIN	1.00
	Total	22.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D10.1	External project website	4	4.00	O	PU	3
D10.2	Dissemination plan	4	4.00	R	PU	12
D10.3	Workshop for dissemination	1	4.00	O	PU	33
D10.4	Exploitation plan	6	5.00	R	PU	24
D10.5	Business plan	6	5.00	R	PU	36

WT3:
Work package description

List of deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
		Total	22.00			

Description of deliverables

D10.1) External project website: [month 3]

D10.2) Dissemination plan: [month 12]

D10.3) Workshop for dissemination: [month 33]

D10.4) Exploitation plan: [month 24]

D10.5) Business plan: [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments

WT3:
Work package description

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

One form per Work Package

Work package number [53]	WP11	Type of activity [54]	RTD
Work package title	Ethical and IPR		
Start month	1		
End month	36		
Lead beneficiary number [55]	5		

Objectives

• Reviewing and analyzing the European and relevant national legislation on data protection, data security and ownership of (personal) data in reference to the data generated and processed within the project;
• Doing a survey on strengths and weaknesses of the European data protection framework in supporting the patient to keep control about their personal medical information in the MyHealthAvatar-scenario;
• Illustrating the impact of intellectual property on ownership of data processed in a 4D-Avatar and its software
• Creating legal and ethical guidelines concerning the use of the final platform; and
• Serving as a legal/ethical helpdesk for the project

Description of work and role of partners

Task 11.1 The legal and ethical framework PM1=>PM24 (Task Leader: LUH)
This workpackage starts with a detailed analysis of the existing European and national rules concerning data security and privacy protection as far as they are relevant to MyHealthAvatar. The outcome of this task will be a definition of the legal and ethical framework of the project in concreto. Furthermore it will define the legal and ethical framework and guidelines for patient-specific computer-based models in general. The framework will be revised after year 2 of the project in order to cover modifications necessary in the development of the project.
Task 11.2. Survey on strengths and weaknesses of the European data protection framework in supporting the patient in scenarios like MyHealthAvatar PM13=>PM24 (Task Leader: LUH)
This task will produce a survey among relevant European stakeholders (patient organizations, regulatory authorities, researchers) on the current situation and necessary steps in order to foster the development of digital avatars in the best interest of the individual patient. The outcome will help European legislators to understand where data protection regulation supports and where it hinders the development of patient-centred health information in electronic format.
Task 11. 3. Understanding the Legal and IPR regime in MyHealthAvatars PM25=>PM30 (Task Leader: LUH)
A health-avatar putting the patient into its centre triggers the question who might be seen as the owner an or (at least) decider on the data processed in the avatar. Is it the patient or the doctor or the hospital? Who has the responsibility and liability for the correctness of these data and who is entitled to independently decide on their exploitation or deletion?
The task will show that data protection is not the only legal framework of relevance but that issues of intellectual property (on data, software, algorithms and concepts) is of equal importance. Within this task the procedures of collecting, saving and sharing data from third party social networks (Facebook, Twitter, etc.) and related projects will be analyzed both from a privacy and an intellectual property perspective. The outcome will not only steer the consortium but will also consist of policy-related recommendations for the European research community how to share date more efficiently in the best interest of the patient.
Other legal and ethical issues that may arise in the data collection, repository of the avatars will also be investigated, such as the legal issues regarding connecting the avatar to hospital records, to external data/model warehouses, data sharing among avatars, data sharing from individual avatars to support biomedical research.
Task 11.4 Defining the rules for the exploitation of the platform after the project's end PM25=>PM36 (Task Leader: LUH)
This task will cover the data protection and intellectual property rules that need to be obeyed in the exploitation phase of the project in order to guarantee compliance with the relevant legal regime.
Task 11.5 Legal and ethical helpdesk PM1=>PM36 (Task Leader: LUH)

WT3:
Work package description

The WP will serve as an internal legal and ethical helpdesk that will support the consortium in all privacy, security and intellectual property related issues upcoming within the project.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
3	USAAR	4.00
5	LUH	33.00
	Total	37.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D11.1	The ethical and legal framework of MyHealthAvatar	5	8.00	R	PU	24
D11.2	Survey on strengths and weaknesses of related European data protection framework	5	9.00	R	PU	24
D11.3	Legal and IPR-related issues in patient centred solutions like MyHealthAvatar	5	10.00	R	PU	30
D11.4	Legal framework for the exploitation of MyHealthAvatar	5	10.00	R	PU	36
		Total	37.00			

Description of deliverables

D11.1) The ethical and legal framework of MyHealthAvatar: [month 24]

D11.2) Survey on strengths and weaknesses of related European data protection framework: [month 24]

D11.3) Legal and IPR-related issues in patient centred solutions like MyHealthAvatar: [month 30]

D11.4) Legal framework for the exploitation of MyHealthAvatar: [month 36]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT4:
List of Milestones

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

List and Schedule of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS011	Kick off meeting	WP1	1	1	
MS021	Scenario based user needs and requirements are defined	WP2	3	6	
MS031	First deployment of the architecture platform	WP3	8	9	
MS032	Simulated database to experiment links with hospitals	WP3	2	12	
MS033	Deployment of a local cloud	WP3	1	18	
MS034	Web interface for toolbox	WP3	8	24	
MS041	Initial proposal for the semantic core ontology	WP4	2	8	
MS042	Definition of the mapping formalism	WP4	2	12	
MS043	Query rewriting and data translation	WP4	2	12	
MS044	Ontology evolution & summarization (Initial version & evaluation)	WP4	2	19	
MS045	Semantic reasoning utilities for decision support (initial version)	WP4	2	15	
MS051	Model and clinical data repository schema	WP5	4	12	
MS052	Web services for the model and the clinical data repositories	WP5	4	24	
MS053	Security of the model and the clinical data repositories	WP5	4	30	
MS054	Final integration of the model and the clinical data repositories	WP5	4	32	

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS061	Initial collection of data	WP6	1	9	
MS062	data & RDF repository schema	WP6	1	12	
MS063	Data reasoning utilities for decision support(initial version)	WP6	1	15	
MS064	Web services for data & RDF repositories	WP6	1	24	
MS065	Security of the data repository	WP6	1	30	
MS066	Final integration of the data repository	WP6	1	32	
MS081	Avatar rendering (initial version)	WP8	1	12	
MS082	Key techniques for visual analytics (initial version)	WP8	1	18	
MS083	Visual data analysis suite (initial version)	WP8	1	24	
MS084	Key techniques for multi-scale analysis	WP8	1	15	
MS091	Demo of MyHealthAvatar (initial version)	WP9	1	30	

WT5:
Tentative schedule of Project Reviews

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

Tentative schedule of Project Reviews

Review number [65]	Tentative timing	Planned venue of review	Comments, if any
RV 1	12	Brussels	
RV 2	24	Brussels	
RV 3	36	Brussels	

WT6:
Project Effort by Beneficiary and Work Package

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

Indicative efforts (man-months) per Beneficiary per Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	WP 9	WP 10	WP 11	Total per Beneficiary
1 - BED	6.00	0.00	8.00	0.00	2.00	18.00	0.00	16.00	17.00	1.00	0.00	68.00
2 - FORTH	1.00	4.00	9.00	18.00	2.00	6.00	0.00	0.00	12.00	1.00	0.00	53.00
3 - USAAR	1.00	9.00	3.00	2.00	5.00	5.00	9.00	3.00	18.00	1.00	4.00	60.00
4 - ICCS	1.00	0.00	2.00	0.00	29.00	4.00	0.00	2.00	10.00	6.00	0.00	54.00
5 - LUH	1.00	0.00	0.00	0.00	2.00	2.00	0.00	0.00	5.00	1.00	33.00	44.00
6 - ASTRID RESEARCH KFT	1.00	0.00	4.00	0.00	6.00	6.00	0.00	8.00	5.00	9.00	0.00	39.00
7 - ANSMART LTD	1.00	0.00	2.00	0.00	0.00	9.00	0.00	3.00	6.00	1.50	0.00	22.50
8 - TEI-C	0.50	0.00	10.00	0.00	0.00	0.00	0.00	5.00	2.00	0.50	0.00	18.00
9 - LIN	1.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00	4.00	1.00	0.00	18.00
Total	13.50	13.00	38.00	20.00	46.00	50.00	9.00	49.00	79.00	22.00	37.00	376.50

WT7:
Project Effort by Activity type per Beneficiary

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

Indicative efforts per Activity Type per Beneficiary

Activity type	Part. 1 BED	Part. 2 FORTH	Part. 3 USAAR	Part. 4 ICCS	Part. 5 LUH	Part. 6 ASTRID	Part. 7 ANSMART	Part. 8 TEI-C	Part. 9 LIN	Total
1. RTD/Innovation activities										
WP 2	0.00	4.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00
WP 3	8.00	9.00	3.00	2.00	0.00	4.00	2.00	10.00	0.00	38.00
WP 4	0.00	18.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00
WP 5	2.00	2.00	5.00	29.00	2.00	6.00	0.00	0.00	0.00	46.00
WP 6	18.00	6.00	5.00	4.00	2.00	6.00	9.00	0.00	0.00	50.00
WP 7	0.00	0.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00
WP 8	16.00	0.00	3.00	2.00	0.00	8.00	3.00	5.00	12.00	49.00
WP 11	0.00	0.00	4.00	0.00	33.00	0.00	0.00	0.00	0.00	37.00
Total Research	44.00	39.00	40.00	37.00	37.00	24.00	14.00	15.00	12.00	262.00
2. Demonstration activities										
WP 9	17.00	12.00	18.00	10.00	5.00	5.00	6.00	2.00	4.00	79.00
Total Demo	17.00	12.00	18.00	10.00	5.00	5.00	6.00	2.00	4.00	79.00
3. Consortium Management activities										
WP 1	6.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1.00	13.50
Total Management	6.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	1.00	13.50
4. Other activities										
WP 10	1.00	1.00	1.00	6.00	1.00	9.00	1.50	0.50	1.00	22.00
Total other	1.00	1.00	1.00	6.00	1.00	9.00	1.50	0.50	1.00	22.00

WT7:
Project Effort by Activity type per Beneficiary

Total	68.00	53.00	60.00	54.00	44.00	39.00	22.50	18.00	18.00	376.50

WT8:
Project Effort and costs

Project Number [1]	600929	Project Acronym [2]	MyHealthAvatar

Project efforts and costs

Beneficiary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs	
1	BED	68.00	353,602.00	4,000.00	72,600.00	255,720.00	685,922.00	512,721.00
2	FORTH	53.00	254,400.00	0.00	36,059.00	221,328.00	511,787.00	361,400.00
3	USAAR	60.00	330,000.00	4,000.00	25,000.00	213,000.00	572,000.00	394,800.00
4	ICCS	54.00	297,000.00	4,000.00	26,840.00	194,303.00	522,143.00	386,007.00
5	LUH	44.00	242,000.00	0.00	22,000.00	158,400.00	422,400.00	310,200.00
6	ASTRID RES	39.00	117,000.00	0.00	23,000.00	84,000.00	224,000.00	174,000.00
7	ANSMART LT	22.50	112,500.00	0.00	14,000.00	75,900.00	202,400.00	144,800.00
8	TEI-C	18.00	45,000.00	0.00	8,000.00	31,800.00	84,800.00	61,920.00
9	LIN	18.00	72,000.00	0.00	14,960.00	52,176.00	139,136.00	101,152.00
Total		376.50	1,823,502.00	12,000.00	242,459.00	1,286,627.00	3,364,588.00	2,447,000.00

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It cannot be changed unless agreed so during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

53. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

54. Type of activity

For all FP7 projects each work package must relate to one (and only one) of the following possible types of activity (only if applicable for the chosen funding scheme – must correspond to the GPF Form Ax.v):

• **RTD/INNO =** Research and technological development including scientific coordination - applicable for Collaborative Projects and Networks of Excellence

• **DEM =** Demonstration - applicable for collaborative projects and Research for the Benefit of Specific Groups

• **MGT =** Management of the consortium - applicable for all funding schemes

• **OTHER =** Other specific activities, applicable for all funding schemes

• **COORD =** Coordination activities – applicable only for CAs

• **SUPP =** Support activities – applicable only for SAs

55. Lead beneficiary number

Number of the beneficiary leading the work in this work package.

56. Person-months per work package

The total number of person-months allocated to each work package.

57. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

58. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

59. Milestone number

Milestone number:MS1, MS2, …, MSn

60. Delivery date for Milestone

Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

61. Deliverable number

Deliverable numbers in order of delivery dates: D1 – Dn

62. Nature

Please indicate the nature of the deliverable using one of the following codes

R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

63. Dissemination level

Please indicate the dissemination level using one of the following codes:

• **PU =** Public

• **PP =** Restricted to other programme participants (including the Commission Services)

• **RE =** Restricted to a group specified by the consortium (including the Commission Services)

• **CO =** Confidential, only for members of the consortium (including the Commission Services)

• **Restreint UE =** Classified with the classification level "Restreint UE" according to Commission Decision 2001/844 and amendments

• **Confidentiel UE =** Classified with the mention of the classification level "Confidentiel UE" according to Commission Decision 2001/844 and amendments

• **Secret UE =** Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

64. Delivery date for Deliverable

Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date

65. Review number

Review number: RV1, RV2, ..., RVn

66. Tentative timing of reviews

Month after which the review will take place. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

67. Person-months per Deliverable

The total number of person-month allocated to each deliverable.

PART B

COLLABORATIVE PROJECT

Table of Contents

B1. CONCEPT AND OBJECTIVES, PROGRESS BEYOND STATE-OF-THE-ART, S/T METHODOLOGY AND WORK PLAN

B1.1 Concept and project objective(s)

The risk, development and treatment of many major diseases such as cancer, neurological and cardiovascular diseases are affected by a great number of individual factors, such as genetic components, age, lifestyle and environment. For example, the growth of cancer is closely related to diet, smoking and alcohol consumption. Often, many of these individual factors exhibit a strong dynamic and temporal nature. Consequently, **long-term and consistent** data collection of these factors could be particularly useful for supporting individualized prediction and treatment of patients. Moreover, the collection of copies of such individual data across many individuals would lead to a huge and comprehensive population data resource, which would offer extremely valuable input to clinical research for new knowledge discovery.

European healthcare systems have been subject to a long and complex history of independent evolution among many different countries. As a result, the picture is highly fragmented with differences between member states, regions, and even between hospitals within the same country. So, from the perspective of the individual patient, maintaining a clinical record in a consistent manner is difficult, and the problem is being exacerbated by the increased population movement within Europe. The number of European countries with a positive migration balance, meaning more people enter than leave the country, has grown over the last decades. In many cases, the size of net migration determines whether a country has population growth or is entering a stage of population decline[POP]. This situation poses as a threat to the provision of high quality healthcare services, and this is particularly true for the prediction and treatment of major and long-term diseases (e.g. cancer) where a consistent record of individual patients is of great importance. To this end, information collection, access, sharing and analysis have become a key to the problem that we are all facing in Europe.

The rapid progress of computing power and ICT technology offers great potential for addressing challenges in information access, collection, sharing and analysis for new knowledge discovery, and has led to a huge amount of valuable data becoming available on the web. These newly available technologies grant us unprecedented opportunities to support next-generation healthcare in tackling, among other things, the ageing population and the impact of its growth on the numbers of patients suffering from chronic diseases. The VPH initiative has led to the collection and integration of predictive models and heterogeneous data to interpret and predict the progress of diseases and the effectiveness of treatments, which have laid down the foundation for new knowledge discovery. However, access to these resources for clinically meaningful use remains a largely unresolved problem[HUN11].

This proposed research will design and establish **MyHealthAvatar**, a solution that offers access, collection and sharing of long term and consistent personal health status data through an integrated **digital representation** *in silico* environment, which will help to deliver clinical analysis, prediction, prevention and treatment tailored to the individual citizen.

What is MyHealthAvatar?

The MyHealthAvatar project is a research and demonstration action, through which the feasibility of an innovative representation of the health status of citizens for future healthcare – **4D MyHealthAvatar,** will be studied. A 4D avatar is a unique interface that will allow data access, collection, sharing and analysis by utilizing modern ICT technology, overcoming the shortcomings of the existing resources in Europe, which is highly fragmented. It will become **the citizen's lifelong companion**, providing long-term and consistent health status information of the individual citizen along a **timeline** representing the citizen's life, starting from birth. Data sharing will be encouraged, which will potentially provide to an extensive collection of population data to offer extremely valuable support to clinical research. The avatar will be equipped with a toolbox to facilitate clinical data analysis and knowledge discovery. This initiative is shown in **Figure 1.1a**.

As a proof of concept, the project will build a test system, featuring the following properties:

P1) Information collection and access. The 4D avatar will function as an interface to support the collection of, and access to, the complete medical information relating to individual citizen's health status, gathered from different sources, including medical data, documents, lifestyle and other personal information, represented along a timeline. Also, it is an interface to access integrated predictive computer simulation models which foresee the growth of the disease and the effect of treatment. The system has:

P1.1) Internal data repositories to store individual data for the avatars
P1.2) An internal model repository to store models commonly used by all the avatars.
P1.3) Links to external sources, such as hospitals' Electronic Health Records (EHRs) and other data and model repositories.

A range of modern ICT techniques will facilitate the data collection and information access, including:

P1.4) Information extraction from the web and data collection using mobile apps;
P1.5) Semantics and linked data to support the data/model searching and reasoning.

P2) Data management and sharing, which will be controlled by the individual citizens. They will decide how the data is shared by stakeholders. MyHealthAvatar will be a tool that allows highly self-motivated data management and user-centred data collection, supported by the necessary data integrity measures. The citizens will have full rights to share their own data. For example, the avatar data can be shared with physicians for clinical treatment, with research organisations to support clinical research, or with other individual patients on a volunteer basis. These will be supported by the underlying ICT architecture, which will have adequate measures to ensure data reliability and integrity.

P3) Information analysis using an integrated ICT toolbox, which will be a vehicle by which medical professionals can augment their clinical knowledge with heterogeneous information from the avatar for clinical decision making and knowledge exploration. It will offer significant assistance to doctors by:

P3.1) displaying related information in a body-centric view around the avatar.

P3.2) allowing simulation via access to the model repositories **(P1.2)**, supported by the computing resource that will be provided by the architecture.

P3.3) performing visually assisted data analysis (i.e. visual analytics) to extract clinically meaningful information from the heterogeneous data of individual/shared avatars, such as the patterns of symptoms, experience of treatments, medicines, self care guidelines, risk factors etc..

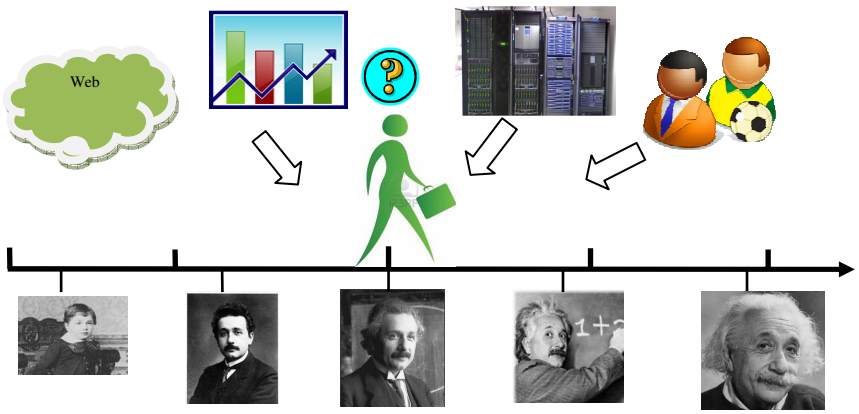


Figure 1.1a MyHealthAvatar: A life companion for heath and personal information collection, access, sharing and analysis

The consortium strongly believes that healthcare should not only care for patients but also look after the health and wellbeing of citizens. It needs to be applied to healthy people by maintenance of a

healthy lifestyle and the notification of early symptoms. Hence, MyHealthAvatar targets both healthy citizens and patients. Hence, in the remainder of the proposal, the terms citizen and patient will be used interchangeably.

What are the benefits?

By integrating digital health information access at a global scale, MyHealthAvatar is expected to meet many common demands from the VPH community and from the highly diverse European healthcare systems. These demands are evidenced by a number of analysis documents produced by very different sources[HUN11]. The most explicit benefits that match the initiative of VPH include:

- **Personalised** – The avatar is a highly individualised metaphor. The information accessible from the avatar is expected to be a life-long record of the individual citizen that offers an useful input to doctors and helps them to carry out personalised healthcare for individuals and groups (women, children, etc);
- **Predictive** – The integrated ICT toolbox of the avatar system will offer the power of predictive diagnosis and treatment through access to the predictive models and data analysis tools. The use of these tools will show the quantified progress of the patient and promote a better modulation of treatment and a faster recovery. These are expected to improve the reliability, repeatability and timeliness of medical decisions and interventions.
- **Integrative** – The integrated ICT toolboxes will allow access to a set of integrative models, data analysis tools and a comprehensive collection of datasets to support clinical decisions. The integrative approach will allow the clinicians to take into account multiple aspects that are influential to health, addressing the complexities in diagnosis, prognosis and treatment selection from the rising number of patients with multiple morbidities.
- **Affordable** – MyHealthAvatar features the adaptation of a range of latest ICT technology with the aim of improving the effectiveness of the systems and enhancing patient engagement. This will provide a new dimension in healthcare and will enhance the sustainability of healthcare systems for dealing with challenges such as the increasingly ageing population in Europe.

