SEQUOIA PROJECT

"Socio-Economic Impact Assessment for Research Projects"

Contract n° 258346

WP3: Socio-economic Impact Assessment of Research Projects

Deliverable 3.2 – Best Practices Report

Project funded by the European Commission "Information Society and Media Directorate - General", Support Action

Contract Number: 258346

Project Acronym: SEQUOIA

Deliverable N°: 3.2

Due date: Month 17 (September 2011)

Delivery Date: 7 June 2012

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Made available to: Public

VERSIONING		
VERSION	DATE	NAME, ORGANIZATION
1	01/12/2011	ANTONELLA PASSANI (T6 ECO)
2	01/01/2012	FRANCESCA SPAGNOLI (EK), SHENJA VAN DER GRAAF (LSE), MARIE DEBICKI (T6 ECO)
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4	28/02/2012	ANTONELLA PASSANI (T6 ECO)
5	04/05/2012	ANTONELLA PASSANI (T6 ECO), FRANCESCA SPAGNOLI (EK), SHENJA VAN DER GRAAF (LSE), MARIE DEBICKI (T6 ECO)
6	22/05/2012	ANTONELLA PASSANI (T6 ECO)
7[1]	06/07/2012	ANTONELLA PASSANI (T6 ECO), MARIE DEBICKI (T6 ECO)

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D3.2 – Best Practices Report

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[1] The final modifications have been made after the final review.

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Introduction

The Best Practices Report aims at presenting five case studies selected among the projects analysed during the SEQUOIA project. These projects emerged from the assessment activities as particularly promising in terms of positive impact on users and society as a whole. The five projects presented here (in no particular order) are the ones that obtained the highest score in the application of SEQUOIA methodology.

However, we must take into consideration the fact that most of the projects analysed by SEQUOIA (see D.3.1) are on-going projects (except for some Call1 projects), so the comparison among the projects was made on the *expected* and not *actual* impacts. In order to have a precise ex-post assessment, it would be necessary to carry out again the assessment at the end of the projects, and, possibly, 2 or more years after the end of the projects.

This report gives examples of the concrete application of the SEQUOIA methodology (see D3.3a), and can be of help for those projects that are willing to use it; in this sense this report complements the "SEQUOIA Self-Assessment How-To Guide" (D3.3b).

The five projects presented here are: S-Cube, Mosaic, CumuloNimbo, Soclos and I2Web. The impact assessment follows the same structure for all five projects under scrutiny: for each one the main areas of impact and beneficiaries are presented, followed by a detailed analysis of the economic and the social impacts of the project[2]. Finally, the SEQUOIA indices are calculated (iROI, xROI, tROI and the multi-criteria indices[3]).

It is important to remember that the assessment reported here refers to data gathered up to December 2011 (when the data gathering process ended). Looking at publicly available data, we can say that many figures have increased since then (for example the number of scientific publications, training sessions etc.); however, it was not possible to update all the necessary data because this would require a second round of interviews and this was not feasible at this stage of the SEQUOIA project.

Furthermore, the results of this report were used also to realise a short video on the projects' results (D5.1). This video was useful for the projects to diffuse their results and was presented during the Final SEQUOIA Conference (D6.2). On the same occasion, the five projects presented in this report were invited to showcase their results during the Conference. This was a good opportunity for all the projects invited to exchange opinions and suggestions about the SEQUOIA methodology, to carry out networking activities and to disseminate their achievements (D6.2).

[2] Each chapter of this report is dedicated to a specific project. All the chapter are organised in the same way but the chapter dedicated to S-Cube is more articulated and present more information. This difference is due to the fact that, when we did the assessment, S-Cube was in a more advanced stage than the other projects. Beside this, S-Cube has also been "used" for testing different versions of the SEQUOIA methodology so more data was gathered.

[3] See Annex 1 for a short definition of SEQUOIA indices: iROI, xROI, tROI, multi-criteria indices (MCA) and RORI

1 S-Cube

S-Cube – Software Services and Systems Network – is a Network of Excellence co-funded through the first Call for FP7-ICT-2007-1-Objective 1.2 Software & Services Architectures, Infrastructures and Engineering (2007-2012). The project started in March 2008 and ended in February 2012.