As a result of this ageing of the population, healthcare and associated social welfare costs are growing exponentially and they will soon become unsustainable unless we change the way in which people are supported. In many cases, there is a need to shift medical care from institutions to the home environment. To this end, ICT tools are being proposed and studied to reform the traditional ways in which medical data are recorded, tested and analyzed, without in any way reducing its quality. MyHealthAvatar will make it possible to set up new interactions between doctors and patients to maintain the quality and intensity of treatment at a more sustainable cost.

MyHealthAvatar can be viewed as a personal bag carried by individual citizens throughout their lifetime. It is a companion that will continually follow the citizen and will empower them to look after their own health records. This fits well into the recent trend of developing patient-centred healthcare systems.

MyHealthAvatar can also help resolve some legal and ethical issues in data sharing. Information and data sharing between different institutions across Europe is a huge challenge involving extremely complicated legal and ethical problems. To this end, it is much easier to let individual citizens manage their own data and to determine how and where it is exposed and shared for clinical and other purposes. Therefore, MyHealthAvatar strikes a good balance between the individual and society conflict.

MyHealthAvatar supports an infrastructure to maximise the yield of biomedical research expenditure through integrated models and data. It supplies healthcare providers with ICT capacity in terms of integrating the patient information into a coherent entity, which will subsequently offer medical professionals and researchers an interface for the access of a large set of patient information through the sharing of the avatar data, and for blending information with extreme heterogeneity, including those from different data sources, different models, organ systems, space-time scales and modalities. Notably, MyHealthAvatar takes advantage of recent ICT advances in the integration of

simulation models, semantic and data reasoning and visual analytics technology within a cloud-based architecture in order to target effective information collection, access, analysis and new knowledge discovery.

A recent survey from healthcare leaders has supported the initiative of a uniformed representation of patient record [PWC10] – 85% of healthcare leaders surveyed said making Electronic Medical Records (EMRs) available would make their healthcare systems more efficient by reducing duplication. There is currently a lack of integrated information on patients for legal and financial reasons, and this makes it impossible to allocate incentives properly.

S&T objectives

MyHealthAvatar project is a research and demonstration action, through which the feasibility of a new digital representation of the health status of citizens will be studied and demonstrated. As mentioned above, the 4D avatar is an innovative digital representation of health status that is designed to act as a lifelong companion of citizens. It features an underlying architecture that supports the access, collection and sharing of a set of long-term records and information of individual patients, and the provision of an ICT toolbox for simulation and data analysis to support clinical decisions from medical professionals. This is not provided in existing healthcare systems. We expect that the experience of MyHealthAvatar will meet individual citizens' desires for transparency, individualization, recognition, respect, dignity, and empowerment of choice[DON11]. In addition, the voluntary data exchange and sharing of the avatars will, over time, create a huge resource of population-based information that will greatly support new knowledge discovery in biomedical research.

The consortium believes that the key to the success of this digital representation is to promote user (i.e. clinician and patient) engagement with the system by supporting easy access to valuable information from a wide range of data sources and requiring minimal user effort in data collection through the use of modern ICT technology and a suitable infrastructure. Thus, within the scope of this feasibility study, we will aim at achieving a number of specific objectives, including:

O1) user requirements, use case and scenario analysis, which identify the specific user needs of the avatars;

O2) a technical study of an ICT system to support the MyHealthAvatar properties (**P1-P3**), which will be under continual evaluation in the clinical context and which will deliver a tested prototype suitable for widespread demonstration;

O3) investigation of the legal and ethical aspects of the avatars;

O4) developing an understanding of clinical acceptability, cultural barriers and risk factors associated with use of the avatars;

O5) recommendations for the expansion of the concept and further implementation in the future;

O6) dissemination and exploitation of the results to influence the future development of healthcare systems.

The technical objective (**O2**) is designed to provide a proof-of-concept of the MyHealthAvatar properties (**P1-P3**) outlined in Section 1.1. **Table 1.1a** gives the details of the breakdown of **O2** and the measureable outcomes.

Table 1.1a Breakdown of Objective 2 and its Measurable Outcomes

No.	Objective Breakdown	Targeted Property	Measurable Outcomes
2.1	Internal data repositories which store individual data for the avatars	**P1.1**	Creation of physical data repositories
2.2	An internal model repository which store models	**P1.2**	Creation of a physical model

	commonly used by all the avatars.		repository
2.3	An architecture that allows the access of information from a range of external sources, e.g. individual hospital records, and other data/model repositories, and also supports data management, transfer, security and sharing controlled by individuals	**P1.3, P2**	The testing results of the links with all of the data and model repositories, and of the data management functionality, etc.
2.4	ICT utilities that support data collection, including web information extraction and mobile apps;	**P1.4**	The testing results of the ICT utilities
2.5	ICT techniques to support data search and reasoning, including semantics and linked data approach	**P1.5**	The testing results of the ICT techniques
2.6	Visual representation of the avatars in multi-layer geometries and colours to support a body(anatomy) centred visualization of health status data	**P3.1**	The testing results of the visual representation of the avatars
2.7	Simulation functionalities within the ICT toolbox through the access of model repositories and computing resources provided by the architecture	**P3.2**	The testing of the simulation functionality in the ICT toolbox
2.8	Visual analytics within the ICT toolbox that offers valuable information blending and analysis from heterogeneous data sources	**P3.3**	Testing results of the visual data analysis functionality in the ICT toolbox
2.9	Design and evaluation of demos in clinical context.	**P1-P3**	The evaluation of the demos

B1.2 Progress beyond the state of the art

1.2.1 Progress beyond the state of art

The "**Digital Patient**" initiative has started to create influence on the VPH community. A number of VPH projects have started the movement in this direction by creating a digital patient road map and by supporting data sharing infrastructures. The most relevant projects include Discipulus[Discipulus], which is a support action for producing a roadmap for the future of Digital Patient, VPH Share[VPH-Share], P-Medicine[P-Medicine], ACGT[ACGT] and Tumor[TUMOR], of all which have shown a high level of interest in data sharing, owing to the importance of data in VPH research. However, to our knowledge, **the research work involved in these projects do not focus on the collection of and access to a long term and patient specific information from the patients' perspective to support individualised healthcare.**

In fact, the general concept of using digital avatar as a personal health information centralization service is not revolutionary – it has been proposed in a number of similar systems. Typical examples include the 3D Avatar from IBM[IBM], HealthVault from Microsoft[VAU] and Google Health[GHEALTH]. Notably, while clear needs on services for health information centralization have been identified, these existing systems have only shown limited impact on the current healthcare. Especially, Google had decided to stop further development on Google Health on 1st Jan, 2012. A lot of analyses have been carried out on its failure[KGOO], which have come up with a number of conclusions, including:

- U.S. health-care providers' failure to share data across institutions, or make it easy for patients to obtain it – by *MIT Technology Review, David Talbot.*

- Lack of standardized ways to move data around in the health system - by *Dr. Kenneth Mandl, an associate professor at Harvard Medical School, physician and researcher in the informatics program at Children's Hospital Boston, and co-founder of the open-source project Indivo.*
- Google Health fell short as an "apps" platform. Contrast it with the iPhone platform (the AMA site has some apps available for the Apple iPhone, iPad and iPod Touch on the AMA iTunes store. Patients can store, carry and share their critical medical information (i.e. medications, allergies, emergency contacts, etc.) in one secure place – by *Dr. Kenneth Mandl*.
- Patient-centred health information technology will undoubtedly be a pillar in the health system. It also stated that social component to the user experience may be a key ingredient in the system – by *Dr. Kenneth Mandl*..
- In terms of system design, the work should be done from both ends of the system. From the bottom, there need to be standardized, easy ways for gathering data in. On the top there should be apps creating a seamless experience for the user. For example, the patients' effort to input and access of information and records stored in the system should stay as minimal as possible – by *Dr. Kenneth Mandl*.
- We should let patients individually and collectively have copies of their health data after encounters, — copies that are in compatible to the electronic format, and uses technologies of Facebook and the iPhone – by *Dr. Kenneth Mandl*.
- Also, close attentions need to be paid to lessons from the barriers in the adoption of EHRs in hospitals, which can be expressed in terms of start up and maintenance cost, training cost and implementations, etc..[EHR]

What is new in MyHealthAvatar?

In summary, **a key lesson from these previous practices is the lack of engagement and popularity from the healthcare professionals and patients**. To overcome this, MyHealthAvatar consortium regards the promotion of public (i.e. clinicians and citizens) engagement as the key to the success. We believe that the public involvement can only been promoted if they receive tangible benefits through the use of the avatars. These tangible benefits include allowing data collection with minimal user efforts; providing useful toolkits for clinical supports, etc.

Fortunately, modern ICT technology offers the capacity to achieve these benefits. Indeed, today's ICT technology such as Internet, visual analytics and mobile phones that facilitate distance communication, information access, analysis and sharing is expected to play a substantial role in future healthcare. Within the context of MyHealthAvatar, the latest ICT is used to promote user participation by providing the means of highly automatic data collection and by offering useful prediction and analysis tools.

To this end, the main contribution of MyHealthAvatar can be summarized as follows:

- A citizen centred avatar that promotes self-engagement of citizens

MyHealthAvatar will be designed as **a life time companion of citizens rather than as just a patient avatar**. The data accessible through the avatar interface will be in a more comprehensive context beyond the scope of clinical data – it will include a life time collection of patient life style and other environmental data in addition to the clinical data. Such a completed life record is expected to add extremely useful values to clinical assessments and decision making.

MyHealthAvatar will increase patient empowerment. It is motivated by the growing attention of the self-engagement of patients and the availability of modern ICT in the promotion of clinical information gathering and exchange. In fact, there is a growing attention on the self-engagement of patients in the future healthcare. Patients are expected to play more significant roles in the future of healthcare. This observation is confirmed by an in-depth large-scale global survey[PWC10] over 500 global health leaders, ranging from ministers of health, pharmaceutical companies and doctors' organizations to health insurance funds and hospitals and over more than 3500 consumers. The survey has identified increased patient roles in healthcare, for example, more people make decisions

concerning their healthcare on information found on websites (48%) than on information provided by their doctors (43%); 71% of health leaders surveyed said that making integrated information available to patients would make them more efficient due to the enhanced self-management; Most of those surveyed believe that patients should be responsible to EMR and have more access to information about their health and the care available for managing their own health; Patients need to take responsibility on themselves and will need to be communicated with in a way that involves them in the entire process, so that 'shared' decisions can be made; Patients should receive their healthcare in place where they believe will benefit them, rather than this choice being controlled by a public body. These finding have led to a range of activities to promote patient awareness and participation, including "Know Your Won Health"(KYOH)[KYOH], patient centred care[PCC, CAM10, CAM11, IAP11], etc.. To support the data storage, the avatar system will build data repositories.

- Innovative ICT to support data collection, search and reasoning

Data collection is one of the keys to the success of the proposed avatar. Since this requires active involvement of the patients, the input of the data needs to be as much effortless as possible. To this end, MyHealthAvatar will utilise the latest ICT technology for data gathering and information searching. Mobile phone techniques will be also used to collect the data from patients.

In fact, the web is a huge source of information. Making use of this information source will support the enrichment of the data collection. Surveys show the popularity of Internet among the community - 80% of patients actively seek information related to their health problems on the Internet (e.g. Dr Google [DRGOO]). The figures, reported in a Porter Novelli (EuroPNStyles) survey, showed that an astonishing 65% of those questioned chose to surf the net when they want to know the answer to a medical query, compared to 43% who ask their doctor, and just 27%who look for information via television programmes. Research also suggests many patients are actively involved in Internet discussions to discuss their health status[LOR02, AMS09], and social innovations (such as social networking) and technological innovations will create new ways to provide patients with support.

Hence, the Internet resource is an effective means of engaging users in terms of attracting their input. MyHealthAvatar will employ the latest techniques in web information extraction (IE or WI) for information gathering from social network and other websites in a semi-automated way. In particular, we will mainly focus on information extraction from the social media as a novel way for data collection. Exponentially increased amount of valuable information is buried in social networks nowadays owing to their ever growing popularity. There are rich evidences to show that social media has provided more valuable data than news in the last 3 years[TELE] . Connecting to the social network is also an ideal way to engage users who are willing to provide their information through the networks. Due to the constant user engagement, the information extracted from the social network is often more completed and up to date. In fact, researchers have started to extract the data from the social media for healthcare[LUG11].

In addition, to support data reuse and to flourish the collection of highly diverse data, the latest technology of ontology and the Linked Data approach[BIZ09] will be adopted. The former supports semantic interoperability among the data and semantic reasoning, and the latter follows the similar mechanism of web document collection and supports rapid increase of data population and the subsequent data search and data reasoning by effectively forming a web of data through the build of a RDF repository. The **Web of Data** is a relatively recent effort, whose main objective is to generate a web exposing and interlinking data in a way such that it is directly amenable to automated processing. It was proposed by the inventor of WWW - Tim Berners-Lee[BIZ09], and has already achieved considerable success in many areas since its birth not a long time ago.

- Useful toolbox to support clinical analysis

MyHealthAvatar also features a toolbox, which will benefit the clinicians and patients by allowing the integration of clinical knowledge with visual data analysis tools and computer simulations for the prediction of diseases growth and treatments and for clinical knowledge discovery. The popularity of the avatar will only be gained if the system provides useful tools. If the tools provided by

MyHealthAvatar can bring clear benefits, the number of participants is expected to climb up quickly. To achieve this, a model repository is needed.

- ICT infrastructure to support data access, management, sharing and security

MyHealthAvatar will be supported by modern ICT architecture to allow data management, sharing and data security. A cloud architecture will be sought to provide the benefit from the latest ICT technology in terms of providing secured data storage and access and powerful computing capability. Also, a solution for a local cloud for avatar will also be studied, which will make use of computing facilitates within the model/data hosting organizations to support data analysis for the avatars without the need to transfer the data remotely.

Further, we will look into a proof of market on an open source API for MyHealthAvatar. Open sources have achieved a great success with numerous successful stories, such as iPhones, Android, Linux and Open Office. It has been regarded as a good strategy to flourish results through active public engagement. There is a potential for MyHealthAvatar to follow this strategy by creating a set of APIs to support data collection, data reasoning and visual analytics. This proof of market will be conducted as a market research. Conclusion and recommendations will be given for the future work in this direction.

- Close work involving patients

The project will involve patients and evaluate the tools in a spiral way to optimize the tools according to the needs of patients. MyHealthAvatar has legal and ethical framework that people can trust. They do know what happens with their data. The project has no commercial interest in selling data.

In summary, MyHealthAvatar **follows recommendations from relevant VPH activities on "Digital Patient" [Discipulus, VPH-Share, HUN11]**. It is designed as an integrated facility that allows multiple functionalities rather than just a data storage facility as in the previous attempts[VAU, GHEALTH]. The distinctive features include:

- ICT utilities to support data collection with minimal user input, including web information extraction, mobile apps, etc.
- ICT toolbox to support clinical decisions by using simulation models and by using visual analytics.
- Data and model repositories to provide rich resources of data and models
- Ontology and RDF repositories to support data search and reasoning.
- A cloud based ICT architecture that allows the access of data from a range of different sources, and integration of the repositories, the toolbox and the ICT utilities.
- A local cloud solution to support the computing requirement for the avatars without remote data transfer.
- A proof of market on open sources for MyHealthAvatar APIs

Also, we will keep a very close eye on the clinical acceptability issues. Two separated WPs are designed for user needs and use cases led by the clinicians. The demo will also be led by the clinicians, with full reports on clinical acceptability, evaluations and future recommendation from the clinical perspective.

1.2.2 Project Baseline and Performance Indicators

The initiative of MyHealthAvatar is to test the feasibility of creating a life time companion for citizens to facilitate their healthcare. In fact, electronically recording personal health information via a central service has been the initiative of several projects, such as 3D Avatar from IBM[IBM], HealthVault from Microsoft[VAU] and Google Health[GHEALTH]. While such a centralization service to store health data of citizens has a great potential in healthcare, its applicability has encountered significant difficulties – see **Section 1.2.1** for detailed discussions. To overcome these barriers**, MyHealthAvatar will adapt the initiative and achievement from these existing projects as its**

baseline, and will make significant progress beyond the state of the art by experimenting a number of ICT tools and data repositories for the purpose of promoting public engagement. **The performance evaluation in clinical context towards these individual tools and repositories and towards their integrations into the avatar system constitutes the performance indicators.** More specifically, these include:

- ICT utilities to support data collection with minimal user input, including web information extraction, mobile apps, etc. In particular, we will mainly focus on information extraction from social media as a novel way for data collection. Mobile phone techniques will be also used to collect the data from patients.

  It is beneficial to use information extraction and mobile apps to allow for data collection to the data repository dynamically along a timeline with minimal user efforts. Both social network and intelligent mobile phones are supported by the latest technology and they have a huge number of participants and customers. It is expected that connecting the 4D avatars to these facilities will significantly increase the level of participation from public, which will be the key to the success of MyHealthAvatar.

- Easy access of data and models through repositories, which provide rich resources of data and models. To support data reuse and to flourish the collection of highly diverse data, the latest technology of ontology and the Linked Data approach[BIZ09] will be adopted.

  The model repository will contain highly advanced cancer models developed through many VPH projects. These will offer valuable insights to the cancer prediction and treatment for the users. The repository will be designed in a general purpose suitable for any predictive models.

- Modern ICT architecture to allow data management, sharing and data security. A cloud architecture will be sought to provide secured data storage and access and powerful computing capability. The cloud based architecture will lay down the foundation and allow high information security and effective integration of different components of the avatar to achieve high performance. Also, links to external sources will be explored together with the standardization issues.

- ICT toolbox to support clinical decisions by accessing models, by using visual analytics and by using data searching and reasoning utilities, which will benefit the clinicians and patients by allowing the integration of clinical knowledge with visual data analysis tools and computer simulations for the prediction of diseases growth and treatments and for clinical knowledge discovery.

  With combined power of the top-down and bottom-up approaches, MyHealthAvatar will endeavour for data/model reuse by generating a web of data/models, which will subsequently support reasoning. The reasoners will be created by both approaches. Upon the combination with visual analytics, these will become useful tools for knowledge interpretation and analysis.

  Uncertainty-aware visual analytics will be investigated beyond the state of the art. The work will address the uncertainty inherent in the data accessible from the avatars, as well as the technical scalabilities. It will provide an interactive data analysis tool to support data analysis and fusion of information from different sources for clinical analysis and knowledge discovery.

B1.3 S/T Methodology and associated work plan

1.3.1 Overall strategy and general description

To demonstrate the initiative of MyHealthAvatar for the concept of “Digital Patient”, we will need to cover the objectives described in Section **1.1**. **Figure 1.3a** shows the overall strategy of the project along a timeline.

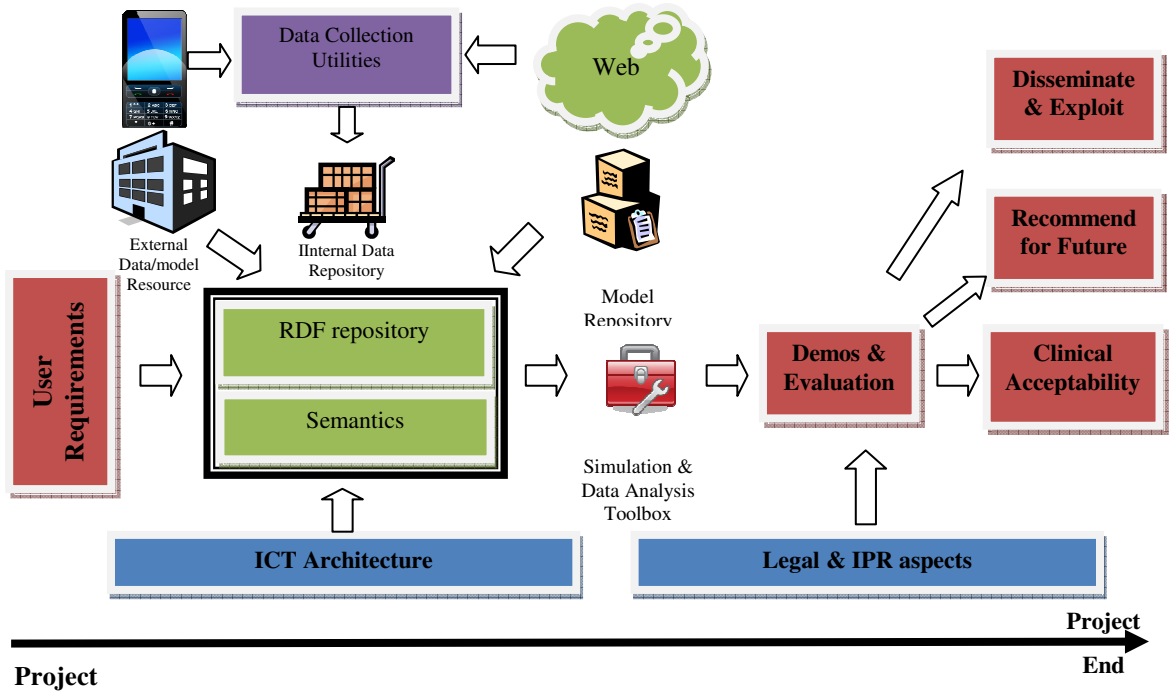


Figure 1.3a Illustration of overall strategy and timeline. The key components of the work include: 1) user requirements – *objective 1*; 2) Internal data repositories and an internal model repository – *Objective 2.1-2.2;* 3) ICT architecture that support data access to internal and external resources and data management – *Objective 2.3*; 4) Data collection utilities – *Objective 2.4*; 5) Semantics and RDF repository to support data search and reasoning – *Objective 2.5;* 6) Simulation and data analysis toolbox – *Objective 2.6, 2.7 and 2.8;* 6) Demo & evaluation – *Objective 2.9*; 7) Investigation of the legal and IPR aspects of the avatars – *Objective 3;* 8) Understanding of clinical acceptability – *Objective 4;* 9) Recommendations for the future work – *Objective 5* ; 10) Dissemination and exploitation of the results to influence the future healthcare system – *Objective 6*

In a brief summary, the work will start from the investigation of user requirements from clinical perspectives(**Objective 1**), which will be used as important reference for the practical work. Data repositories will be built for internal storage of the avatars (**Objective 2.1**). Model repositories will also be built to support model access. The data collection for the internal storage will be supported by the data collection utilities (**Objective 2.4**). In addition to the internal data storage, the avatar will also have access to external resources, such as data and model repositories, which will be supported by the underlying ICT architecture(**Objective 2.3**).

The abovementioned data and model access will be facilitated by the introduction of semantics and linked data approach, leading to a RDF repository to support data search and reasoning (**Object 2.5**). Based on the access of data and models, the toolbox that supports simulation and visual data analysis for clinical application can be realised (**Objective 2.6-2.8**).

The demos will be designed and demonstrated for clinical evaluation of the concept (**Objective 2.9**), based on which the conclusions on clinical acceptability(**Objective 4)** will be drawn, future recommendation (**Objective 5**) will be given and dissemination and exploitation (**Objective 6**) will take place.

Notably, an investigation of all the legal and IPR aspects that may arise under the envisaged implementation of the avatars will also be implemented (**Objective 3**).

The work will be organized along the timeline. All the techniques will progressively evolve towards the end of the project. Significant milestones will be achieved around the mid-term of the project, which will support the organization of the final demos. A first version of the demos will be ready at month 30 as a milestone, which will lead to the final demo.

The envisaged MyHealthAvatar needs to reply on a number of issues, each of which exhibits a certain level of risk. Most of the partners within the consortium have been working together in a number of previous projects. The experience of joint work significantly helps reduce the risk.

Architecture

The definition of the architecture entails always the risk that some important stakeholders concerns are not captured that has implications in the implementation and the deployment of the system. The most important such concern relates to the protection of the sensitive patient data, the patients' anonymity, and the access control. The general contingency plan in these concerns is to follow an iterative, agile approach in the system definition and building, where the requirements are revisited and appropriate correcting actions are taken if needed. The consortium as a whole has a lot of experience from different perspectives (technical, clinical, legal), which guarantees the close monitoring of the realization of the MyHealthAvatar platform.

Model repository

The models involved in MyHealthAvatar will come from existing VPH projects, such as Tumor, ContraCancrum, ACGT and P-Medicine. Although the use of these models will be subject to the clearance of legal issues, we expect **low** risk to this end. This is because all the models are for the use of research (hence reuse is encouraged). Many partners in this project are involved in these related projects. The involvement from LUH(who is also involved in many of these projects) will offer great help in the legal and IPR aspect.

Data repositories

For the clinical data repository(WP5), the data will mainly come from the abovementioned VPH projects. Therefore it will be handled in a similar manner to the model repository. In case that the data to be collected from other projects is not enough, literature mining will be extensively applied in order to collect pertinent data form published work. The latter could at least be applicable in the generic simulation context.

For the second data repository(WP6), the risk is two-fold. On the technical side, the risk to build the repository is **low**, due to the significant experience of the partners from similar tasks. On the other side, attracting participants in the trial is a challenge. Although the partners are well experienced from the previous projects in getting volunteer participants, it is hard to predict the level of participation. More discussions to cover this are given below in **Engaging to the public**.

Data collection utilities

The main technical risk in developing the data collection utilities is the web information extraction. Technically, information extraction is still a largely unsolved problem. However, recent research interest in this area has significantly pushed the bar forward. With well-identified key words from ontology(through the work in WP4), and a considerable number of open sources available, it is reasonable to expect that we should be able to execute information extraction with a certain level of automation. The availability of APIs from Facebook and Twitter largely eases this problem. Overall, we classify the risk as **medium to high** in this aspect. The contingency plan is to allow human interventions at different levels as a backup to a fully automatic extraction.

Semantic interoperability and linked data

The consortium is well experienced in this area with a lot of supports from the previous projects. The main task is to adapt the results from the previous projects (by combing and extending) under the new settings to support the innovation in MyHealthAvatar. Therefore, the risk is **low** solely from the technical perspective. The development will go through several iterations to reduce the risk.

Visual analytics

The risk of the work on avatar rendering is **low** as the techniques are all available. The challenge to the work on visual analytics is **considerable high**, as the issues on uncertainty visualization and scalability are all among the key challenges in visual analytics. However, there are a lot of resources available to support the research in this direction, which significantly reduces the risk. A lot of

alternative techniques and routes are available for contingency. Experiences show that the success of many visualization tasks largely depends on the collaboration between the visualization and application experts. Working closely together and constant communications between the visualization team and the data providers will help reduce the risk significantly.

Engaging to the public

Notably, one of the major initiatives of MyHealthAvatar is to get public participation. However, significant efforts will still be expected during the project development stage to make MyHealthAvatar known to the public. To reduce the risk, the consortium will work closely together to overcome the barriers by various means, such as a wide dissemination approach to publicise the project, contacting alternative participant lists, etc.. Also, as a backup plan, we have also budgeted the purchase of social media data in the case if the volume of the collected data does not reach the expected level. In that case, the purchased social media data will still allow the continuation of the project. The data purchase approach also simplifies potential ethical issues.

Links to external resources

For the data warehouses from other VPH projects, we do not see major problems, as many partners are already involved in these projects. The presence of LUH will help clear the legal and IPR issues. For organizations like hospitals, it is not possible to build a link with them in the scope of this project due to the complexity of legal issues. However, the issues of building a link with hospitals will be studied as a topic and recommendation will be given to the future work.

Clinical evaluation and acceptability

Integration of ICT with clinical knowledge is always a challenge in VPH projects. The technical partners will work very closely together with the clinical partner(USAAR) to maximise the clinical acceptability in the work. In fact, 2 work packages have been designed to allow for a progressive development of clinical requirement and scenarios. Alternative routes will be made available in case of difficulties. The previous collaborations between the partners in many projects will help ease the problem.

Also, a Beta version of the demos will be ready prior to month 30 as a milestone, which will allow early test on the entire system from the clinical partners and leave sufficient time for the handling of feedbacks.

Legal and IPR issues

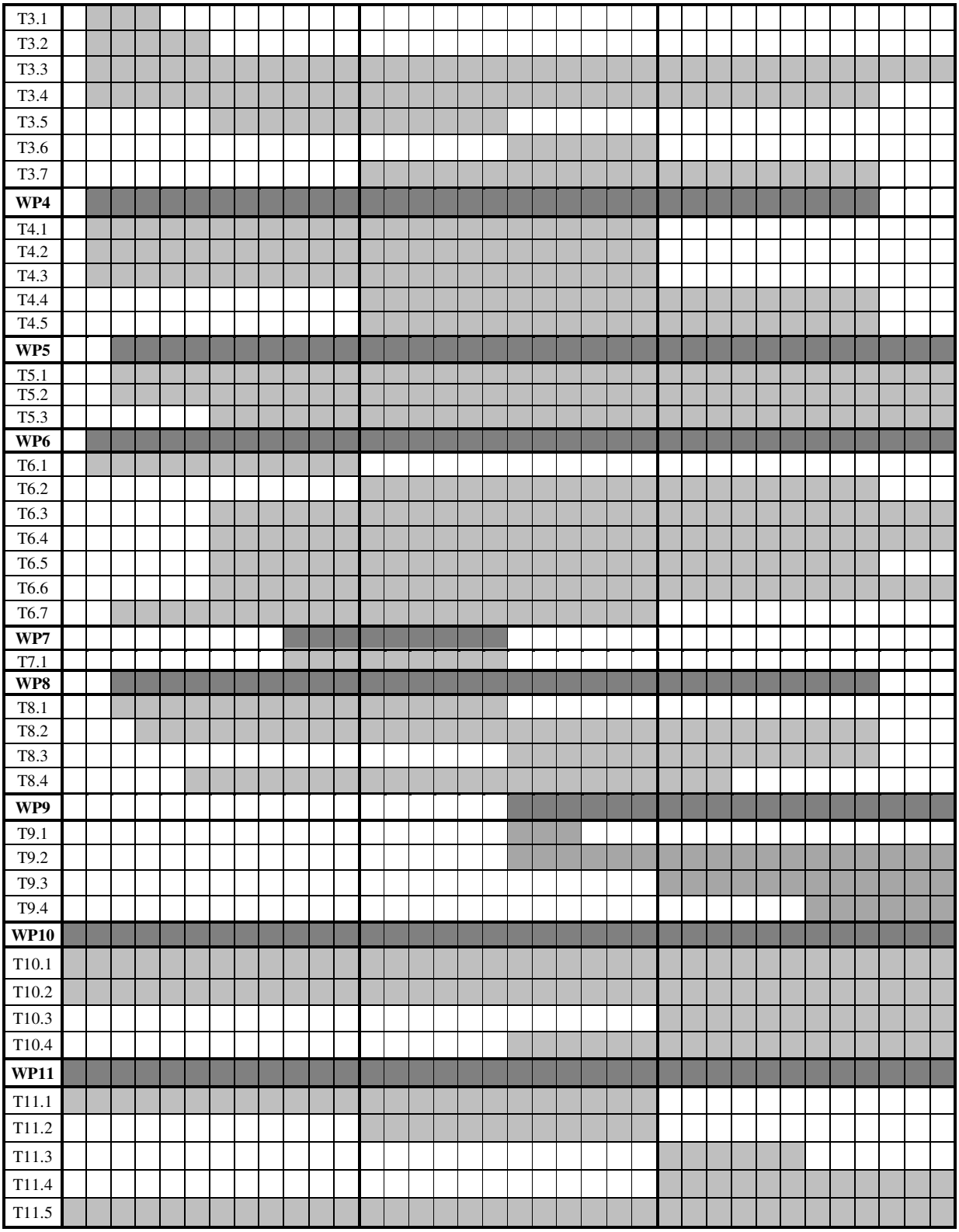
The ethical and legal issues and related research will be handled by LUH, who is an experienced partner in handling legal issues in VPH projects. Also, most of the partners have participated a number of VPH projects and have already developed a good knowledge in handling these issues. Therefore the overall risk is **low**.

More discussions on the contingency plan for the project implementation are presented in **Section 2.1**.

1.3.2 Timing of work packages and their components

There are totally 11 work packages (WP), which are designed to collectively achieve the project objectives as stated in **Section 1.1**. All the details of the WPs are given in **WT3**. The **Gantt Chart** is also provided below.

WP	Year 1												Year 2												Year 3											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
WP1																																				
T1.1																																				
T1.2																																				
WP2																																				
T2.1																																				
T2.2																																				
T2.3																																				
WP3																																				


T3.1
T3.2
T3.3
T3.4
T3.5
T3.6
T3.7
WP4
T4.1
T4.2
T4.3
T4.4
T4.5
WP5
T5.1
T5.2
T5.3
WP6
T6.1
T6.2
T6.3
T6.4
T6.5
T6.6
T6.7
WP7
T7.1
WP8
T8.1
T8.2
T8.3
T8.4
WP9
T9.1
T9.2
T9.3
T9.4
WP10
T10.1
T10.2
T10.3
T10.4
WP11
T11.1
T11.2
T11.3
T11.4
T11.5

B2. IMPLEMENTATION

B 2.1 Management structure and procedures

Project Management is concerned with the co-ordination of project activities, assessment and evaluation of the overall performance of the project; delivery and assurance of final products; monitoring of resource use; management and allocation of budget, coordinating the external image of the project and liaison with key stakeholders, addressing and resolving issues related to IPR, conflict management and resolution as well as management of the relationship with the European Commission (EC).

The management framework will link all project components and maintain communication with the EC, ensuring that the project fulfils its goals through the successful completion of its individual WPs and tasks. A specially constituted Project Office (PO) will be set up with access to dedicated central resources of the coordinating institution covering a range of skills (e.g. administrative, legal and financial management). All of the activities within this section will be covered in more detail in the Consortium Agreement.

2.1.1 Management organisation

Managing MyHealthAvatar is a very challenging task, not only for guaranteeing the successful completion of the project, but also for ensuring that the developed translational models fully match the VPH needs. The general management organisation is schematically presented in **Figure 2.1a**.

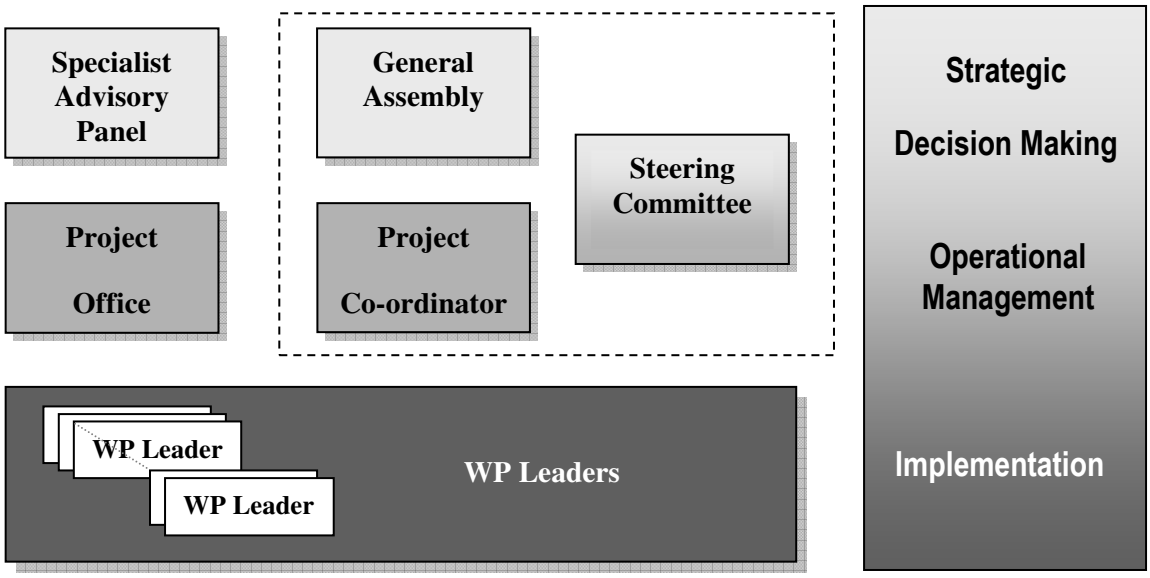


Figure 2.1a. Project Management Structure

MyHealthAvatar will be coordinated by two decision-making bodies: the **General Assembly (GA)** and the **Steering Committee (SC)**, which will work closely with the **Project Co-ordinator (PC).**

The **General Assembly** is the ultimate decision-making board of the Consortium; it is in charge of setting policy and strategic decision making and will normally meet ***once per year***. The GA will be chaired by the PC or a senior executive appointed by the PC and all partners shall be entitled to nominate one voting representative. The GA will be the main legislative body of the project, and its decisions will be binding on all partners. It shall have decision-making powers in all fundamental questions of project execution, such as:

- approval and review of the project's progress
- the main strategy of the consortium to achieve the project's objectives

- modifications and adaptations of the work plan and decisions affecting the Consortium Agreement
- all budget-related matters and major exploitation issues
- conflicts that cannot be resolved in the SC and actions with regard to a defaulting party
- nomination of the Specialist Advisory Panel members
- proposals for the review and/or amendment of the terms of the EC contract.

The **Steering Committee** will be the supervisory body for the project execution. Membership of the SC will consist of the PC (BED), one representative elected from, respectively, the partners. The SC will report to the PC and the GA under the conditions provided in detail in the Consortium Agreement. The SC will supervise all WPs and will react to issues that emerge in the day-to-day project execution. The role of the SC is to be a versatile and rapid decision-making instrument that can deal with conflicts within the consortium and initiate activities related to innovations made by the project and intellectual property. It will also supervise and assess the dissemination/exploitation activities of the project.

The SC will be responsible for monitoring project progress, agreeing suitable quality measures and dealing with dissemination and everyday exploitation issues. It will have decision-making power in subordinate technical issues, such as deciding on the management of the project and technical roadmaps with regard to the project and crucial issues and conflicts arising in the day-to-day work.

Furthermore, the SC will prepare issues for discussion and make proposals for the decisions of the GA. It will meet at least quarterly, generally by tele- or video-conference, though emergency SC meetings can be called if circumstances demand or by request of one of the project partners.

A **Specialist Advisory Panel (SAP)** will be established to provide advice and support in the proper management and co-ordination of the project. The panel will have an advisory role only. External advisors will review key results and progress reports and will give a written feedback. In addition, they are expected to open doors for the dissemination of the project in their domains. The members of the panel are expected to have specific technical expertise or a special interest in the VPH and therefore provide DIGITAL AVATAR with valuable feedback/comments for successfully translating the results of the project into clinical and industrial practice. The SAP will meet once per project year in combination with the annual project meetings and include approximately 3 external experts nominated by the GA.

The **PC** will act as intermediary for the project with the European Commission (EC) and will ensure that the projects fulfils all of its contractual obligations and that it performs all necessary duties, as required by the EC. The PC will direct the project execution and will report to, and be accountable to, the SC (which, in turn, will report to, and be accountable to, the GA) under conditions to be set forth in the Consortium Agreement. The PC is responsible for the high-level management of the project and for ensuring that its strategic intent is carried out, as agreed by the partners and according to the objectives agreed with the Commission. Specific responsibilities include:

- being the official point of contact with the EC and the contract signatory for the contract with the EC
- chairing the SC and GA (including agenda setting and production of minutes)
- preparing regular management and closure reports as required by the contract
- managing the delivery of contract deliverables and major project milestones
- being the point of contact for conflict resolution
- establishing efficient internal management and control procedures, including budgets.

The **PO** will be set up at partner BED, which has long experience of co-ordinating EC projects, and will support the PC in co-ordinating all project activities and organising GA meetings. It will perform daily project management for the SC and PC and will organise the reporting activities to the EC. It will also manage the documents produced by the consortium during the project by using and providing suitable IT tools for the partners. It will monitor the progress and the quality of the work by reviewing respective documents such as deliverables and reports and reporting to the PC and SC. It

will be responsible for involving the central services of the coordinating institution in matters of administrative, contractual and financial management. Specific responsibilities include:

- establishing the infrastructure (monitoring mechanisms, circulation of guidelines, analytical accounting system) for the project administration and developing the project management guidelines
- supporting the evolution of the work-plan (time-plan of the tasks, critical tasks)
- advising the SC & PC for monitoring the activities and the allocation of manpower.
- supporting the meetings of the project's committees and major plenary meetings (preparation, agenda, circulation of minutes, presentations and proceedings).
- handling the financial aspects of the project (checking effort, resources in regular time segments)
- helping the PC to make the regular management reports and to organise the annual Project Review.
- ensuring the effectiveness and accuracy of the project's internal information services.