1.1 Mapping the areas of impact

S-Cube aims at establishing an integrated, multidisciplinary, vibrant research community and to support Europe in leading the software-services revolution, thereby helping shape the Internet of Services, which – as part of the Future Internet – will be a backbone of our future interactive society.

The project addresses QoS & SLA (Quality of Service and Service Level Agreement), infrastructure, service composition, and business process modelling from three perspectives: engineering design, adaptation & monitoring.

It pursues the following objectives:

- Re-aligning, re-shaping and integrating research agendas of key European players from diverse research areas, by synthesizing and integrating diversified knowledge; inaugurating a Europe-wide common programme of education and training for researchers and industry.
- Establishing a proactive mobility plan to enable cross-fertilisation, among research communities for establishing a common software services research culture.
- Establishing trust relationships with industry; defining a broader research vision and perspective.

Hereafter the main outputs of the project are presented.

- *Integrated research Community on Service-oriented Systems*

As stated by the project, “the challenges faced in the Future Internet cannot be addressed by a single research organization or community in isolation. Thus, an integrated, multi-disciplinary research community is key”. Within S-Cube more than 70 researchers and 50 Ph.D. students coming from 15 institutions work together on different typologies of integration activities and joint research activities.

- *Highly-relevant, joint research results (publications)*

Joint research works drive the integration of different communities, resulting in specific publications. The publications also serve as a bridge between diverse communities (i.e. creating awareness for the need for cross-disciplinary work). We will consider here also the S-Cube knowledge model as an open instrument that summarizes some of the research outputs and offers them to the wider research community.

- *Joint education and training of students and postgraduates*

Enabling Europe to lead the Future Internet “revolution” requires well-trained students and researchers. Similarly to the research results, such an education

requires a multi-disciplinary approach to teaching and education. Specifically, here we will consider the S-Cube summer school and the participation of S-Cube to the IMPSE project that offers advanced training courses.

Description of the structure of the project's activities

The S-Cube project is organised around the following structure of activities:

- Baseline: Collection of as-is knowledge and research agendas of the beneficiaries.
- Integration: Integration of state-of-the-art knowledge; alignment of research agendas.
- Consolidation: Elaboration of common research agendas and complementary joint research projects.
- Sustainability: Establishment of long-term collaborations and joint research roadmap.

The project – at the time of writing – just ended.

Identification of the main stakeholders and of the expected impacts

Considering that the entire service-engineering community could be considered as potential users of the S-Cube project, 5 more specific categories of stakeholders - that will benefit from S-Cube - have been identified:

- *Researchers and research communities*: considering the main objective of the project, the researchers and research communities are the main beneficiaries of the project. S-Cube will enable them to have a better understanding and integration of the research activities regarding the Future Internet. Interdisciplinarity is fundamental from this point of view.
- *Students (mainly postgraduates):* they represent another important category of project stakeholders. In fact, they will benefit from the common programme of education and training created by the project in the relevant areas for service-based systems.
- *Developers and software engineers:* S-Cube will help the developers and software engineers to develop and improve service-based systems, thanks to a better understanding of how to design and evolve service systems.
- *Service providers*: service providers will benefit from S-Cube as the project will offer them a better understanding and knowledge of service-based systems. Thanks to the project they will be able to build composed, adaptable, and context-aware services, and therefore they will be able to better address user needs and dynamically respond to varying user contexts.
- *Industry and SMEs:* this category will be able to benefit from the catalogue of techniques and methods elaborated by S-Cube. Thanks to this catalogue, they will have access to up-to-date information about novel trends in technology and techniques for service systems, influencing the way systems can be planned and built.

The table below summarizes the relation between stakeholders, main activities enabled for them by the project, and expected impacts for each category.