The **Work Package Leaders (WPLs)** are responsible for the proper execution and organisation of the tasks in their respective WPs to achieve the objectives of that WP. They will report regularly to the PO, the PC and the SB. In particular, they will immediately make known serious problems that must be solved at a higher management level. WPLs will be responsible for the coordination, monitoring and technical decision making of their respective WPs as long as the technical work in the project is not affected as a whole. This will create a decentralised coordination and decision-making structure, which will facilitate successful project completion. In some WPs, it may be useful to install also a **Task Leader (TL)** for particular tasks; the TL will have the same responsibilities as the WPL and will report to the WPL.

The decision-making bodies aim to make decisions built on consensus, with the Chair suggesting a consensus route, if necessary. If consensus is not accomplished, each member of the body has a vote on the decision. Decisions will be by simple majority, with the Chair having a casting vote in the case of a tie. The detailed rules for decision-making and project management will be laid down in the Consortium Agreement.

2.1.2 Reporting and management mechanisms to ensure quality

The project will start with a Kick-Off Meeting to be held at the site of the PC and, at the end of each project year, plenary Project Meetings will be called, within which formal GA meetings will be held. SC meetings will be held quarterly and sub-meetings, possibly at a WP level, will be organised on an irregular basis, according to the needs of the project.

Before the project commences, the consortium members will sign **a formal Consortium Agreement (CA)** in which roles, responsibilities, and mutual obligations will be defined. These will include questions of intellectual property rights[1] (IPR) and the structure and organisation of the project. It will adopt the recommended guidelines laid down by the Commission and will include:

- specific arrangements concerning IPR to be applied among the participants and their

[1] The IPR policy will be in line with Directives adopted by the European Union concerning IPR issues, such as:

- Council Directive 91/250/EEC of 14 May 1991 on the legal protection of computer programs;
- Council Directive 92/100/EEC of 19 Nov. 1992 on rental right and lending right and on certain rights related to copyright in the field of intellectual property
- Council Directive 93/98/EEC of 29 Oct. 1993 harmonising the terms of protection of copyright and certain related rights;
- Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases;
- Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society;

affiliates, in compliance with the general arrangements stipulated in the contract
- management of knowledge generated by the project, and rules for knowledge transfer
- the internal organisation of the consortium, its governance structure, decision-making processes, reporting mechanisms, controls, penalties and management arrangements
- arrangements for the distribution of the EC contribution among participants and among activities
- rules for partners joining and leaving the consortium
- provisions for the settlement of disputes within the partnership.

To ensure the quality of the project execution and project results (besides some basic provisions and rules laid down in the CA), the SC will prepare guidelines to define, in depth, the following aspects:

- quality measures for the technological development and rules for assessing deliverables and milestones
- definition of project standards (templates, guidelines) and specification of rules for publications
- rules for reporting, communication and interaction within the consortium
- rules to respect gender equality at all levels of the project.

For efficient reporting, the PO will set-up standard management reporting templates for the management of the programme. All WPs will confirm the Project Milestones with the PO and all WPs currently active will provide the PO with an informal report on a monthly basis. The report will cover the achievement of milestones against plan and completion of agreed WP deliverables, programme dependencies between the WPs and their status, comparisons of resources utilised against those budgeted and risks/ issues that may prevent delivery on time, to cost and to quality.

At 6-monthly intervals, the PO will consolidate formal reports of all WPs and all partners and produce a project-wide consolidated report, which will be reviewed by the SC before submission to the EC.

A project website will be created at the start of the project and this will include a secure archive into which all documents and deliverables relevant to, or produced by, the project will be placed. Access will be provided to relevant parts of it for the Project Officer and the EC Reviewers.

The project reporting mechanism will include the following.

- *Fact Sheets.* Every three months, a Fact Sheet will be prepared by each partner containing a table with the effort spent on each WP in the last quarter and a list of activities in that quarter.
- *Work Package Management Reports.* For ongoing WPs, the WPL will compile a Work Package Management Report every 3 months, containing the main activities and achievements, delays, problems, meetings, etc., in the reporting period.
- *Project Management Reports.* The PO will compile an overall Project Management Report from the Work Package Management Reports submitted by WPLs; this will be distributed among the partners and reviewed by the SC.
- *Progress Reports.* Progress Reports about the project will be prepared by the PO and issued by the SC, after review. These will be submitted to the Project Officer as project deliverables.

Conflict resolution and relationship breakdown

Decision-making processes within the consortium will aim to build consensus and avoid situations whereby the activities of one partner have adverse affects on the activities of another. In the event that disputes or differences arise that cannot be resolved, the following process will be followed.

Disputes within a WP that cannot be resolved by the relevant WPL should be referred to the PC who will attempt to reconcile the differences informally. If this does not resolve the dispute, the PC will table the issue for discussion at the earliest opportunity with the SC, if necessary at an emergency meeting.

If agreement is still not reached, the dispute will be passed to the next meeting of the GA; if the issue is particularly pressing, a special meeting of the GA will be arranged, the decision of which will be final from an internal perspective. If a partner wishes to escalate the dispute outside the consortium, the final settlement of outstanding disputes will be managed through arbitration in Brussels under the rules of arbitration of the International Chamber of Commerce by an arbitration panel appointed under those rules. The award of the arbitration panel will be final and binding upon the partners concerned. Where the dispute concerns IPR, the dispute can be elevated to the IPR Council for clarification. The decisions of the IPR Council in such matters are binding for all partners.

2.1.3 Contingency planning

All projects should try to identify possible risks and determine methods (contingency plans) to overcome them or, even better, to prevent them for the duration of the project. For this, the consortium will develop a process to identify, manage and overcome risks that may occur within the activities of all WPs.

This system will be part of the Project Management Reports, as a separate section that will refer to the "Risk Management and Contingency Plans". It will be a "live" document that will be updated throughout the project's duration; when a risk is identified, a suitable plan to overcome it will be developed.

The PO will work with each of the WPs to establish contingency plans in the event of delays in WP deliverables, reduced quality and delays between WPs.

During the project, both technical and non-technical risk will be handled by applying specific contingency plans. The PO will insist that where one WP is dependent upon another for delivery of materials, a contingency plan must be produced as part of the project set-up. This is to avoid circumstances in which decisions taken necessarily by one WP create adverse knock-on effects in another WP. Table 2.1 summarises the main risks that the consortium has identified at this stage and the possible contingencies.

Table 2.1a. Contingency planning

Risk	Contingency plan
The user requirements identified for the scenarios are not focused and/or feasible within the scope of the project.	The project will manage the user requirements process in order to ensure that expectations are realistic. It will also clearly prioritise those functions that will be essential for piloting and identify any longer term priority requirements. Partner MDST will advise to ensure high industrial and clinical relevance. The software development will be based on the Extreme Programming (XP) model, which will demand good interactions between partners and a strong and regular involvement of users in the technical development.
Conflicting expectations with regard to the Digital Avatar Concept within the consortium	In the proposal phase, it is possible that some partners have a clearer understanding of what the Digital Avatar concept is than others. As the project development is a joint effort, conflicting perceptions on this important aspect is a risk element. We have addressed this through close discussions at the proposal stage, and will further address the issue through the project management mechanisms led by the PC.
The required applications and services cannot be developed within the time and resource constraints of the project.	The target of Digital Avatar is highly ambitious and, to our knowledge, no outcome of such generality has previously been attempted. Thus, the level of resources available to complete the work is the most likely challenge when it comes to the physical design and implementation of the platform envisaged by DIGITAL AVATAR. Being aware of this, the consortium and task leaders will emphasise efficient resource utilisation and the necessity to respect the schedule of work. In extremis, one mitigation approach would be to transfer resources from other WPs or task activities. The consortium will, at the outset, prioritise the set of artefacts to be produced so that the most important will have the highest priority in resource allocation.

The application of the software fails to produce consistent evaluation feedback.	The evaluation criteria and the testing/validation plan will be extensively discussed and rigorously specified before pilot implementations begin. This means that any variations in the outcomes achieved or feedback received should provide valuable information about real differences in the potential of Digital Avatar within each of the scenarios targeted.
Conflicts within the consortium	There is always a risk that conflicts may arise inside a consortium of independent partners. Some early-phase mitigation elements include careful partner selection, with many of the partners already having worked together on multiple EC projects, the signing of a comprehensive consortium agreement, and the development of clear conflict-resolution mechanisms. During the start-up of the project, we will also emphasise team-building and clarification of goals and responsibilities. Throughout the project, monitoring of partner relations and project climate will be important, and any "brewing conflicts" will be addressed at the appropriate level of the project governance structure.
Delays and administrative oversights	The PO can expend much time and energy on eliciting the required reporting, cost statements and other administrative deliverables from project partners. This can damage the project climate and may have even more severe consequences. This risk will be reduced by establishing clear administrative procedures, appointing one person from each partner to be responsible for administrative reporting, requiring regular feedback and implementing agreed actions against partners that fail to comply with procedures.
The consortium structure is disrupted, e.g. a partner resigns or fails.	There will be strong management of the project by experienced co-ordinators, and senior management within each partner organisation has provided full assurance of their commitment to the project. In the case of partner resignation or failure to deliver, management will take swift action for reassignment of work to existing or new partners.
The addition of beneficiaries during the lifetime of the project.	The addition of new beneficiaries will be adapted by the management structure as follows: • an initial request is made to the PC. • a consortium decision is made through the GA organized by the PC • an enquiry is made to PO via the PC • a concrete plan and an initial draft of amendment are submitted to PO • a formal request is launched through NEF

B 2.2 Beneficiaries

Participant 1	**University of Bedfordshire (BED), UK**
Organisation	The University of Bedfordshire, formed in August 2006 from an amalgamation of the University of Luton and the Bedford campus of De Montfort University, now has 25,000 students. The Department of Computer Science & Technology comprises 40 academic staff and is responsible for the delivery of 20 awards. The Department regularly enrols over 500 postgraduate students on its taught Masters degrees and it has more than 50 PhD students. The Department has a strong record of international collaboration, in both research and in teaching, where it has collaborative agreements with universities in many countries. The research lab currently contains researchers of 13 different nationalities.
Main Tasks	Role: coordinator WP1, WP6 and WP8 leader, involvement in several other work packages Main tasks in the project: • Development of the data repositories and visualization techniques • Organize workshop for dissemination activities
Relevant Previous Experience	The **Centre for Computer Graphics and Visualisation** (CCGV) has undertaken research in computer graphics, computer animation and visualisation for over 20 years. It specialises in developing visualisation solutions to real-world problems and has been particularly active in the area of medical applications. It has extensive knowledge and experience of GPU algorithms through research. It has been involved in 25 internationally funded projects (including projects in FPs 4,5,6,7) over the last 14 years, 8 of these as Project Coordinator. CCGV is housed in a new,

	purpose-built lab which opened in April 2009. **Indicative Publications**: B Liu, G J Clapworthy, F Dong, *Multi-layer Depth Peeling by Single-Pass Hardware Rasterisation for Faster Isosurface Raytracing on a GPU*, Computer Graphics Forum, 29(3): 1231-1240, 2010 B Liu, G J Clapworthy, F Dong, *Fast Isosurface Rendering on a GPU by Cell Rasterization*, Computer Graphics Forum, 28(8): 2151-2164, 2009 A Agrawal, J Kohout, G J Clapworthy, N J B McFarlane, et al., *Enabling the Interactive Display of Large Medical Volume Datasets by Multiresolution Bricking*, Journal of Supercomputing, 51(1): 3-12, 2010 F Dong, G J Clapworthy, H Lin, *Rendering of Novel Views From Photographs Using Inference in Markov Random Field*, IET Electronics Letters, 45(25): 1312-1313, 2009 F Dong, G J Clapworthy, H Lin, *Contour Synthesis by Least Squares Construction*, IET Electronics Letters, 45(21): 1072-1074, 2009 X Zhao, E Liu, G J Clapworthy, *RESTful Web Service Composition: Extracting a Process Model from Linear Logic Theorem Proving*, *Proc. 7th International Conference on Next Generation Web Services Practices (NWeSP 2011)*, Salamanca, pp 398-403, October 2011 S J Zasada , T Wang , A Haidar , E Liu, N Graf, G J Clapworthy, S Manos, P V Coveney, *IMENSE: An e-Infrastructure Environment for Patient-Specific Multiscale Modelling and Treatment*, Journal of Computational Science, 2011 X Zhao, T Wang, E Liu, G J Clapworthy, *Web Services in Distributed Information Systems*, International Journal of Distributed Systems and Technologies, 1(1): 1-16, 2010 X Zhao, E Liu, G J Clapworthy, M Viceconti, D Testi, *SOA-based Digital Library Services and Composition in Biomedical Application*s, Computer Methods and Programs in Biomedicine, 2010
Staff Members Involved	**Feng Dong** is Professor of Visual Computing. He joined CCGV in September 2007 from Brunel University. Prof Dong was awarded a BSc, MSc and PhD from Zhejiang University, where he became a member of academic staff at the State Key Lab of CAD and Computer Graphics, the leading computer graphics lab in China. He has many interests within computer graphics, including medical visualisation, and image processing; his recent work has also developed new areas in texture synthesis, image-based rendering and figure animation. **Dr. Enjie Liu** is a Senior Lecturer and member of CCGV. She joined University of Bedfordshire in 2003, and before that she worked as Research Fellow at University of Surrey. She received a PhD in Communication Networks from Queen Mary University of London, and a BSc in Computer Science in China. She has previously worked on several European projects both at BED and at her previous universities. One of her main research interests is the deployment and security of web services; she will be responsible for the development of the Web Services framework. **Gordon Clapworthy** is Professor of Computer Graphics and Head of CCGV. He has a BSc (Hons, Class 1) in Mathematics and a PhD in Aeronautical Engineering from the University of London and an MSc (distinction) in Computer Science from City University. He spent a sabbatical year developing computer animation applications with Electronic Arts. He has produced 200 refereed publications. Recently, his main activity has been the development of novel visualisation algorithms for biomedical data.
Participant 2	**Foundation for Research and Technology Hellas (FORTH), GR**
Description	The Foundation for Research and Technology – Hellas (FORTH) is one of the largest research centres of Greece. The research and technological focus of the foundation is centred on selected areas of great scientific, social, and economic interest. Its high quality research results as well as its valuable socioeconomic contribution, make FORTH one of the top research centres internationally. The Institute of Computer Science (ICS) – through its Computational Medicine Laboratory - is involved in PM4PM.

Main Tasks	Role: WP3and WP4 leader, involvement in several other work packages Main tasks in the project: • Architecture and integration • Semantic interoperability
Relevant Previous Experience	The Institute of Computer Science, (ICS) was formed in 1983 and it has broad on-going R&D efforts including information systems, image processing and pattern recognition; computer vision; sensor technologies; digital communications; network management; computer architectures; human-computer interaction and biomedical informatics. ICS-FORTH maintains close links with industry and has played a major role in the development of the Science and Technology Park of Crete (STEP-C). The ICS-FORTH group involved in the current proposal is the Computational MEdicine Laboratory which is an active participant in national and international standardisation activities. It has recently been involved in several projects and initiatives related to this project, e.g. ACGT (FP6), ContraCancrum, P-Medicine, INTEGRATE, EURECA and Tumor (all as a coordinator in FP7). In these projects FORTH/CML has acted as a key technology provider focusing on architectures, semantic inter-operability, mark-up languages and implementation of tools for predictive, multi-scale models.
Staff Members Involved	**Dr Kostas Marias** is a Principal Researcher in ICS-FORTH and was previously a Researcher at the University of Oxford, where he completed his PhD in Medical Image Analysis/ Medical Physics. He was also a senior consulting scientist with the diagnostic software company Mirada Solutions Ltd. (UK), a spin-off from the University of Oxford. He has an MSc in Physical Science and Engineering in Medicine from Imperial College, UK and an Electrical Engineering Diploma from the National Technical University of Athens (NTUA). Currently he is the coordinator of 2 EC projects on cancer modelling (ContraCancrum and Tumor) and is actively involved in providing open access image analysis/modelling tools in the clinical setting for the promotion of predictive oncology. He has published more than 70 papers in international journals and conference proceedings in the above fields. **Dr Vangelis Sakkalis** is an Associate Researcher at ICS-FORTH. He has a PhD in Electronic and Computer Engineering and an MSc from Imperial College, UK. His research interests include biosignal and image analysis, visualization, classification algorithms, biostatistics and biomedical informatics and modeling. He is currently the Technical Coordinator of Tumor, has participated in numerous EU projects and has published more than 80 papers. **Mr Stelios Sfakianakis** received a BSc in Computer Science and an MSc (with highest distinction) in Advanced Information Systems from the University of Athens. He has worked on the design and implementation of an SOA for the realization of the Integrated Electronic Health Record by means of CORBA and Web Services middleware. His experience includes application, design and development using UML, distributed systems using CORBA, Web, REST and Grid Services, and the design of OWL/RDF-S ontologies and their employment in the semantics-based description of services. **Mr Georgios Zacharioudakis** has a BSc in Computer Science and an MSc in Distributed Systems and has been involved in various EU projects as a software engineer. His work concerns the integration of heterogeneous and distributed services, the design of health care telematics applications, ambient intelligence components and applications, using SOA architectures and open technologies/protocols. **Apostolos Karantanas** is Associate Professor of Radiology at the Medical School, University of Crete, and Director of the Department of Medical Imaging, University Hospital. He is the author of 140 Medline publications and several others in international conferences, 3 books, and 31 chapters in books. He is a reviewer in 15 Medline journals, member of the Editorial Board in two and has been a Guest Editor in 3 issues of medline journals. He is past President of European Society of Musculoskeletal Radiology, member of the Educational Committee of the European Association of Radiology and regular faculty member of scientific meetings organized by the International Skeletal Society, European Society of Musculoskeletal Radiology, European Society of Radiology and European Society of Magnetic Resonance in Medicine and Biology. **Dimitris Kafetzopoulos**, a principal researcher at the Institute of Molecular Biology and Biotechnology (IMBB) of FORTH, leading the research group of Post-Genomic Applications. His research interests include drug development methodologies, molecular classification using DNA microarrays and multianalyte approaches in genotyping. He has participated and coordinated

	several national and European research projects, including research contracts with the pharmaceutical industry, multidisciplinary research and technology foresight projects. In 2002, for his inventive and innovative research, he has been awarded a prize by the Greek Patent Office. He is also teaching the topics of post-genomic methodologies and management of research results at the University of Crete graduate program.
Participant 3	**Universitaet des Saarlandes (USAAR), DE**
Description	**Saarland University** has 8 faculties and provides a broad spectrum of disciplines and a strong focus on life sciences and computer science aspects. At the Faculty of Medicine (University Hospital), located in Homburg/Saarland more than 1800 people are studying medicine. There are 36 hospitals or institutions treating more than 54.000 inpatients and nearly 190.000 outpatients each year. The clinical participant from Saarland University is the **Department of Paediatric Oncology and Haematology**[2]. The research focus of the Department of Paediatric Oncology and Haematology are kidney tumours and translational research by building an infrastructure for the seamless sharing of clinical and research data in Oncology via a legal and ethical IT infrastructure.
Main Tasks	Role: WP2, WP7 and WP9 leader, involvement in several other work packages Main tasks in the project: • Identify user needs and use scenarios • Lead the demonstration activities.
Relevant Previous Experience	**USAAR** has been involved in EU Framework Programs for many years. In FP7, USAAR is/was a partner in the ACGT, ContraCancrum, CONTRACT, EURECA, TUMOUR projects, and is coordinating P-Medicine, which is a large integrated project to build an IT infrastructure for personalized medicine. Since 1989, USAAR has taken part in SIOP trials for kidney tumours and since 1994 Norbert Graf has been coordinating trials for kidney tumours in Germany. **Indicative Publications**: Manakis Georgios C, Emmanouilidou Dimitra, Sakkalis Vangelis, **Graf N**, Marias Kostas: A fully automated image analysis framework for quantitative assessment of temporal tumor changes. Proceedings of the 3rd International Conference on E-Health and Bioengineering - EHB 2011, 24-26 November 2011, Iasi, Romania Keller A. Petra Leidinger , Andrea Bauer , Abdou Elsharawy , Jan Haas , Christina Backes , Anke Wendschlag , Nathalia Giese , Christine Tjaden , Katja Ott , Jens Werner , Thilo Hackert , Klemens Ruprecht , Hanno Huwer , Junko Huebers , Gunnar Jacobs , Philip Rosenstiel , Henrik Dommisch , Arne Schaefer , Joachim Mueller-Quernheim , Bernd Wullich , Bastian Keck , **Graf N**, Jörg Reichrath , Vogel B, Nebel A, Sven Jager , Peer Staehler , Ioannis Amarantos , Valesca Boisguerin , Staehler C, Markus Beier , Matthias Scheffler , Markus W Büchler , Joerg Wischhusen , Sebastian Häusler , Johannes Dietl , Sylvia Hofmann , Hans-Peter Lenhof , Stefan Schreiber , Hugo Katus , Wolfgang Rottbauer , Meder Benjamin , Jörg Hoheisel , Andre Franke , Eckart Meese. Toward the blood-born miRNome of human diseases. Nature methods, 8:841-843, 2011 *(IF: 20.7, 2009)* Rossi S, Christ-Neumann ML, Rüping St, Buffa FM, Wegener D, McVie G, Coveney PV, **Graf N**, Delorenzi M on Behalf of the p-Medicine Consortium (www.p-medicine.eu): p-Medicine: From data sharing and integration via VPH models to personalized medicine. Ecancer 5:218, 2011; http://www.ecancermedicalscience.com/view-article.asp?doi=10.3332/ecancer.2011.218 Luis Martin, Anguita A, **Graf N**, Manolis Tsiknaki, Mathias Brochhausen, Stefan Rüping, Anca Bucur, Stelios Sfakianakis, Thierry Sengstag, Fransesca Buffa , Stenzhorn, Holger: ACGT: Advancing Clinico-genomic trials on cancer. Four years of experience. Stud Health Technol Inform 169:734-738, 2011 (IF: **Graf N:** *In silico oncology. - Part II : Clinical requirements regarding in silico oncology* In: Hrsg.: Deisboeck, Thomas S. ; Stamatakos, Georgios S.: Multiscale cancer modeling. - Boca Raton, Fla. : CRC ; London : Taylor & Francis, 2011. - (Chapman & Hall/CRC mathematical and computational biology series ; 34) , S. 437-446 Brochhausen M, Spear Andrew, Cocos Cristian, Weiler G, Martín Luis, Anguita Alberto, Stenzhorn H, Daskalaki Evangelia, Schera F, Schwarz U, Sfakianakis S, Kiefer S, Dörr M, **Graf N**, Tsiknakis M: The ACGT Master Ontology and its Applications – Towards an Ontology-Driven Cancer Research and Management

[2] www.uks.eu/kinderonkologie

	System. J Biomed Inform 44:8-25, 2011 *(IF2.432, 2009)* Georgios S Stamatakos, Eleni Ch Georgiadi, **Graf N**, Eleni A Kolokotroni, Dimitra D Dionysiou: Exploiting clinical trial data drastically narrows the window of possible solutions to the problem of clinical adaptation of a multiscale cancer model. PLOS one 6:e17594, 2011 *(IF: 4.351, 2009)*
Staff Members Involved	**Prof. Dr. Norbert Graf** is Professor of Paediatrics and Director of the Clinic for Paediatric Oncology and Haematology and a member of the Faculty of Medicine. He is the chairman of the Renal Tumour Study Group of the International Society of Paediatric Oncology (SIOP-RTSG) and the Principal Investigator of the current Trial for Kidney Tumours within SIOP. He is an Associate Member of COG (Children's Oncology Group, North America) and closely cooperating the COG Renal Study Group. He is the coordinator of P-Medicine. He has more than 25 years of experience with clinical trials.
Participant 4	**Institute of Communication and Computer Systems (ICCS), GR**
Description	The Institute of Communication and Computer Systems (ICCS) is an academic research body affiliated to the National Technical University of Athens (NTUA). It is the research host of the School of Electrical and Computer Engineering of NTUA. ICCS focuses on fundamental and applied research in information technologies, micro-electronics, communications, biomedical informatics, biomedical engineering etc. It has participated in and coordinated numerous large scale research and development projects funded by the EC in both FP6 and FP7.
Main Tasks	Role: WP5 and WP10 leader, involvement in several other work packages Main tasks in the project: • Development of the data and model repositories • Dissemination activities
Relevant Previous Experience	The *In Silico* Oncology Group (ISOG), ICCS-NTUA is a world leader in multiscale cancer modelling and the emergent discipline of *in silico* oncology and has developed, tested and disseminated several novel, clinically driven and clinically oriented simulation models. ISOG founded the workshop series "International Advanced Research Workshops on *In Silico* Oncology" and has led WPs related to *in silico* oncology in the ACGT, ContraCancrum, Tumor and P-Medicine EC-funded projects. ISOG, in collaboration with Massachusetts General Hospital/ Harvard Medical School co-organized the First Transatlantic Workshop on Multiscale Cancer Modeling, co-funded by the EC and the National Cancer Institute (NCI), US. A multi-author, transatlantic CRC textbook partly based on the workshop lectures was published in 2010/2011. **Indicative Publications**: G.S.Stamatakos, E.Ch.Georgiadi, N.Graf, E.A.Kolokotroni, and D.D.Dionysiou, "Exploiting Clinical Trial Data Drastically Narrows the Window of Possible Solutions to the Problem of Clinical Adaptation of a Multiscale Cancer Model", PLOS ONE 6(3), e17594, 2011 G.Stamatakos "In Silico Oncology Part I: Clinically Oriented Cancer Multilevel Modeling Based on Discrete Event Simulation" In T.Deisboeck and G. Stamatakos Eds 407-436 2011-01-01 CRC Press, Print ISBN: 978-1-4398-1440-6 eBook ISBN: 978-1-4398-1442-0 DOI: 10.1201/b10407-19 Boca Raton, Florida, USA, 2011 G.S.Stamatakos, E.A.Kolokotroni, D.D.Dionysiou, E.Ch.Georgiadi, C.Desmedt. An advanced discrete state - discrete event multiscale simulation model of the response of a solid tumor to chemotherapy: Mimicking a clinical study. J. Theor. Biol. 266, 124-139, 2010 D.D.Dionysiou, G.S. Stamatakos, N.K.Uzunoglu, K.S.Nikita, A. Marioli, A Four Dimensional In Vivo Model of Tumour Response to Radiotherapy: Parametric Validation Considering Radiosensitivity, Genetic Profile and Fractionation, J. Theor. Biol., 230, 1-20, 2004 G.S. Stamatakos, D.D. Dionysiou, E.I. Zacharaki, N.A. Mouravliansky, K.S.Nikita, N.K. & Uzunoglu , *In silico* radiation oncology: combining novel simulation algorithms with current visualization techniques , IEEE Proceedings: Special Issue on Bioinformatics: Advances and Challenges , 90(11), 1764-1777, 2002
Staff Members Involved	**Georgios S.Stamatakos** is Research Professor of Analysis and Simulation of Biological Systems and Leader of ISOG. He has a Diploma degree in electrical engineering from NTUA, an MSc in Bioengineering from the University of Strathclyde, UK and a PhD in Biophysics from NTUA. In 1999 he completed a postdoctoral fellowship research project on medical technology in ICCS-NTUA, being the recipient of a national research grant. The focus of his research group is on multiscale cancer modelling and *in silico* oncology. Other interests include biomathematics, bioinformatics, systems biology, systems medicine, computational bioelectromagnetics and

	biooptics. He has published over 100 papers and has led the development and clinical adaptation of several clinically driven multiscale oncosimulators within the framework of various EC projects. He is a member of the Editorial Board of Cancer Informatics. **Dimitra D. Dionysiou** has a diploma degree and a PhD in Electrical and Computer Engineering from NTUA and an MSc in Bioinformatics from the University of Athens. She has helped to develop several clinically-oriented multiscale oncosimulators within the EC-funded projects ACGT, ContraCancrum, Tumor and P-Medicine. Her research interests include *in silico* oncology, multiscale cancer modelling, bioinformatics, systems biology, biological process modelling and biomedical engineering. She has published more than 50 papers in international peer-reviewed journals, books and conference proceedings and has been co-organizer of the series of International Advanced Research Workshops on *In Silico* Oncology (in 2006, 2008 and 2010). **Nikolaos K. Uzunoglu** is Professor of Electrical and Computer Engineering and is the Head of the Microwave and Fibre Optics Laboratory, ICCS-NTUA. His research interests include electromagnetic theory, microwaves, fibre optics, biomedical engineering and *in silico* oncology. In 1981 he received the International G. Marconi Award in Telecommunications.
Participant 5	**Leibniz Universitaet Hannover (LUH), DE**
Organisation	Founded in 1831 by the scholar Karl Karmarsch, the "Higher Trade School of Hannover" started with only 64 students. Today the university has around 21,000 students in the natural sciences and engineering, the humanities and social sciences, as well as in law and economics. The working group of Prof. Dr. Nikolaus Forgó will participate via two institutions of LUH: The Institute for Legal Informatics (IRI) and the L3S Research Center (L3S). IRI, being part of LUH's law school, was established in 1983 and is the first Institute dedicated to scientific research on all issues of Information and Communication Technologies at a German University. With currently more than 40 people staff, IRI is one of Europe's largest institutions in the field and is actively involved in about 10 European research projects with a focus on data protection, data security and intellectual property. Nikolaus Forgó has been leading IRI in cooperation with Prof. Dr. Metzger since 2008. The L3S Research Center focuses on fundamental and application-oriented research in all areas of Web Science. L3S researchers develop new methods and technologies that enable intelligent, seamless access to information via the Web; link individuals and communities in all areas of the knowledge society, including academia and education; and connect the Internet to the real world. Since 2008, the L3S has been involved in 12 EU projects as part of the EU's Seventh Framework Programme, four of them (LivingKnowledge, Okkam, EUWB and EERQI) integrated projects, as well as the STELLAR Network of Excellence.
Main Tasks	LUH is WP leader of WP11 "Legal Framework & IPR". Its major tasks in MyHealthAvatar comprise: • In-depth analysis of the existing European rules on data privacy as relevant for MyHealthAvatar • Definition of the legal, ethical and security requirements and guidelines of the project • Design of the MyHealthAvatar Data Privacy Framework • Design and analysis of the intellectual property framework guiding patients, researchers and research organisations on their respective right on data, algorithms and software developed in the project and after the project's end. • Development of a Data Governance and Business Model. • Assisting the Consortium with upcoming legal questions during the project
Relevant Previous Experience	Forgó's group was/is currently involved in the following FP7 projects: • *ACGT,* EU-project, *finished 2010* • EURECA, EU-project*, running* • P-Medicine, EU-project, *running* • *CONSENT,* , EU-project, *running* • *CONTRACT,* EU-project, *running* • *RESPECT,* EU-project, *running* • SMART, EU-project, *running* • PONTE, EU-project, *running*

	• Linked2Safety, EU-project, *running* • *VPH-NoE,* EU-project, *running*
Staff Members Involved	Prof. Dr. Nikolaus Forgó Dr. Tina Krügel, LL.M. RA Thorsten Heermann, Dipl.-Jur. Wolfgang Rottwinkel *(adminstrative matters)* N.N.
Participant 6	**Astrid Research Kft (ASTRID), HU**
Description	Astrid Research is one of the leading medical/bioinformatics companies in Central Eastern Europe. It is a knowledge-based research SME in which medical doctors, molecular biologists, software engineers, chemists and mathematicians work in close cooperation in multidisciplinary teams. Astrid's main focus is on creating software and hardware solutions to support research activities in life sciences. Astrid began research in medical image processing in 2007, its first project being the automated detection of melanoma malignum on digital images. During this time several software applications were developed supporting telemedicine, patient compliance and therapy adjustment. Later that year, as the personalized medicine era started to enter, the company put greater effort into high throughput data analysis and biostatistics. Astrid's strong points are genomic bioinformatics, automated phenotyping and data analysis of high throughput technologies (e.g. microarray, NGS, chromatography), processing and evaluation of data from different data sources (e.g. data from lab experiments, clinical data, image processing), data mining and biostatistics.
Main Tasks	Role: WP10.4 leader, involvement in several other work packages Main tasks in the project: • Exploitation leader • Contribute to technical development and demo
Relevant Previous Experience	Astrid has long experience in biobanking, data integration and data analysis. **Schzobank** is one of the largest biobanking-based personalized medicine research projects in Central Eastern Europe. Its aim is to develop biomarkers and methods to support, rationalize and accelerate the discovery and development of novel drugs for the treatment of psychotic disorders. Astrid's role is to build the IT infrastructure of data collection, storage and integration. The other aim is the analysis of data from different data sources (genomics, transcriptomics, proteomics, metabolomics). In the **DrScreen** project, the aim is to develop automated image analysis for retinopathy screening (ophthalmological application). The task of the system being developed is to distinguish between the pathological and the normal retina using digital images. We would like to use the system in the frame of the "English National Screening Programme for diabetic retinopathy" and other similar screening programs in the future. Astrid's role is the framework building, image processing algorithm development, implementation, verification and the clinical validation of the software. **Indicative Publications:** É Csősz, P Boross, A Csutak, A Berta, F Tóth, Sz Póliska, Zs Török, J Tőzsér: *Quantitative analysis of proteins in the tear fluid of patients with diabetic retinopathy*, Journal of Proteomics, accepted, 2012 B Antal, A Hajdu, Zs Szabo-Maros, Zs Torok, A Csutak, T Peto: *A Two-phase Decision Support Framework for the Automatic Screening of Digital Fundus Images*, Journal of Computational Science, accepted, 2012 M Laczik, E Tukacs, B Uzonyi, B Domokos, Zs Doma, M Kiss, A Horváth, Z Batta, Zs Maros-Szabó, Zs Török: *GenoViewer, a SAM/BAM viewer tool*, Bioinformation 8(2): 107-109, 2012 R J Qureshi, L Kovacs, B Harangi, B Nagy, T Peto, A Hajdu: *Combining algorithms for automatic detection of optic disc and macula in fundus images*, Computer Vision and Image Understanding, accepted, 2011 G Inczedy-Farkas, J Benkovits, N Balogh, P Almos, B Scholtz, G Zahuczky, Zs Török, K Nagy, J Rethelyi, Z Makkos, A Kassai-Farkas, A Egerhazy, J Tuzko, Z Janka, I Bitter, Gy Nemeth, L Nagy, M M Molnar: *SchizoBank – The Hungarian national schizophrenia biobank and its role in schizophrenia research*, Clinical Medicine, 2010, Vol. 151, 1403-1408
Staff Members Involved	**Dr Zsolt Török** is Chief Scientific Officer at Astrid. His expertise lies in the fields of surgery, cardiovascular diseasses, genomic bioinformatics and bio-banking. He has publications on intelligent signal processing, e.g. "Extracting metadata from fundus images for the screening of diabetic retinopathy" (2009), "A multi-level ensemble-based system for detecting misctoaneurysms in fundus images" (2010) and "Image processing support in the early detection of melanoma malignum" (2010). Dr. Zsolt Török will contribute to the integration of medical imaging in the hybrid Gauss-Markov model for estimation of individual patient risk as well for implementation of knowledge deployment mechanism and decision support remote service leading this work package. **Balint Domokos** is Chief Technology Officer at Astrid and has an MSc from the Faculty of

	Electrical Engineering and Informatics, Technical University of Budapest. He worked at Ericsson Telecommunications Hungary before joining MediaTechnik as a consultant/software developer. Mr. Domokos later worked for Powercom Interactive Media in Malaysia, Singapore and Indonesia where he designed and developed server side components of SMS payment interfaces, etc., and then moved to Misys International Banking Systems in Dublin as a senior software engineer. At Astrid, he is responsible for scientific/technological issues of bioinformatics products and services.
Participant 7	**AnSmart Ltd. (ANS), UK**
Organisation	AnSmart Ltd is a research driven SME. It specializes in the development of intelligent mobile apps using state-of-art technology in computer vision, image processing and machine learning. The company has dedicated a research and development team consisting of PhD experts who have substantial knowledge in artificial intelligent, machine learning and medical image analysis. AnSmart also has in-house expertise for mobile software development. We follow software engineering principles, including software development lifecycle approaches, project management, version control, source code and document control. The company offers a variety of complete end-to-end intelligent mobile solutions to allow easy information access, data management, data analysis and visualization in mobile environment.
Main Tasks	Role: involvement in several work packages Main tasks in the project: • Contribute to exploitation • Contribute to technical development and demo
Relevant Previous Experience	AnSmart has established a strong relationship with world-leading academic and clinical experts. Collaborating with the largest eye hospital in UK, Moorfields Eye Hospital, the company is currently working on a number of mobile apps targeting in mobile health (mHealth) market. One of the projects focuses on developing a mobile app that allows self examination and tracking of eyeball and eyelid movement for the early detection of a variety of eye diseases and self monitoring of the progress of eye treatment. The mobile app aims to support the images/videos captured from mobile camera, obtain quantitative measures by automatic analyzing eye motion using the cutting-edge technology and establish communications with hospital to store the measures for records. The other project is to develop a software system that performs self eye testing for children through intelligent games on sensor-based devices. The test results will be statistically analyzed and visualized through a mobile app, e.g. comparing with the previous history, national average, or even predicting the future trend. By using this app, eye testing will be much fun to children so that they are willing to repeat the tests. It helps early detection of eye disease and may also help reduce the burden of opticians, orthoptists and hospitals **Indicative Publications:** 1. X.Ye, G.Beddoe, G.Slabaugh. *Automatic Graph Cut Segmentation of Lesions in CT using Mean Shift Super-Pixels*, International Journal of Biomedical Imaging, 2010. 2.G.Slabaugh, X.Yang, X.Ye, R.Boyes, and G.Beddoe. *A Robust and Fast System for CTC Computer-Aided Detection of Colorectal Lesions*. Algorithms. 3(1), 21-43, special journal issue on Machine Learning for Medical Imaging, 2010 3. X Ye, X Lin, J. Dehmeshki, G Slabaugh, G Beddoe, Shape *Based Computer-Aided Detection of Lung Nodules in Thoracic CT Images*, IEEE Transactions on Biomedical Engineering, Vol 57, No 7, pp 1810-1820, 2009 4. J.Dehmeshki, X. Ye*, H.Amin, M.Abaei, X.Lin. *Volumetric Quantification of Atherosclerotic Plaque in CT Considering Partial Volume Effect*. IEEE Trans. on Medical Imaging, 26(3), 2007. 5. M. Ganz, X. Yang and G.Slabaugh. *Automatic Segmentation of Polyps in Colonoscopic Narrow-Band Imaging Data*. IEEE Transactions on Biomedical Engineering 59(8), 2012. 6. E.Vazquez, X. Yang, and G.Slabaugh. *Erosion Band Signatures for Spatial Extraction of Features*, Eduard Vazquez, Machine Vision and Applications 2012. 7. X. Yang and G.Slabaugh. *A Robust and Efficient Approach to Detect 3D Rectal Tubes from CT Colonography*, Medical Physics 38(11), 2011
Staff Members Involved	**Dr. Xujiong Ye** is Chief Technology Officer at AnSmart Ltd. She has 10-year industrial and management experience from a commercial R&D company. She was in charge of the design and implementation of many medical imaging software APIs using the state-of-the-art computer vision, machine learning and medical image processing technology, which achieved CE marked and FDA approval. The APIs have been integrated into a number of third party visualization workstations. She received a Ph.D from Zhejiang University, China, and spent three years at Medical Vision

	Laboratory, Oxford University. Apart from her business experience, Dr. Ye also has a high research profile. She has over 30 publications and 4 patents pending in the fields of (medical) image processing and computer vision. She has been working with many young researchers and has a significant supervision experience. **Dr Robert X. Yang** is a senior research engineer. He obtained his BSc degree in Computer Science and Electronics, from University of Yunnan, China, in 1998, and his PhD in computing from University of Ulster, UK, in 2004. Robert has over 9 years research and software development experiences in ICT for medical industries. He has a broad knowledge of technology development and software engineering. One of the key software products in medical industry he developed has obtained CE marked and approval from FDA. Currently he is actively involved in the development of web service and mobile phone applications.
Participant 8	**Technological Education Institution of Crete (TEI), Greece**
Organisation	The Technological Educational Institute of Crete was founded in 1983. It is a higher educational institute with full University status. It now comprises the Schools of Applied Technology, Health & Welfare Services, Management & Economics and Agricultural Technology. In addition, there are departments of general sciences, foreign languages, and physical education. With a permanent teaching staff of 200 and approximately 10,000 students, TEI is a thriving academic institution.
Main Tasks	Role: WP3 leader, involvement in several other work packages Main tasks in the project: • Development of the system architecture • Input to the avatar-centred visual analytics
Relevant Previous Experience	The Department of Applied Informatics and Multimedia was established in 2000 within the Faculty of Applied Technologies of the Technological Education Institution of Crete. Today, the Department has grown into a fully operational educational and research unit with more than 2,500 undergraduate students and a number of postgraduate and PhD students. In parallel to its educational goals, the Department operates a number of Research and Development laboratories. Amongst those research laboratories is the Biomedical informatics and eHealth technologies lab, focusing on the innovative application of mainstream computer science methods, tools and technologies in the domain of translational medicine, bioinformatics and eHealth and the Interactive Software Technologies & System Engineering Laboratory, which focuses on a range of technological areas with an emphasis on Human Computer Interaction, Visual querying mechanisms, Computer Supported Collaborative Work, and Virtual Organization Informatics **Indicative Publications:** 1. A. Hristoskova, V. Sakkalis, G. Zacharioudakis, M. Tsiknakis, F. De Turck, Ontology-driven Monitoring of Patient's Vital Signs enabling Personalized Medical Detection and Alert, IEEE Transactions on Biomedical Engineering (accepted). 2. G. Tsiliki, M.Zervakis, M. Ioannou, E. Sanidas, E. Stathopoulos, G. Potamias, M. Tsiknakis, D. Kafetzopoulos, Multi-platform data integration in microarray analysis. IEEE Trans Inf Technol Biomed. Vol 15, No 6, November 2011, pp. 806-812. 3. K. Marias, D. Dionysiou, V. Sakkalis, N. Graf, R. M. Bohle, P. V. Coveney, S. Wan, A. Folarin, P. Büchler, M. Reyes, G. Clapworthy, E. Liu, J. Sabczynski, T. Bily, A. Roniotis, M. Tsiknakis, et al, Clinically driven design of multi-scale cancer models: the ContraCancrum project paradigm, Interface Focus, 2011, doi:10.1098/rsfs.2010.0037. 4. M. Brochhausen, G. Grigonyte, L. Martín, N. Graf, J. Haller, B. Smith, M. Tsiknakis, The ACGT Master Ontology and its applications – Towards an ontology-driven cancer research and management system. J Biomed Inform, 2011 Feb;44(1):8-25. 5. M. Zervakis, M.E. Blazadonakis, V. Danilatou, G. Tsiliki, M. Tsiknakis, D. Kafetzopoulos, Outcome Prediction Based on Microarray Analysis: A Critical Perspective on Methods, BMC Bioinformatics 2009, 10:53. 6. N. Graf, A. Hoppe, E. Georgiadi, R. Belleman, C. Desmedt, D. Dionysiou, M. Erdt, J. Jacques, E. Kolokotroni, A. Lunzer, M. Tsiknakis, G. Stamatakos, The impact of "in silico" oncology on clinical decision making in the context of nephroblastoma, Clinical Pediatrics, Klin Padiatr 2009; 221: 1? 9.