Stakeholders/beneficiaries and relevance score (from 1 to 5[4])	*Main activities possible using S-Cube's outputs*	*Expected impact*
Researchers and research communities (5)	Understanding of open, multi-disciplinary research to be addressed for the Future Internet. Baseline of novel techniques and methods for service engineering and adaptation.	Better alignment and orientation of research in the field of SOC driven by findings and guidance of key researchers and research organizations in the field.
Student and postgraduates (5)	Participation to joint Masters programme on service engineering and summer schools on service-oriented computing; Access to the virtual campus and the S-Cube knowledge model.	Well-trained European students in the relevant areas for service-based systems, including software engineering, business.
Developers and software engineers (5)	Develop and evolve (maintain) service-based systems.	Improved understanding of how to design and evolve services systems (leading to better planning and efficient development processes.
Service providers (5)	In the role of service integrators, understand how to build composed services that are adaptable and context-aware.	Improved user satisfaction due to better addressing user needs and dynamically responding to varying user contexts.
Industry and SMEs (4)	Catalogue of techniques and methods that can be transferred to industry (e.g., quality modelling languages, knowledge model with key terminology, lecture modules).	Availability of up-to-date information about novel trends in technology and techniques for service systems influencing the way systems can be built and planned.

Tab. 1 - Most relevant beneficiaries/users of S-Cube, activities they will be enabled to do thanks to S-Cube outputs, and expected impacts

It should be noted that project partners are the project's stakeholders too, especially as "researchers and research centres" and "students and postgraduates". This is consistent with the fact that S-Cube, as a Network of Excellence (NoE), offers services and support to research institutions that are also inside the consortium. All other typologies of stakeholders are external to the project consortium.

[4] Where 1 is "very relevant" and 1 is "not relevant".

1.2 Economic impact

S-Cube total cost is € 5.745.000. The table below shows the total project costs divided by category, in order to identify their effects on cash outflows.

Cost categories	Euros
Personnel (not counting personnel costs related to management and to dissemination)	4.500.000
Training	0
Use case running	0
Subcontracting	45.000
Travel	700.000
Dissemination costs (personnel plus other costs)	500.000

Tab. 2 – S-Cube's costs divided by categories

The economic impact brought by the knowledge advances in the Software Services and Systems will require a long timeframe to be experienced by society (given that it would probably bring in the future to the discovery of new applications that could improve the welfare of some societal groups) and, therefore, at the present stage, it is almost impossible to foresee and quantify all the potential benefits brought by the project.

However, we asked the S-Cube team to express their qualitative opinion about the various possible expected benefits, selecting the appropriate items from a pre-defined list. The table below shows that the most relevant benefits of the NoE are that of expanding the range and the typologies of research activities and services made available to research communities and that of having more well-trained and educated graduates in the field. As a direct consequence, other expected benefits include succeeding in improving the quality of the software services and systems, reaching more users by better targeting their needs, improving scalability, and higher efficiency in performing research activities.

Expected benefits	
Improve service/product/system quality	X
Reach more users	X
Lower entry barriers in a specific economic sector	
Improve the access to large amounts of data. Improve the possibility to exploit large amounts of data (more efficient data analysis)	
More efficient data exchange	
Improve scalability	X
Expand the range and the typologies of research activities and services made available to research communities	X
Cost reductions	
Reduce the time needed to deliver a service (reduce the time-to-market period)	
Reduce the time needed to deploy a service over the network/the architecture	
Keeping pace with competitors/with the research in the field	
Ability to better target users/beneficiaries' needs	X
Increment the optimisation of resources/improve efficiency	X
Other	Well-trained and educated graduates

Tab. 3 - S-Cube's expected benefits

Even if, at the present stage, it is not possible to have a complete view of the future, this assessment exercise will try to give, at least, a partial evaluation and quantification of the economic benefits brought by some of the short-term outputs already produced by S-Cube.

When SEQUOIA interviewed the project representatives, the S-Cube project had not yet identified a commercial exploitation of its outputs and it had not drafted a Business Plan. With reference to the sustainability plan of the project's outputs, however, S-Cube expected to generate 17 new partnership agreements with other universities and 17 new project proposals. S-Cube expects to realize the most substantial economic impact of its outputs 3 years after the end of the project.