	7. M. Tsiknakis, M. Brochhausen, J. Nabrzyski, J. Pucaski, S. Sfakianakis, G. Potamias, C. Desmedt and D. Kafetzopoulos, A semantic grid infrastructure enabling integrated access and analysis of multilevel biomedical data in support of post-genomic clinical trials on Cancer, IEEE Transactions on Information Technology in Biomedicine, Special issue on Bio-Grids, 2008, vol 12, no 2, pp. 191-204. 8. D. Akoumianakis, G. Milolidakis, P. Gnagnarella, A. Misotti, N. Bessis, Networking tactics for online eHealth campaigns and intervention studies: Preliminary results from a case study on nutritional support for cancer patients, 4th International Conference on Intelligent Networking and Collaborative Systems, BUCHAREST, ROMANIA; 09/2012 9. D. Akoumianakis, Learning as 'Knowing': Towards Retaining and Visualizing Use in Virtual Settings, Educational Technology & Society (Special issue on "Knowledge Visualization for Learning and Knowledge Management"), 2011, 14 (3), 55-68. 10. G. Vellis, D. Kotsalis, D. Akoumianakis, J. Vanderdonckt, Towards a new generation of MBUI engineering methods: Supporting polymorphic instantiation in synchronous collaborative and ubiquitous environments. In Coyette, A., Faure, D., Gonzalez, J., Vanderdonckt, J. (Eds.), Proc. of Int. Workshop on User Interface Description Language UIDL'2011 (Lisbon, 6 September 2011), Thales Research and Technology France, Paris, 2011 (ISBN 978-2-9536757-1-9).
Staff Members Involved	**Dr Manolis Tsiknakis** is an associate professor of biomedical informatics and eHealth technologies. Prior to joining TEI-Crete, he has been a principal researcher at FORTH, where he has been involved for more than 15 years in cutting edge research, in the domain of biomedical informatics and eHealth technologies. He has been a principal investigator in a number of EU and nationally funded projects in the domain of biomedical informatics, translational research and eHealth. He has recently been the scientific coordinator of the FP6 integrated project Advancing Clinico-Genomic Trials on Cancer (ACGT - www.eu-acgt.org) which focused on delivering an ontology driven, semantic grid services technological infrastructure enabling efficient execution of discovery-driven analytical workflows in the context of multi-centric, post-genomic clinical trials. He is also a Principal Investigator in a number of FP7 projects. He is also the technical coordination of the development of the technological infrastructure of the National Biobanking Infrastructure (BBMRI Greece). For a number of years Prof. Tsiknakis has focused his research on various computational aspects of biomedical informatics, such as (a) ontology based integration and analysis of multilevel biomedical data; (b) high performance computational approaches to demanding biomedical applications; and (c) the Semantic interoperability (SIOp) of health information systems, which is a key ingredient for meeting present and future challenges of health systems like an ageing population or political pressure to reduce costs. Prof Tsiknakis has acted as technical manager of a large nationally funded effort for the design and development of an integrated regional health information network in Crete, called HYGEIAnet, which received an EU eHealth award in 2003. He is a member of the Editorial Board of the Open Medical Informatics Journal, and a member of the programme committee in numerous high-profile conferences. He has been a key note speaker in important IEEE conferences, and also acts as a regular reviewer for a number of scientific journal and conferences. He has published extensively on issues related to the application of innovative Information and Communication Technologies in the domain of clinical and translational research, care and wellness management. **Dr Demosthenes Akoumianakis**, is Professor of Database and Intelligent Systems. Human Computer Interaction design: His main line of research and development activities is Human Computer Interaction, focusing on the development of methodological tools and techniques for requirements engineering, analysis and construction of advanced user interfaces. In the context of this work, prof Akoumianakis is also focusing his research activities on visual interactive interfaces and visual querying mechanisms for accessing and manipulating complex multidimensional data. Recent case studies explored conversational querying, dynamic querying mechanisms, starfield displays, movable filters και treemaps in data-intensive applications. His specific interest of the lab is in designing interaction techniques which afford unfolding patterns in spatial and temporal data. **Prof. Akoumianakis** has been involved in several European Collaborative research and

	development projects in the fields of Human-Computer Interaction, Accessible information systems, Web communities, System Dynamics and Assistive Technologies. He has also contributed to a substantial number of R&D proposals as a member of consortium editorial boards or technical contact person on behalf of ICS-FORTH, where he has been prior to joining TEI Crete. **Dr Mathaios Pediaditis** is a Postdoctoral Research Assistant at the Bioamedical Informatics and eHealth laboratory of TEI-C. His domain of expertise and research interests lie in the areas related to network and IS security, processing and analysis of biomedical signals (e.g. ECG, EMG), images and video, affective computing and algorithms and techniques to assess frustration, stress, and mood indirectly, through natural interaction and conversation.
Participant 9	**University of LinColn (LIN), UK**
Organisation	University of Lincoln is a research-based university with quality teaching and excellent research. The University carries out major research on mobility technology, medical imaging for cancer diagnosis, prevention of community re-offending, anti-terrorist surveillance, food security and water conservation and treatment of insomnia. The school of computer science at University of Lincoln provides a range of expertise in Computing Technologies and Information Systems, including specialists in robotics and autonomous systems, computer vision and image engineering, medical applications of technology, social computing, games computing, cultural computing and business computing. With around 500 students studying a range of undergraduate, integrated masters and postgraduate courses, the School offers an exciting, thriving and expanding academic and research environment. The highly-active research centres feature world-leading developments in video surveillance, robotics, medical image processing and vision, social computing and pervasive computing gaming. There are also strong links to industrial collaborators.
Main Tasks	Role: Task leader (Task 8.4) in WP8, involvement in several other work packages Main tasks in the project: • Development of the multi-scale medical image analysis toolkit
Relevant Previous Experience	The Centre of Vision Engineering has been active in the area of medical imaging, including the development of new medical imaging devices and systems, as well as the exploration of advanced computing technology to detect and understand cancerous growths in various human organs from multi- modality images. It has developed image enhancement techniques for the detection of markers in prostate cancer treatment and for the identification of cells in unstained mammalian tissue cultures; algorithms for automatic lesion detection from medical images; 3D surfaces based registration in CT colonography; robust segmentation of region of interests (e.g. lesion or anatomy). The centre has an excellent track record in both publications and external grants, including the recent reward of a major £1.6m Wellcome Grant to develop dosimetry and imaging for proton therapy. **Indicative Publications**: 1. X.Ye, H.Roth, G. Slabaugh, X.Yang, M, Hung, J.McQuillan, D.Hawkes, S.Halligan. *Computer-aided Detection for CT Colonography: False Positive Reduction Using Surface-based Prone-Supine Registration*. Radiological Society of North America (RSNA). Nov, 2011. 2. X.Ye and G.Slabaugh. A Model-Driven Bayesian Method for Polyp Detection and False Positive Suppression in CT Colonography Computer-Aided Detection. Book chapter contributed to Machine Learning in Computer-Aided Diagnosis: Medical Imaging Intelligence and Analysis, IGI Global, January 2012. 3. X.Ye, G.Beddoe, G.Slabaugh. Automatic Graph Cut Segmentation of Lesions in CT using Mean Shift Super-Pixels. International Journal of Biomedical Imaging, 2010 4. J.Dehmeshki,H. Amin, M.Valdivieso, X. Ye. Segmentation of Pulmonary Nodules in Thoracic CT Scans: A Region Growing Approach. IEEE Transactions on Medical Imaging, vol. 27, no. 4, 2008.
Staff Members Involved	Dr. Xujiong Ye is a reader in school of Computer Science, University of Lincoln, UK. She has over 10 years' research and development experiences in medical image analysis and processing from both of academia and industry. She was in charge of the design and implementation of many medical imaging software APIs by utilising the state-of-the-art computer vision, machine learning and

	medical image processing technology, which achieved CE marked and FDA approval. She has great experience in automatic lung nodule/colonic polyp detection and segmentation, colonic surfaces registration and quantification of coronary artery calcification from medical images. She received her PhD, MSc and BSc from Zhejiang University, China, and was a three-year post doctoral researcher at Medical Vision Laboratory, University of Oxford. Dr Ye has over 40 publications and 4 patents pending in the fields of medical image processing, computer vision, and machine learning.

B 2.3 Consortium as a whole

MyHealthAvatar was designed as a proof of concept for an innovative digital representation of health status. A suitable consortium has been formed by 9 partners across 4 different EU countries, which covers all the essential elements of the project, including the clinical, technical, industrial and legal aspects – see **Figure 2.3a**. The partners were selected according to the requirement of the project, the expertise and experience, as well as their complementarity. This brings together the diverse elements needed and a critical mass in order to reach the aim and objectives of the project.

To ensure that the developed concept of MyHealthAvatar will be clinically useful and acceptable, the clinical partner will play an important role – they will present their problems to the ICT specialists and have key commitment in the evaluation, which will be carried out throughout. To deeply involve the clinical partner in the development cycle, they will lead three WPs in the investigation of the clinical needs and acceptability, and the design and implementation of the demonstration. In addition, the industry partners (2 SMEs) will be able to directly exploit the work to improve their existing product for clinical use – all these ensure that MyHealthAvatar will have a foreseeable clinical significance.

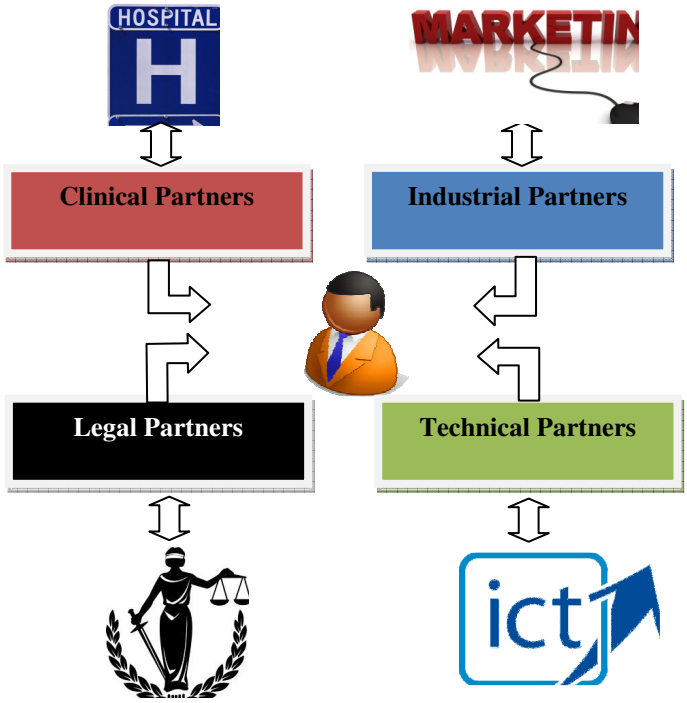


Figure 2.3a Complementarity and collective contributions of the MyHealthAvatar Consortium

The nature of the project suggests that a supportive and interdisciplinary environment is essential. It creates a collaborative working environment, supporting knowledge and data sharing for integrative research across different key areas. **Figure 2.3a** shows the complementarity between the partners and collective contributions among the consortium members. All the partners play as a bridge to link the avatar to a critical aspect, namely, **Clinics, ICT, Legal and Marketing**.

- The technical partners consist of ICT experts in architecture and ontology (FORTH, TEI), clinically oriented simulation models(ICCS), visualization and web services(BED) and medical image analysis(LIN). They are all leading players in their areas and will collectively meet a wide variety of technical requirements in MyHealthAvatar.
- The clinical partner (USAAR) has a very extensive clinical experience. It has been involved in EU Framework Programs for many years. In FP7, USAAR is/was already member in ACGT, ContraCancrum, CONTRACT, EURECA, TUMOUR, and is coordinating P-Medicine, which is a large integrated project to build an IT infrastructure for personalized medicine. It has extensive experience in clinical research and evaluations of ICT techniques for healthcare. Also, the FORTH team has clinical experts, who will provide multiscale data and offer clinical evaluation to the work of the project.
- Both ASTRID and ANS are active players (SMEs) in industry. Astrid Research is one of the leading medical and bioinformatics company in Central Eastern Europe. It is a knowledge based research SME, where medical doctors, molecular biologists, software engineers, chemists and mathematicians work close cooperation in multidisciplinary teams. It has been involved in a number of research projects and has good experience in EC projects. ANS is a research driven, intelligent mobile software company. The company has a strong commitment to technical innovation and is equipped with staff with experience in data analysis and mobile computing. Led by Astrid, both of the SMEs will significantly contribute to the exploitation. In addition, they will also be involved in the technical development of the project.
- LUH is an expert in law. It is one of Europe's largest institutions in the field. The research group involved has extensive experience in dealing with legal and IPR issues in VPH projects. In total, they have been involved in over 20 projects in recent years to deal with the legal issues in ICT projects related to healthcare.

The dissemination and exploitation activities will be led by ICCS, who has a good experience in hosting workshops and social events, making publications for dissemination. It will be supported by the entire consortium, especially by the 2 SMEs who will be deeply involved in the exploitation activities, including integrating the project results into their own products.

Table 2.3a shows a summary of how the objectives are addressed by the expertise of the partners.

All the partners have foreseeable benefit of involving in MyHealthAvatar. The development of "digital patient" is a new initiative in the future EC funding for healthcare research. This is closely related to the experience and expertise of the consortium members, leading to a great motivation and synergy among the partners.

The majority of the application partners have worked together in many other VPH projects (e.g. ContraCancrum, ACGT, P-Medicine, Tumor, etc..). The previous experience ensures that the ability of the new tools to interface with existing research infrastructures and resources (e.g. models and data).

We believe that the current formation of the consortium covers the essential requirements of the project. Therefore, we believe the MyHealthAvatar consortium members represent an initial critical mass for setting up this project.

Table 2.3a MyHealthAvatar consortium expertise and main roles

Technical Expertise Needed	**Involved objectives**	**Expertise Provider**
Building model/data repository	**2.1, 2.2**	ICCS, BED
System architecture	**2.3**	TEI, FORTH
Information extraction, mobile apps	**2.4**	BED, ANS
Semantic interoperability and Linked Data approach	**2.5**	FORTH, BED
Visualization and visual analytics	**2.6,2.8**	BED, LIN

Clinically oriented simulation	**2.7**	ICCS
Clinical demo and evaluation	**2.9**	USAAR, FORTH
Legal and ethical issues.	**3**	LUH
Clinical acceptability	**4**	USSAR
Recommendation for the future	**5**	ALL
Dissemination	**6**	ALL(led by ICCS)
Exploitation	**6**	ASTRID, ANS

B 2.4 Resources to be committed

Through careful estimation and discussions within the consortium, the request budget has been planned for the minimum required resources that was felt, with our current understanding of the challenges to be addressed, are absolutely necessary for the successful implementation of the project.

The total work effort on the project overall amounts to 360 person-months for the envisaged 11 work packages over a period of 36 months. Apart from research, **significant amount of resource will be devoted to the demonstration activities, which is the largest WP in the project** with 76 person-months in total for the demonstration to demonstrate the feasibility of the avatars.

The person-months are calculated according to the input of the partners to the work packages. The personal rate varies according to different countries. They are reasonably distributed among the partners according to the amount of work they will take in the project. This is a logical breakdown of resources for realising this planned project.

Considerable amount of resources are allocated to other direct cost, including travel, equipment and consumables. The required equipments include computer servers, desktops, laptops and other mobile computing facilitates, including mobile phones and tablet computers. The inclusion of mobile computing facilitates is to experiment the access to the avatars from different computing platforms, which is needed in WP3, WP5, WP6, WP8 and WP9. Also, we have also budgeted 25K €, for the purchase of social media data if the volume of the collected data does not reach the expected level. In that case, the purchased social media data will still allow the project to continue with the rest of the interesting targets.

The travel cost will be used for project meetings, attending technical conferences and participating in other dissemination activities. Consumables will be used for items to support day to day running of the project. Notably, additional 20K € have been built into the budget of the coordinator to pay the travels of the external advisors to the annual meetings; another extra 20K € has been also reserved as additional consumables by the workshop task leader (BED) for organising the project's workshop for dissemination. The requested budget for equipment is mainly destined to the technical development, which is essential to the project.

The total costs of the MyHealthAvatar project have been calculated at just over **3.3M** €, the requested financial contribution of the Commission is just over **2.4 M** €.

The seriousness and quality in the execution of the entire project is backed-up by years of experience, international institutional recognition and successful completion and implementation of previous contracted projects and developments at both the national and international scale. All the members of the consortium have confirmed their commitment to the project, which include the devotion of a significant part of time from permanent staff members (including clinicians). Also, some of the existing resources will be put at disposal of MyHealthAvatar as an overhead contribution from the corresponding partners, including:

1) A lot of resources to be utilised by MyHealthAvatar will come from the work from either on-going and completed projects, including ContraCancrum, ACGT, Tumor, P-Medicine, etc. Many

members of the MyHealthAvatar consortium have been actively involved in these projects. Indeed, the main purpose of MyHealthAvatar is to experiment the integration of existing information and testing the access of currently available resources. These resources constitute a significant part of the input from the partners, which is complementary to the EC contribution. The industrial partners will also put a lot of their resource at the dispose of the project – for example, ASTRID will contribute their industrial experience to the building of the data/model repositories for the future exploitation; ANS will use their infrastructure to working on the mobile apps for data collection.

2) Evaluation expertise from previous projects – all the partners have extensive experience of evaluation in their only areas which has been developed over a significant number of years, e.g. ICCS has 15 years of experiences and has developed top-down clinical trial adapted modelling approach. Especially, as the clinical partners, USAAR have very extensive experience involved in the VPH research by contributing to the result evaluation. It is the coordinator of P-Medicine. These will be extremely useful to the success of the project. The medical experts from FORTH will also share their data and medical experience with the consortium.

3) ICT infrastructure support and software development tools. MyHealthAvatar will be built upon the existing ICT infrastructure and software tools available at the members of the consortium. For example, FORTH and TEI has been involved in a lot of work in building ICT architecture as well as working on ontology, BED has developed a solid infrastructure on visualization and web service work in recent years; ICCS has done substantial work in building infrastructure for the data repositories in Tumor.

4) Community service. As a VPH project, the success of MyHealthAvatar will heavily rely on the support from the well-established VPH community, in which most of the partners in MyHealthAvatar have been deeply involved.

2.4.1 3rd parties and subcontracting

Subcontracting cost for finance auditing has been included for those partners whose are expected to receive EC contribution above the threshold (e.g. BED, USAAR, ICCS). No other 3rd parties are foreseen in this project.

B3. IMPACT

B 3.1 Strategic impact

3.1.1 Contributions to the expected impacts listed in the work programme

The proposal targets ICT-2011.5.2 Virtual Physiological Human with particular outcome d) Early demonstrators and proof of concept of digital representations of health status of patients.

Expected Impact: Proven concepts of digital representations of patient health status.

MyHealthAvatar is an experiment to build a new digital representation of the "**Digital Patient**", which consists of components including data provider, toolbox and ICT architecture.