The quality of the project's technical outputs increases their efficiency, which is the most relevant category of technological improvement, which will also contribute to reduce the negative impact on the environment.

In particular, the assessment exercise selected two project activities as the most relevant in terms of economic impact SoE1 (Spreading of Excellence) and IA1 (Integrating Knowledge and Resources), thanks to which the following three economically measurable outputs were identified:

1. The advanced training course (master) IMSE project (International Master in Service Engineering), co-financed by the Erasmus Mundis Program and organized by S-Cube together with other eight partners, whose main aim is that of preparing students with a background in either business or information technology, and where the Knowledge generated by S-Cube has been/will be used to provide high level training modules;

2. The Summer School on "Service Oriented Computing" (in partnership with the IMSE - IMSE students participate in the Summer School as part of their study programme), bringing together the best international experts on software and services with PhD students, young researchers and professionals from leading academic, research and industrial organizations across Europe and around the world, and where the Knowledge generated by the S-Cube NoE has been used to provide high-level training sessions;
3. The "Convergence Knowledge Model", a sort of specialized Wikipedia, whose main objective is that of capturing terminology, supporting the elimination of duplication of research efforts by tracking research progress reported in publications of the field of service-based applications (SBAs), and providing a comprehensive overview of the state of the art and an in-depth analysis of the research areas relevant to SBAs.

With reference to Points 1 and 2, the benefits of such outputs can be easily evaluated by calculating the net financial incomes generated by student fees, while the Knowledge Model (Point 3), being conceived as an on-line free tool, could be evaluated in economic terms by using the "shadow prices technique"[5].

The next section will show the information and calculation needed for performing these evaluations.

Evaluation of IMSE

IMSE is organized by 3 Universities (Tilburg, Stuttgart and Crete) and 9 partners (among which one is S-Cube), that cooperate in sharing their capitalized knowledge into the various training modules.

The IMSE training programme is articulated over four semesters (2 years) and offers 20 different training modules, 11 of which are directly managed by S-Cube staff. The tuition fee for each academic year is € 4.000 for EU/EEA students. The latest edition of IMSE counted 18 students, therefore generating a total revenue (calculated over 2 years) of € 144.000. Such value could be considered as a proxy of the total "knowledge benefits" generated by the IMSE. Starting from this global value, it is possible to calculate the share produced by S-Cube, dividing the IMSE total revenues by the total number of IMSE training modules, thus obtaining the value of €79.200. Finally, to calculate the global value of S-Cube benefits to IMSE, we can reasonably consider that the master will be repeated over, at least, 3 editions, before being changed/updated in its structure. This means that, over a period of 3 years, the benefits generated by S-Cube will be worth € 237.600.

The meaning of this value is two-fold:
1) financial - it is the financial amount, additional to the support given by the EU for the S-Cube project, attracted by S-Cube consortium's partners, and enabling them to perform additional/incremental research activities related to the same topic;
2) economic - it is a proxy (the willingness to pay) for measuring the value of the knowledge generated and disseminated by S-Cube to IMSE students.

The table below summarizes all the inputs and assumptions used in this assessment exercise for obtaining the value of S-Cube's participation in the IMSE.

[5] The shadow prices reflect the value that society assigns to a good or a service, in the absence of a market for such goods/services.

Master IMSE	
Annual fee (€)	4.000
n° students	18
Master length (years)	2
Total revenues (€)	144.000
N° tot. Training modules	20
Revenues/ training module (€)	7.200
N° modules taught by S-Cube	11
S-Cube revenues per master edition(€)	79.200
N° editions foreseen	3
S-Cube total revenues	237.600

Tab. 4 - Inputs and assumptions used to obtain the value of S-Cube's participation in the IMSE

Evaluation of Summer School on "Service oriented Computing"

The Summer School on "Service oriented Computing", organized by S-Cube with the participation of other 3 European projects (Compas, SOA4All and MASTER), and in cooperation with IMSE (the Summer School is regarded as an IMSE module), takes place over 6 days and 10 specialized sessions.

The average tuition fee for each student is about € 1.350 (hotel accommodation included). The most recent edition of IMSE counted 90 students, among which 18 students came from the IMSE Master, therefore generating a total gross revenue of € 97.200 (€1.350* 72 students attending only the summer school); by subtracting the students' accommodation costs (about €50/day, for a total accommodation cost of €27.000), we obtain the net revenues amount of €94.500. Such value could be considered as a proxy of the total "knowledge benefits" generated by S-Cube for the Summer School on "Service Oriented Computing".

Finally, to calculate the global value of S-Cube benefits for the Summer School, we can consider that it will be repeated over, at least, 3 editions, before being changed/updated in its structure. This means that, over a period of 3 years, the benefits generated by S-Cube worth € 283.500.

The meaning of this value is two-fold:

1) financial - it is the amount of the financial incomes for S-Cube consortium's partners, additional to the financial support given by the EU for running the project;
2) economic - it is a proxy (the willingness to pay) for measuring the value of the knowledge generated and spread by S-Cube to the Summer School students.

The table below summarizes all the inputs and assumptions used in this assessment exercise for evaluating the value of S-Cube's participation in the Summer School on "Service oriented Computing".

Summer School on Service Oriented Computing	
Application fee (€)	1.350
Daily accommodation cost/student (€)	50
length summer school (days)	6
N° tot students	90
N° students from IMSE	18
N° students Summer School only	72
Total incomes from fees (€)	97.200
Total accommodation costs (€)	27.000
S-Cube total revenues per edition (€)	94.500
n° editions foreseen	3
S-Cube total revenues (€)	283.500

Tab. 5 - Inputs and assumptions used to evaluate the value of S-Cube's participation in the Summer School on "Service Oriented Computing"

Evaluation of the S-Cube Knowledge Model

The S-Cube knowledge Model is an online freely accessible tool for any user (but mainly the researchers in the SoC field), available on the S-Cube Website. Given its open accessibility, the exploitation of such product by its final users does not provide any financial income to the project consortium. However, it has an intrinsic economic value given by the fact that it is a continuously updated encyclopaedia specialized in the SoC field, allowing to make quick searches, analyse the state of the art, and get in contact with other researchers of the field, thus avoiding redundancies and/or fragmentation of research efforts.

The economic value of the S-Cube Knowledge Model, therefore, needs to be estimated by using the "shadow prices" approach, and by finding some appropriate proxies able to indirectly quantify the value of the intangible benefits generated by its use. With reference to this, in this assessment exercise the approach used was that of identifying the value of the "parallel market" of commercial websites, where private companies pay in order to get some space on widely visited websites, for making advertisement (using banners). The cost for the banner naturally depends on the visibility (n° of hits) of the website itself.

The total amount that private companies pay for banner space on a specific website may be considered, then, as an indirect measure of the value of the site itself. Starting from this, we can infer the value of the S-Cube Knowledge Model by calculating the average revenues obtainable by a commercial website with the same number of visits as the first, for selling banner space.

More specifically, S-Cube deliverables on the project web portal show that, since its opening, it has had an annual average number of about 28.500 visits. A commercial web site with the same visibility could expect an annual average income from banner selling of about € 2.100[6]. If we consider an economic life of the S-Cube site of 8 years (3 years during the project's life plus 5 more years – a period during which the Knowledge Model could still be considered up-to-date), we obtain a total value of €

[6] The "comparative" website used for this assessment is www.washmaps.com.

16.800. This value could be, therefore, considered as a good proxy for quantifying the economic value of the Knowledge Model site.

The table below summarizes all the inputs and assumptions used in this assessment exercise for evaluating the value of the Knowledge Model.

Knowledge model	
Average yearly visits	28.343
Yearly annual price for average banner (average dimensions) (€)	300
Average n° of banners on the sites	7
Total incomes for banner spaces selling (€)	2.100
N° years of site visibility	8
Total economic value (€)	16.800

Tab. 6 - Inputs and assumptions used in this assessment exercise for evaluating the value of the Knowledge Model

Evaluation of S-Cube economic impact on employment

During its life, the S-Cube project sponsored 20 PhD scholarships and 10 post-doctoral scholarships, thereby determining a positive benefit deriving from the potential exploitation of the resulting highly-trained students by the new economy. To see how the proxy for employment impact is calculated please see Annex 1.