MyHealthAvatar will be a life companion of individual citizens that allows access to a **comprehensive and consistent** set of health status data for the specific individuals over **a long history**. This will provide an important reference for medical professionals to make personalized clinical decisions. Through data sharing of the individual avatars, MyHealthAvatar will lead to an extremely rich set of population data that can contribute significantly to biomedical research. Indeed, the possibility to find, retrieve, and reuse all of the data, information and knowledge of patients and their physiological attributes could truly revolutionise the field, leading to an exponential increase of VPH technology.

Engaging public interest is the key to the success of the MyHealthAvatar initiative. To this end, we will utilise the latest ICT advance to ensure the increase of data population by allowing and rich information access and easy data input, including:

- Internal data and model repositories that will store personal health status data to allow individual access and sharing, and simulation models that will be commonly used by all the avatars for the prediction of disease.
- Links to external resources, including to existing data and model warehouses, and to hospitals where important clinical information of individual patients are held.
- Semantic interoperability and RDF data repository to support data search, reasoning and flourishing of data storage.
- Data input with minimal user effort. A key feature of MyHealthAvatar is the capability of accessing a complete set of data that records a wide range of relevant factors for risk to the health of individual patients. Such data will include environmental factors (e.g. lifestyle, location), family histories, etc. A total reliance on individuals' extra effort to input these records is difficult, if not impossible. ICT technology, such as information extraction, mobile apps can offer great help in this aspect, e.g. by connecting to and information extraction from social network sites, such as Facebook and Twitter. Given the popularity of these sites and active involvement of many citizens nowadays, these social websites have become a huge resource of information. The connection to these sites offers an important means for information extraction of the citizens.

Another strategy of MyHealthAvatar is to offer tools and clinically useful information through the avatar to encourage the engagement of both medical professionals and patients. More specifically, the integrated toolbox will provide a spread of tools to allow data analysis and access to integrated VPH predictive models.

- Predictive model simulations will provide valuable information on the prediction of diseases under concern, through access to the model repositories, as mentioned above.
- **Visual analytics** has become an important means for dealing with the exploration of, and new knowledge discovery from, the ever-increasing volumes of available data by allowing the fusion and analysis of irregular, heterogeneous (and often uncertain) data from different

sources through interactive visualization; this will provide support to clinical decision making.

All of these repositories, links and toolboxes will be integrated and supported by a **cloud** based ICT architecture that allows effective communication between its various components and provides high data security and computing power. This experimental work will lead to a system prototype by which the MyHealthAvatar project will offer a proof of concept for a representation of the "**Digital Patient**".

Expected Impact: More predictive, individualised, effective and safer healthcare

A more predictive healthcare

MyHealthAvatar will study an innovative digital representation that allows access to the predictive and integrative models from VPH together with data from a wide variety of different sources. These integrated models have been developed in a range of projects within the VPH initiative and the expected impact will be to yield more predictive, individualised, effective and safer healthcare. To this end, MyHealthAvatar can be viewed as an interface that allows the access to, and integration of, these existing resources, leading into more significant impact on healthcare in terms of prediction, individualization, effectiveness and safety.

The predictive models that will be accessed through the avatars will allow prediction of disease in terms of its generation and progression. From its design, MyHealthAvatar will allow access to a range of models and will be capable of being linked to external resources, including those from successful model repositories of other successful VPH projects, which will give rise to a more predictive healthcare.

A unique feature of MyHealthAvatar will be its ability to demonstrate the influence of multiple risk factors on predictions of the development, diagnosis and treatment of diseases through the collection of these data and through information analysis from different sources using reasoning and visual analytics. In fact, treatment prediction for a particular patient is often dependent on a wide range of factors, including age, gender, physical condition, medical history, fitness, etc. Lifestyle has a significant influence on the health of patients, and family history can also offer additional clues for clinical decision makers. While these complicated factors present a considerable level of difficulty to the doctors, revealing the information currently hidden within this mass of data offers a high level of opportunity in the continued search for improved and personalized healthcare.

The visual analytics toolkit from the integrated toolbox of MyHealthAvatar will offer a power tool for new knowledge discovery by the effective integration of intelligent data analysis with expert knowledge through interactive visualization of data patterns. Visual analytics makes use of information from heterogeneous data sources through information fusion, and brings together valuable information in visual form to support exploration. It successfully overcomes the limitation of traditional intelligent data analysis that works only with a small number of well-defined and well-trained cases. It will be supported by the reasoning tools offered by ontology and linked data.

Effective

The concept of MyHealthAvatar supports effective combination of the results from the models and the data. The data collection results in observations of an individual patient and relates them to a vast dataset of observations of others with similar symptoms and known conditions. By processing all of this information, the model can simulate the likely reaction of an individual patient to possible treatments or interventions. Such tools will not only improve the quality of treatment, but will also be applicable to preventive medicine by predicting the occurrence or worsening of specific conditions for people at risk.

In particular, MyHealthAvatar will feature a comprehensive set of data, covering a wide variety of information on the health status, symptom and treatment of individual patients. A combination of these population data from individual avatars will be extremely valuable, and this value will grow with time as the system becomes more widely used. Currently, only a small fraction of the wealth of available data is contributing to the development of safer treatment options applicable to individual

patients. That is because potential users have access to only a small proportion of the available data and because they do not have appropriate tools to process it. MyHealthAvatar will offer an effective solution to this.

From the perspective of healthcare systems, MyHealthAvatar can improve the effectiveness of the systems by reducing the burden on current systems that has resulted from increased life expectancy, the ageing population and population movements. In essence, MyHealthAvatar promotes greater self-management by patients, which will help to address the limited budgetary and staffing resources available to healthcare providers. It will produce greater efficiency in the organisation of resources and care provision through effective tracking of patients' records, leading to improved productivity. For example, the avatar is expected to save resources by automating data collection by the use of modern ICT technology, covering interactions between patients and healthcare providers and facilitating data transmission from institution to institution through the avatars, and by assisting disease prevention, diagnosis, treatment, health monitoring and lifestyle management using the ICT toolboxes. This will be critical to keep healthcare affordable, sustainable and accessible.

Individual healthcare

Often, individual patients show a unique susceptibility to particular diseases, which has led to the concept of personalised medicines or procedures. To this end, individual information is needed in a **consistent** fashion in order to allow effective individual care. MyHealthAvatar offers a mechanism for achieving this.

Within the context of MyHealthAvatar, a comprehensive set of individual information is gathered during **the entire life span** of the subject. Potentially, this information could be traced back through previous generations. The information is available to be searched, browsed and interactively explored by medical professionals to support diagnosis and treatment on an individual basis.

MyHealthAvatar will strongly encourage the self-engagement of citizens in their own healthcare. This will enable more "patient-friendly" healthcare services to be developed with enhanced flexibility to address the different individual needs of patients. Studies have shown increasing numbers of patients are becoming more actively involved in their healthcare as a result of access to the Internet. On-line and mobile tools are already opening up the possibility of remote monitoring and diagnosis. From the perspective of individual patients, MyHealthAvatar will make it easier to retain patients' records in a coherent form, support follow-ups, and enable patients to be fully and rapidly informed of results from tests and generally become fully and actively involved in their own healthcare. This is particularly useful if, for example, medical care is needed when s/he is holidaying abroad or has recently migrated to a new area.

Safer healthcare

MyHealthAvatar is an interface that will allow access to new and existing integrative models and data to support clinical applications. These models and data provide important references for clinical decisions from different angles, leading to a safer healthcare since safer healthcare depends on an in-depth investigation not a "quick fix"[Fein11]. The use of these "virtual" tools can greatly reduce experiments on real patients, resulting in a safer process during the knowledge discovery.

By reducing the burden on the healthcare system, the active involvement of patients encouraged by, MyHealthAvatar has the potential to reduce the risk of medical error and to help the early detection of health problems. Research has already shown positive results in safety and life saving by the introduction of eHealth. For example, home telemonitoring of heart patients can improve survival rates by 15%, reduce the duration of hospital days by 26% and save 10% in nursing costs; ePrescriptions can reduce errors in drugs dosage by 15%. MyHealthAvatar will help to drive future healthcare further in this direction, leading to safer healthcare systems across Europe.

Expected Impact: Reinforced leadership of European industry and strengthened multidisciplinary research excellence in supporting innovative medical care

MyHealthAvatar fits well into the global trend of an increasing involvement of ICT in the reshaping of future healthcare systems and contributes to the reinforced leadership of Europe in supporting innovative medical care.

eHealth is one of the most rapidly growing areas in health, and the 58th World Health Assembly (Geneva, 2005) established an eHealth strategy for the WHO (World Health Organization), which urged Member States to plan for appropriate eHealth services in their respective countries. WHO also launched the Global Observatory for eHealth (GOe), an initiative dedicated to the study of eHealth.

The EU's eHealth action plan sets out a clear roadmap for eHealth, which features in the Digital Agenda for Europe adopted by the European Commission in May 2010. **The Digital Agenda aims to provide Europeans, by 2015, with secure access to their online medical health records not just at home but also when they are travelling anywhere in the EU**. eHealth also has an important role in the Directive of the European Parliament and in the Council on the application of patients' rights in cross-border healthcare (Article 14). Under Pillar 7, ICT for Social Challenges, the Digital Agenda focuses on ICT's capability to reduce energy consumption, support the lives of ageing citizens lives, revolutionise health services and deliver better public services[EURO].

MyHealthAvatar complies fully with the vision and future strategy of the VPH, which is to promote and facilitate the use of computational models, software tools and web services to achieve a more efficient and effective 21st century healthcare system and to create new economic opportunities for European healthcare industries by using computational tools to link individual patient data with virtual population databases to promote personalized, predictive and integrative and evidence-based approaches to medicine. It will strengthen the multidisciplinary research excellent in VPH by offering an interface to allow access and integration of the models and data from existing resources. It will also reinforce European leadership by addressing the challenges identified[HUN11], including the need for improving the interoperability, transfer, reuse and sharing of data in highly fragmented systems in Europe to support the requirements of healthcare and biomedical research, for integrating the data available to patients in support of personalized, predictive and integrative healthcare, and for assisting the study of EC regulatory policy.

The healthcare sector throughout Europe faces many common challenges. Working together to develop and implement new systems will greatly benefit European industry. As leaders in developing eHealth, European enterprises are in a strong position in the world marketplace. The EU has contributed more than €500 million of research funding to the development of eHealth tools and systems since the early 1990s, and this has helped to place Europe in a world-leading position in the use of regional health networks, electronic health records in primary care and in the deployment of health (smart) cards, in particular. MyHealthAvatar will bring further opportunities in providing access to the facilities and resources (e.g. data and models) that have already been developed and hence help to maintain Europe's leading position.

3.1.2 Steps that will be needed to bring about these impacts

In order to bring about the previously mentioned impacts, the following steps will be needed:

a) well defined requirements from clinicians and citizens
b) the creation of a prototype for the envisaged MyHealthAvatar system as described in the proposal
c) technical and clinical validation of the above system
d) investigation of ethical and legal barriers in the envisaged avatar system
e) investigation of clinical acceptability and other cultural barriers to the adaptation of the avatars
f) disseminations to a wide range of audiences, including hospitals, technicians and policy makers
g) a realistic market analysis and a multidimensional exploitation
h) recommendations for the future work of the full system

i) future grant support to develop a full avatar system
j) clinical adaptation of the system
k) a wide public engagement with the system, supported by the ICT utilities within the avatars
l) encouragement of data sharing of individual avatars to research community.

Among these, steps a)-h) will be implemented within this project, which will lay down a strong foundation on which to build the remaining long-term steps.

3.1.3 Specific Influence Areas

A significant feature of VPH is its evolutionary approach of collecting and integrating predictive models and heterogeneous data through a large number of VPH related projects and activities, which have laid down the foundation for new knowledge discovery. However, access to these resources for clinically meaningful use is still a largely unresolved problem. Also, the highly fragmented healthcare systems developed during the long history in Europe makes it extremely difficult to access a consistent record of individual patients. Within this context, the consortium perceives the concept of "**Digital Patient**" as an innovative representation and potential solution to the abovementioned problem by acting as:

- an interface to collect, store and manage individual patient information
- an interface for data sharing and information exchange with other people
- an interface to access external resources and information
- an interface to access toolbox that offers a range of clinically proven tools to support the display of clinical information and to assist in clinical analysis and decision making.
- a means to contribute data to biomedical and clinical research for new knowledge discovery.

This complies with the vision and strategy from the VPH community on the Digital Patient[DISCIPULUS]:

"The vision of a "digital me" that contains all my healthcare information, safely managed for access by the various biomedical professionals with my approval, communicated with all my wearable and implanted technology to constantly monitor my health status and informing me, my family and friends, or my healthcare providers of alarming events, supporting the collaboration of various specialists around my complex systemic diseases, and used with all my data to predict the future development of my health in order to facilitate disease prevention and a fully self-aware lifestyle, is a powerful vision. But the challenges are huge." – Peter Hunter, et al. – A Vision and Strategy for the VPH[HUN11].

MyHealthAvatar is designed to be managed by individual citizens. It will act as a life companion of a citizen from birth, and allow access to a long-term and comprehensive set of clinical and health status information of the citizen concerned, including his/her complete medical history and all the risk factors for the development of major diseases, which will provide extremely useful information for clinical decisions. As a personal individual companion, these data will be accessible despite changes of hospital or migration to a different European country. Indeed, it is expected that the introduction of MyHealthAvatar service will be able to greatly facilitate the access to healthcare and help break down legal and ethical barriers, promoting collaborations between healthcare providers from different EU member states.

MyHealthAvatar complies with the trend to patient-centred healthcare. It offers a pathway to enhance the self-awareness of patients and to empower them to play more significant roles in taking care of their own health, which is regarded as an effective way of dealing with the increased challenges anticipated in future healthcare. Through the self management of their own avatars, patients will be better informed about their treatment, condition, and on improved lifestyle, which will contribute to the awareness of their own health problems, and hence make the future healthcare system more efficient. It will also make it easier for patients to discover and talk with fellow patients suffering from similar diseases/conditions and to exchange experiences and hence raise their spirits collectively in the fight against the illness.

MyHealthAvatar is expected to have a great influence to the future of our society. As a novel digital representation of patient information, it will certainly have an impact on the knowledge representation and analysis in VPH. This complies with the priority and strategy of FP7 ICT for Healthcare, and constitutes a suitable preparatory action aiming at the grand challenge on a "**Digital Patient**", which is currently under roadmap by the VPH community. In addition, MyHealthAvatar pays special attention to engaging the public by designing the avatars as personal life-time companions of the citizens. This has huge implications to society both socially and economically. It will be a way to fully demonstrate the power of ICT technology in the impact of our daily life and has the potential to change the way we think, communicate and search for information. Meanwhile, the acceptance of the avatars by the public will open huge marketing opportunities for industrial sectors in addition to ICT, such as toys, books, clothing, television and movies, etc., reinforcing European industrial leadership.

3.1.4 Necessity for a European approach

The MyHealthAvatar system will mainly target the fragmented EU healthcare systems by supporting their interoperability through the use of personal avatars. With citizens increasingly travelling across the borders between EU countries, the health status information of individuals should be accessible whenever and wherever it is needed. Building the avatar system described in this proposal will facilitate this and help to fulfil the goal at the heart of EC's strategy for the development of eHealth.

For historical reasons, the interoperability of EC healthcare systems is poor. In addition to the major difficulties that it brings to cross-border operations in healthcare, this leads to the fragmentation of the eHealth markets and the failure of European suppliers of eHealth solutions. The importance of cross-border interoperability of eHealth solutions is recognised in the "eHealth Action Plan", "Recommendation on cross-border interoperability of electronic health record systems" and "Communication on telemedicine for the benefit of patients, healthcare systems and society" of the European Commission and also confirmed in the eHealth Resolution (WHA58/28) of the World Health Assembly.

MyHealthAvatar will bring together existing VPH models and data across the VPH community in Europe to offer enhanced healthcare using the avatar as an interface. Although ICT has been revolutionising the healthcare sector in recent years, the EU has found that efforts across the continent have been fragmented and could benefit from improved integration. VPH models, data and tools have been widely introduced, but their uptake by health authorities, hospitals and doctors is still very low. If the avatar system can provide a way to increase the interoperability of these models and data from the previous VPH projects in addition to its connection to the other data sources (e.g. hospital records), the potential benefits that can be brought to patients will increase significantly.

In the healthcare sector throughout Europe, suppliers and users face many common challenges. By working together to develop and implement MyHealthAvatar as a common interface, the benefit will reach not only doctors and patients, but also European industry. As leaders in developing eHealth, European enterprises are in a strong position in the world marketplace, and the European Union aims to encourage them to build on their efforts up to now. Meanwhile, the acceptance of the avatars by the public will open huge marketing opportunities for industrial sectors in addition to ICT, such as toys, books, clothing, television and movies, etc., reinforcing European industrial leadership

B 3.2 Plan for the use and dissemination of foreground

The consortium recognises the hurdles to be overcome before MyHealthAvatar can be placed in the hands of professionals and patients. The project will support the dissemination of the MyHealthAvatar initiative and the deployment of the investigated techniques, converting research results into concrete services that are actually used by those who need them.

The goal of dissemination and exploitation is to:

- spread the news of MyHealthAvatar
- deploy the techniques for practical use at the earlier opportunity, test the efficiency of the techniques in real world settings and identify potential projects

- promote cultural acceptance of the new techniques and overcome cultural barriers
- share knowledge and experience of MyHealthAvatar with the resource community
- drive innovation through the exploitation of SMEs.

3.2.1 Dissemination strategy

WP10 deals with dissemination issues. The dissemination effort will be coordinated by ICCS. The project coordinator will guide the synthesis of a Dissemination Committee (DC), with members from all partners, which will be in charge of the strategic direction of dissemination. The committee will include members with significant role in the VPH-NoE, which will help to ensure a ready means of communication with other relevant VPH projects, such as Discipulus and VPH-Share.

The DC will liaise closely with the Project Coordinator and the PMO at BED (which will be the main source of information about the project) to ensure that appropriate dissemination materials are produced when necessary. The DC will also seek to identify other application domains in which MyHealthAvatar's technology could be of use, so as to broaden the future scope of the project. The DC will also seek to engage the industrial and clinical communities and to produce materials suitable for dissemination about MyHealthAvatar to the general public.

In detail, the proposed plan for dissemination will:

- establish communication with scientific, technological, industrial and clinical stakeholders for the dissemination of information about MyHealthAvatar, including its motivation, objectives, approaches and results
- develop materials for disseminating the data-collecting approach of MyHealthAvatar to the general public
- exchange information with other initiatives and relevant projects
- actively promote the use of MyHealthAvatar within relevant professional groups, such as the VPH community, and by the general public, as they will be the owners of their own avatars
- allow for and promote the commercialisation of the MyHealthAvatar approach, such as on the site that stores the citizen's health Avatar.

ICCS is an academic establishment, i.e. a module of the National Technical University of Athens, and will therefore there will be a great opportunity throughout the project to inform researchers, students and teaching personnel alike about the objectives and the results of the project to invest part of their dynamism to the cause of advancing science and technology under a de facto idealistic umbrella.

ICCS will contribute to the broad and targeted dissemination of the project's results. It will take advantage of its long-standing experience in multiscale cancer modeling in order to disseminate the project's outcome to researchers active in the field of cancer modeling.

More specifically, the following specific dissemination actions will be carried out:

(a) MyHealthAvatar web-site and dissemination materials

At the outset, a project website will be created and this will be regularly maintained and updated. It will constitute the main public source of information about the R&D, training/workshops and other activities of the project.

The DC will co-ordinate a "Dissemination Toolkit" which will include the project logo, some illustrative images and movies free of copyright, a popular science description of the project results, a project flyer, PowerPoint presentations and any other material that could be useful for dissemination. This material will be regularly updated throughout the project and the latest version will always be accessible to partners on a private part of the MyHealthAvatar website. These generic dissemination resources are especially useful and important in this project since the citizens are the main players in this project. By the end of the project, we expect to have a dissemination portfolio that can address issues relevant to all key stakeholders, worldwide. Connections will be sought with existing VPH portals, such as Biomed Town. We will also link to other relevant projects, such as Discipulus, VPH-Share, Tumor and P-Medicine.

A lot of project deliverable will be made public. Resources from the project (ontology, repositories) will be made open source. They can be linked to external sources as well, e.g. open link data cloud.

(b) Publications

All MyHealthAvatar partners will regularly take part in international scientific discussions. The results will be relevant to technological, scientific and clinical journals and conferences and to trade magazines. All partners will help to select events and channels through which the project will be disseminated and will contribute to a Dissemination Plan, the first draft of which will be produced at PM12. This will continue to be revisited and updated under the leadership of the DC for the remainder of the project. By publishing high-quality papers about the MyHealthAvatar results, academic partners will obtain improved international visibility and improve their position in attracting the best international PhD, Master and graduate level students to their institutions.