Impact on employment	
N° of PhD scholarships sponsored	20
N° of Post-Doc scholarships sponsored	10
Time frame of a PhD sponsored	36 months
Time frame of a Post-Doc sponsored	24 months
Average income of a PhD holder (€)	2.753
Average income of a Post-Doc holder (€)	3.128
Total value of impact on employment (€)	2.732.880

Tab. 7 - Inputs and assumptions used in this assessment exercise of the impact on employment

The values calculated in Section 1.2, together with the information regarding the social impacts (see next section), will be used in Section 1.4 to calculate the project's global indexes (iROI, xROI, tROI and RORI), summarizing the project performance in terms of expected socio-economic impact.

1.3 Social impact

Considering the objectives and outputs of the project, one of the main social impacts of S-Cube concerns eLearning. In fact, the S-Cube Virtual Campus will be a central access point for training and education material on service-based systems.

The project is expected also to have an impact on ICT support for efficient transport and on the ICT industry in general. With reference to transport and mobility, the S-Cube results may be exploited in the FI PPP project Finest. For the ICT industry in general, the project should promote awareness for novel techniques and methods, specifically on adaptive services and systems.

We then asked the project what is the contribution S-Cube provides for the fulfilment of some of the 2020 European Digital Agenda goals. S-Cube is mostly related to the political goal to “Increase ICT related Services demand”. But it will also work towards the fulfilment of some other goals: “Increment eCommerce”, “Increase interoperability at a more general level”, “Creation of content and borderless services” and “Creation of a united market”. The project will have, in fact, an impact on all the aspects related to services and commerce.

Technological benefits

The S-Cube project produced important technological benefits. The project is developing new methodologies and languages, improving existing ones and applying them in new fields and sectors. The languages it uses are Java, C++ and BPEL, and is conforming to WebServices stack standards (for example WSDL, WS-Agreement, BPEL).

The most technological innovative aspect of the S-Cube project is related to the development of an interoperable community, that – S-Cube claims – will enable also the revolution of the software-services sector. The S-Cube project is mainly based on different technologies, such as SOA, Mobile, Context-aware services, Cloud, virtualization, content-based services, Grid and mash-ups.

According to the self-assessment made by the project, the outputs of the project should be particularly positive in terms of efficiency, reliability and maintainability (they scored 10, 9,5 and 9,2, respectively, in the self-assessment analysis, where 1 was the minimum score and 10 the highest). The functionality, usability and quality in use of the project’s output are also expected to be high (see figure below).