The DC will also regularly post news, announcements and events related to MyHealthAvatar on the main web pages and will transmit such information to the VPH-NoE for inclusion in their dissemination channels. They will also organise press releases at appropriate points in the project.

The relevant list of events and conferences include:

- Eurovis: EG/IEEE TCVG Symposium on Visualization: 2013-2015
- ISPA: Intern. Symp. on Image and Signal Processing and Analysis: 2013-2015
- Vis/Infovis/VAST: IEEE conference on Visualization/Visual Analytics: 2013-2015
- CVPR: IEEE Computer Vision and Pattern Recognition: 2013-2015
- ECCV: European Conference on Computer Vision: 2013-2015
- MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention: 2013-2015
- ICCV: International Conference on Computer Vision: 2013-2015
- ISBI: IEEE International Symposium on Biomedical Imaging, 2013-2015
- RSNA: Radiological Society of North America: 2013-2015
- SPIE: Medical Imaging: 2013-2015
- MIUA: Medical Image Understanding and Analysis: 2013-2015
- IEEE International Conference on Image Processing: 2013-2015
- SPIE Electronic Imaging: 2013-2015
- International Semantic Web Conference (ISWC) : 2013-2015
- International conference on next generation web services practices: 2013-2015
- European Conference on Web Services: 2013-2015
- IEEE International Conference on Data Mining (ICDM) : 2013-2015
- IEEE Infocom: 2013-2015
- VPH Conferences: 2013-2015
- 6th International Advanced Research Workshop on In Silico Oncology and Cancer Investigation) : 2013-2015
- SIOP Meeting: : 2013-2015
- ASCO meeting 2013 in Chicago: 2013-2015

- 17th ECCO - 38th ESMO - 32nd ESTRO European Cancer Congress , 27th September to 1st October 2013, Amsterdam, Netherlands: http://www.ecco-org.eu
- IEEE International Conference on Bioinformatics and Bioengineering (IEEE BIBE)
- Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)

We will take the opportunities of these conferences to evaluate the MyHealthAvatar tools that are developed within the scope of the project.

(c) Workshop

In the later stages of the project, early versions of the data collection system will be made available to selected users, professional and non-professional. Interested VPH projects may also be given this possibility. MyHealthAvatar will run a workshop which will provide training and an opportunity for scientists to investigate the MyHealthAvatar benefits for themselves. Our preference would be to run this within the annual **VPH conference organised by the VPH-NoE** (subject to the agreement of the organisers). Events may also be organized alongside those from Discipulus. In addition to academic participants, these events will be made open to the general public, including the policy makers and those from funding bodies.

Also, during the project's lifetime the 6th IARWISOCI (6th International Advanced Research Workshop on In Silico Oncology and Cancer Investigation), co-organized by ICCS, will take place (in autumn 2014). ICCS plans to include into the workshop programme a dedicated section for the dissemination of MyHealthAvatar-related work achieved by that time. The IARWISOCI workshop series are held every other year. They were initiated by ICCS- in Sparta, Greece in 2004. The second workshop took place in Chania, Crete, Greece in 2006. The 2008 event took place in Istanbul, Turkey, after having become an IEEE (Institute of Electrical and Electronics Engineers) technically co-sponsored event. The 2010 event took place in Athens, and included dedicated sections for the EU-projects ContraCancrum and Tumor.

(d) Concertation activities

MyHealthAvatar plans and accounts for concertation activities with other ICT funded projects in the related area, including:

- **Discipulus**

The DISCIPULUS project is a **support action** under FP7 aiming at a **roadmap** for the realisation of the "Digital VPH Patient. It regards the Digital Patient as a method of integrating diverse computational models and individual data to produce a computational patient avatar, which would allow revolutionary health prediction and disease treatment. It will develop a vision and sound ICT research agenda around the Digital Patient. Digital Patient is regarded as a major step towards utilising existing predictive models within VPH by incorporating them in a systematic way into the clinical decision-making process. This support action is still ongoing[DISCIPULUS].

- **VPH Share**

VPH-Share is an ongoing FP7 Integrated Project (IP), which will develop an info-structure for sharing data and knowledge to support the collaborative development of multiscale models for the composition of new VPH workflows. The operations range from secure access and storage through annotation, data inference and assimilation, to complex image processing and physics-based mathematical modelling, to data reduction and representation. The project focuses the interface with the wealth of data from medical research and from clinical processes. One of the objectives of VPH Share is to develop the concept of a patient avatar as the information representation[VPH-SHARE]. However, it does not target the collection of and access to the long term individual patient data as in MyHealthAvatar.

- **P-Medicine**

From data sharing and integration via VPH models to personalized medicine (P-Medicine) is a 4-year Integrated Project aiming at developing new tools, IT infrastructure and VPH models to accelerate personalized medicine. One of the emphases is on formulating an open, modular framework of tools and services to gradually adopt efficient secure sharing and handling of large personalized data sets[P-MEDICINE].

- **ACGT**

The objective of the Advancing Clinico-Genomic Trials on Cancer (ACGT) project (IP), which concluded in 2010, was to develop open-source, semantic and grid-based technologies in support of post genomic clinical trials in cancer research. The technological infrastructure developed facilitates secure access and analysis of multi-level clinical and genomic data enriched with high-performing knowledge discovery operations and services in support of multi-centric, post-genomic clinical trials[ACGT].

- **Tumor**

Tumor is implementing a EU cancer model/data repository, and developing/providing specific tools and methods for the collection, curation, validation and customization of existing EU and US cancer models, by linking the most significant relevant EU VPH projects on cancer modelling (ContraCancrum, ACGT), and the US project (CViT)[TUMOR].

In addition, we will also look into collaboration with successful VPH projects Call 9, such as CHIC, Dr. Dr THERAPAT.

The concertation activities with these VPH projects will potentially lead to more access to clinical participants and hence allow increased opportunities for clinical evolutions.

3.2.2 Use of project results and exploitation

We will seek for synergies and joint potential between exploitation opportunities.

For academic partners, the technical developments will be integrated quickly into their teaching curricula and research agendas, giving themselves and their graduates a competitive edge.

The academic partners (i.e., universities and research institutes) will also make sure that the developments are carried into future national and international research projects, deeply rooting the MyHealthAvatar results in their research and development activities. In particular, **the project results will act as a vehicle to allow them embark on the future research in the Digital Patient.**

The academic exploitation of strategic guidelines naturally has a longer time horizon. We will prepare the future research agenda, based on the results achieved by MyHealthAvatar, and identify new problems which have to be solved to strengthen the MyHealthAvatar impact further. We will also be tasked with preparing the workforce for the future landscape, both for direct work in industry and for research – this development will be particularly important for SMEs who are often not themselves able to train personnel in these new networking technologies. The long-term result of the efforts of the academic partners will be to place the approaches developed in MyHealthAvatar in the mainstream of teaching and research in networking and communications systems.

The exploitation goals of the industrial partners are different yet complementary to those of academic partners. In fact, led by ASTRID, the industrial partners are expected to play a main role in the exploitation. They will mainly focus their exploitation activities on improving their current operations and business position in existing markets and on the creation of, and preparation for, new markets, with the intention of securing a strong leadership position in them.

Industrial partners can exploit direct improvements externally. The prime objective here is to create new products and services or to improve their existing products for existing or currently incipient markets. For example, the techniques developed within the scope of this project could potentially enhance the disease discovery suite from ASTRID, and may also open up a new direction for ANS on visual analytics on mobile devices. In particular, the future trend of patient-centred care and the

initiative of promoting the self engagement of citizens in their healthcare in MyHealthAvatar will open up many business opportunities.

These initiatives will provide an essential time-to-market advantage over competitors. Both of the industrial partners will be better prepared for new markets, products and services and can position themselves early. They can also work towards the creation of new customer relationships by creating a community around their new offerings. They intend to provide the MyHealthAvatar results to forthcoming test-bed projects to ensure early adoption of its approaches within the community as a solid foundation for future European and world-wide research. It will also become possible for them start up dedicated companies for such new business models. In addition, training for sales personnel, engineers, etc., can be started early, thus bringing an advantage over the competition. Overall, being aware of future strategic developments will allow them to embrace new usage scenarios and to prepare technical solutions. In the long run, this will lead to new business opportunities.

The MyHealthAvatar approach does not necessarily imply that there will be a disruption of the business model. The latter will however be shifted, not only due to the technology itself but also due to continuing trends such as the open source movement.

ASTRID leads the exploitation task in WP10, which will define the exploitation plan of the project. Market research will be carried out and a preliminary exploitation planning report will be prepared and circulated within the consortium for comment prior to the delivery of the first formal version at PM24.

To analyze the market for the MyHealthAvatar outcomes, the report will provide a global view of all the key technical aspects involved in the project. The global view will be expressed in terms of functionalities, attributes as well as the scale of innovation. This will allow the consortium to gain a broad vision and a good understanding of the level of advance of the MyHealthAvatar techniques as compared to existing products on market. The analysis will focus on the core techniques by assessing their innovation scales. Also, the market research will look into other business opportunities brought by the use of open sources. In fact, the open source model has been very successful in recent years and MyHealthAvatar could also be explored as an open source in the future.

To better define and analyze the potential market, a set of indicators will be set up as a basis for the marketing. An important exploitation task is to collect data for these indicators, based on which further market decisions will be made with regards to the marketing strategy, e.g. priority marketing areas, countries, etc.

A comparative study is to be carried out to identify the main competitors by looking into its strengths and weaknesses – see below. This study will be continued as part of the exploitation task.

Exploitation will continue to receive attention throughout the final year of the project, including the identification of possible early adopters or third parties that may be necessary in a deployment scenario, culminating in a Business Plan to be delivered.

3.2.3 The management of knowledge and intellectual property

The strategy for the protection, use, dissemination and intellectual property rights and management of knowledge that will be generated under the project will be incorporated in the Consortium Agreement and will be based on the following basic principles: (i) foreground shall be the property of the beneficiary carrying out the work generating that foreground; and (ii) the full consortium members grant mutual access rights on a royalty–free basis to knowledge or background for the purpose of carrying out their own project work or for using their own knowledge. The Consortium Agreement will address the adequate protection of knowledge, the allocation of the cost of protection, the responsibility for the extension of the protection rights, the protection and enforcement against infringement rights by third parties, the licensing of knowledge, the internal procedure of information and consultation to deal with potential problems arising from access rights and protection and use of both foreground and background.

The data in MyHealthAvatar is the core of the project. Linking with the earlier mentioned external projects and the collection of patient dairy in WP6 constitute the two major data sources. We will aim at fulfilling a public ownership by making the data publically accessible, subject to the clearance of legal and ethical issues. The presence of LUH will help us to solve the implicit legal and data ownership issues.

The management of knowledge will be achieved via two fundamental management structures of MyHealthAvatar, i.e. the General Assembly and the Steering Committee. As a rule, the SC will formulate proposals concerning knowledge management issues which will be approved, disapproved or altered by the GA. Since the work plan contains several technically innovative approaches, it is expected that important intellectual property will result from the works. One task of the SC at the start of the project will be to finalise the procedures to assure the protection of knowledge and intellectual property created in the project and to decide upon a dissemination strategy and promotion activities in cooperation with the respective work groups and partners of the consortium. Relevant information such as deliverable reports, publications, patent applications, etc will be made available for the consortium by a private document repository, available only to consortium members, on the MyHealthAvatar website.

Should any issue arise concerning intellectual property, the SC will formulate a potential resolution which will be discussed and eventually approved following any modifications by the GA. The Consortium Agreement will document in detail the treatment of intellectual property rights. IPR management is also discussed in Section 2.12. In analogy with knowledge and intellectual property management, other innovation activities arising from the project will first be discussed at the SC level and then passed to the GA for eventual modification and final approval.

We will also strive to structure standards so that a reasonable patent strategy can be pursued by all partners, whereby possible essential patents not owned by a partner can be outbalanced by patents owned by partners to avoid standards become hostage to non-participants' demands for excessive compensation and thus preventing implementation of the standard. With respect to legal aspects of IPR management inside the consortium such as ownership and access rights, we will of course comply with the rules for EC projects.

Notably, both exploitation and IPR issues will be supported by the research in WP11 regarding potential legal issues in future avatar systems.

B4. ETHICAL ISSUES (IF APPLICABLE)

4.1 Overview

When dealing with clinical and biological information, the project will follow *The Charter of Fundamental Rights of the European Union*[3] (Nice, 2000), the *Convention of the Council of Europe on Human Rights and Biomedicine*[4] (Oviedo, 1997) and *The European Union Directive 95/46/EC*[5] (processing of personal data and on the free movement of such data). The consortium will also take into considerations the positions expressed by the *European Group on Ethics in Science and New Technologies*[6].

The general ethical guidelines for undertaking ICT research in FP7 can be found in the Guide for applicants[GUI], which will be fully complied within the entire duration of the project.

Besides the general issues on data treatment posed by any ICT for Health research, VPH research

[3] http://www.europarl.europa.eu/charter/default_en.htm
[4] http://conventions.coe.int/Treaty/en/Treaties/Html/164.htm
[5] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31995L0046:EN:HTML
[6] http://ec.europa.eu/european_group_ethics/index_en.htm

raises some original issues, as discussed at length in the VPH Research Roadmap of the STEP action[7].

In that document, it is suggested that all these issues should be analysed in the context of the relevant European legislation, which will have to consider and take into account particularly Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data, and the ARTICLE 29 Data Protection Working Party's[8] working document on the processing of personal data relating to health in electronic health records (EHR) (document 00323/07/EN; WP 131; adopted on 15 February 2007), particularly the section on "Use of EHR for other purposes": There (p. 16), it is stated that "processing of EHR-data for the purposes of medical scientific research and government statistics could be allowed as an exception to the rule ... so as to protect the fundamental rights and the privacy of individuals. Moreover, whenever feasible and possible, data from EHR systems should be used for other purposes (e.g. statistics or quality evaluation) only in anonymised form or at least with secure pseudonymisation."

Aspects that were subjected to ethical attention during the development of this proposal relate to informed consent and privacy

MyHealthAvatar is a research project aiming at developing technology. We plan to maintain a constant monitoring of ethical, legal and privacy issues during the project, and it will be an agenda item at all SC meetings. Individual partners will, of course, have to be scrutinised by their own local ethics committees and copies of the necessary approvals will be collected by the PC and made available to the EC upon request.

In the unlikely event of a serious ethical problem, the SC will organise an extraordinary meeting with representatives of the Ethical Committees of the partner institutions involved.

The consortium is well-experienced in dealing with ethical issues arising from the handling of data, especially those directly involved in the data collection and data repositories within this project have similar experiences in the past through a number of VPH projects (e.g. ContraCancrum, ACGT, P-Medicine, Tumor). The activities will also be supervised by our legal expert, LUH, who will deal with the ethical and legal issues by setting up a legal and ethical help desk to offer internal advices

In no case, and under no circumstances, will research activity involving ethically sensitive issues be commenced without proper local authorisation from the Ethical Committee, according to the national law in force where the activities will be conducted, and taking account of all EU legislation.

4.2 Potential ethical issues

WP5 will need to use data/model collected from other projects such as ContraCancrum, ACGT, P-Medicine, Tumor. All the data have already been to an ethical clearing process that strictly complied with law and regulations. The data have been fully anonymised prior to use and any data in which item values considered to provide a high risk of identification or to permit sub-population attributions to be inferred have been excluded. For example, the anonymised data concerning glioblastoma and lung cancer will be supplied by USAAR from the EC project ContraCancrum. All related ethical issues have already been dealt with within the ContraCancrum project. USAAR has kindly agreed to allow MyHealthAvatar to use the data in anonymised form. Further, the potential IPR and other issues arising from the use of the data from the previous projects will be dealt with by the experts from LUH, who has a good knowledge in this area.

WP6 will involve the collection of a small number of multiscale datasets. This will be handled by FORTH, who has great experience in following ethical rules of data collection in many VPH projects.

[7] Seeding the EuroPhysiome: A Roadmap to the Virtual Physiological Human, //www.europhysiome.org/

[8] Working Party set up under Article 29 of Directive 95/46/EC; it is an independent European advisory body on data protection and privacy; its tasks are described in Article 30 of Directive 95/46/EC and Article 15 of Directive 2002/58/EC. http://europa.eu.int/comm/justice_home/fsj/privacy/index_en.htm

WP6 will also need some volunteer participants who will be involved in the data collection through their use of social media (Facebook, Twitter, etc.) and from the mobile apps(for health data, etc.). This will give rise to the issues of privacy and informed consent.

4.2.1 Privacy and Informed Consent

The principles of the Charter of Fundamental Rights of the European Union will be complied by the approach adopted by the research of MyHealthAvatar, which will pay full respect to cover dignity, freedom, equality, solidarity, citizens' rights and justice. We will in particular comply with Article 8 of the European Human Rights Convention and with articles 7 and 8 of the Charter of Fundamental Rights of the European Union. All the researchers will comply with national legislation, European Union legislation, respect international conventions and declarations and take into account the Opinions of the European Group on Ethics. In particular, we will look into new dangers associated with the process of the ICT research in MyHealthAvatar and will seriously consider the sensitive implications for privacy and autonomy. The specific actions that will be taken by MyHealthAvatar include:

- We will carry out a prior assessment of risk and identification of precautionary actions proportional to the potential risk/harm in the project.
- We will work closely with the Ethics Committees, require the necessary clearance of ethics committees if needed and keep them informed in the ethical and practical implications of the ICT work in the project, especially when particular issues become apparent within the research process.
- The researchers in MyHealthAvatar will be made aware that volunteers have the right to remain anonymous. The research activities will firmly comply with Data Protection legislation in the Member State where the research will be carried out regarding ICT research data that relates to volunteers.
- Informed consent will be carried to all the participants for the abovementioned activities. This will empower the individual involved to make a voluntary informed decision about whether or not to participate in the research based on knowledge of the purpose, procedures and outcomes of the research. They will have to have the possibility to obtain additional information about their personal data processed and to revoke their consent at any time.
- Before consent is sought, information must be given specifying the alternatives, risks, and benefits for those involved in a way the participants understand. Appropriate consent procedures will be used. Special consideration must be given when volunteers have reduced autonomy or are vulnerable.
- All the information acquired from the abovementioned activities will go through an ethical cleaning process (e.g. be anonymised). Researchers will ensure that the manner in which research outcomes are reported does not contravene the right to privacy and data protection.
- The data hosting will also comply with relevant guidelines and regulations, which will need to be fully approved by the ethics committee.
- The data access will only also strictly follow the guidelines and regulations, which will be fully approved by the ethics committee.
- A data protection officer (DPO) will be nominated in the project and this task will be undertaken by LUH as task leader of task 11.5 ("Legal ane ethical helpdesk").

The data collection is likely to take place in the places where the involved partners locate (i.e. USAAR (DE) or BED (UK) or FORTH(GR)). The data repository will be built in BED (UK). The activities will be closely monitored and approved by the local ethics committees.

Notably, all the activities will be assisted by LUH. In fact, with an aim to provide a full solution for the future deployment of the concept of this project, the important ethical issues related to MyHealthAvatar will be researched in WP11, and a recommendation will be given at the end of this project.

ETHICAL ISSUES TABLE

	YES	PAGE
Informed Consent		
• Does the proposal involve children?		
• Does the proposal involve patients or persons not able to give consent?		
• Does the proposal involve adult healthy volunteers?	x	Section 4, p48
• Does the proposal involve Human Genetic Material?		
• Does the proposal involve Human biological samples?		
• Does the proposal involve Human data collection?		
Research on Human embryo/foetus		
• Does the proposal involve Human Embryos?		
• Does the proposal involve Human Foetal Tissue / Cells?		
• Does the proposal involve Human Embryonic Stem Cells?		
Privacy		
• Does the proposal involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)	x	Section 4, p48
• Does the proposal involve tracking the location or observation of people?		
Research on Animals		
• Does the proposal involve research on animals?		
• Are those animals transgenic small laboratory animals?		
• Are those animals transgenic farm animals?		
• Are those animals cloned farm animals?		
• Are those animals non-human primates?		
Research Involving Developing Countries		
• Use of local resources (genetic, animal, plant etc)		

• Impact on local community		
Dual Use		
• Research having direct military application		
• Research having the potential for terrorist abuse		
ICT Implants		
• Does the proposal involve clinical trials of ICT implants?		
I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROPOSAL		

B5. GENDER ASPECTS (OPTIONAL)

Gender Issues

Although there is a still a clear gender imbalance in the engineering field, this proposal involves a significant proportion of female researchers (see Section 2.2). All partners are Equal Opportunities employers and have processes to ensure that there is no gender bias in the employment of their staff. Gender issues will be addressed at the management level in the quality assurance procedures where rules will be defined in the Project Manual in order to respect gender aspects on levels of the project execution and promote the participation of women researchers in the project according to the EC guidelines[9].

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