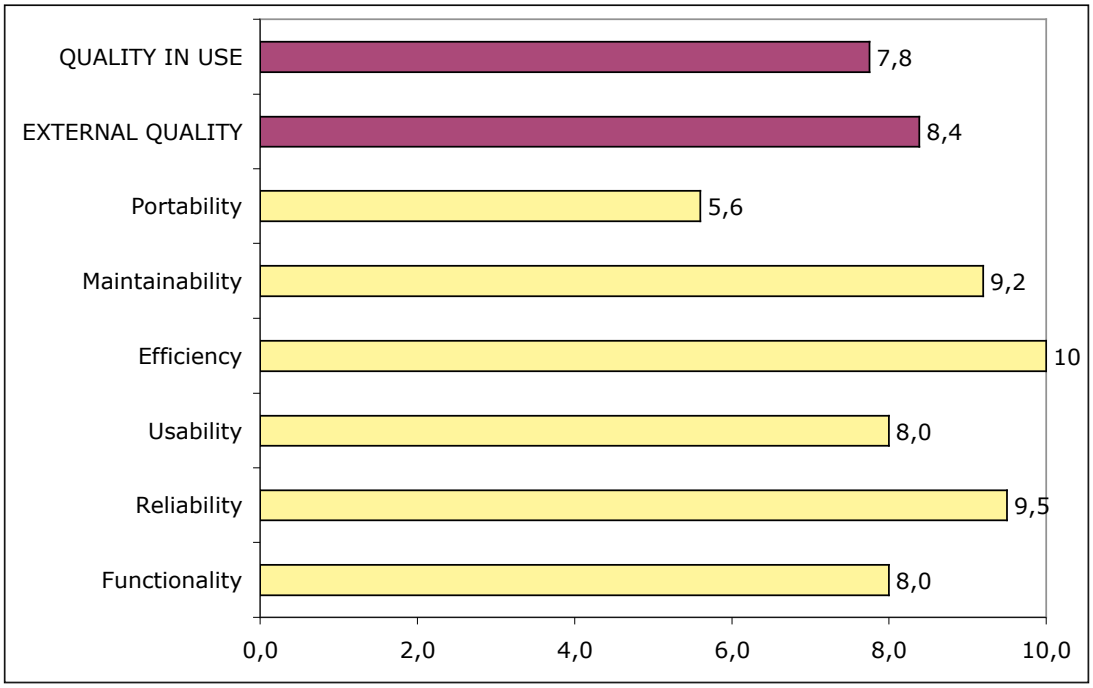

Fig. 1 - Technical benefits of the S-Cube project[7]

In total, the project estimated its technological benefits at a value of 8,16 on a 1-10 scale.

Impact on employment and working routines

During its lifetime, 61 to 100 persons worked on the project. In the future, the project expects to have an impact on employment rate in various territories because it is training new professionals that will be competitive on the labour market.

It is also interesting to analyse the project's impact on employment from a gender point of view. In general, the average participation of women in the project amounts to 20%, considering the female participation in the S-Cube network (22,3%), the participants in Conferences and Workshops (from 14 to 24% for the various conferences), and the co-authorship of publications. These data are rather low considering the EC target/guideline of 40% female participation in committees, groups and panels, but are quite positive if considering the general low participation of women to research in this field of activity.

The project may have some impact on working routines. The main impact regarding this aspect refers to the way the researchers work: they will benefit from more awareness of the need for cross-disciplinary work, a better integration with other European researchers, and richer collaborations and a wider access to research results. This will certainly have positive impacts on their research work.

Regarding the self-evaluation made by the project on its impact on working routines, the respondents strongly agreed that the project will reduce the work of its users, and agreed that it will provide solutions for working efficiently and conveniently for organisations of all sizes, allowing users to do their everyday work more quickly.

[7] In "red" the two macro variables used for the technological impact self-assessment and in "yellow" the micro variables that compose them.

Impact on knowledge production and sharing

In terms of knowledge production, the outputs of the project are very positive, as shown in the table below. On the S-Cube website a high number of documents (including articles, proceedings and reports) are available in the Literature Database, and links to original documents are provided even if open access is not fully guaranteed.

Journal articles	Articles presented at conferences or proceedings	Books	Chapters of books	Scientific Deliverables
15	100	2	10	50

Tab. 8 - Scientific production of S-Cube at the date of impact assessment[8]

Knowledge produced by the project was shared and diffused by publications and training activities, but also by several exchange initiatives. In fact, S-Cube presented the project and its outputs at 150 conferences, organised 60 exchange initiatives and established 120 collaboration links such as joint teaching courses, exchange of resources, or exchanges of information.

Knowledge diffusion used also the training channel, which is in accordance with the identification of students and postgraduates as important beneficiaries of the project. 16 training modules have been developed at Master and PhD level on the following topics:

- Advanced internet
- Computing Service-Oriented Design QoS-Based
- Web Service Discovery
- Software Quality & Processes
- Quality Assurance for Service-based Systems: From Software Engineering to Service Engineering Human Provided Services in Mixed Service-Oriented Systems Service-Centric Systems Requirements Engineering
- Data quality in adaptive service systems
- Service-based software development
- Proactive dynamic service discovery
- Web Services Business Process Execution Language (WS-BPEL)
- Aspects and BPEL Agile Service Networks
- Introduction to Grid and Cloud computing

Not only were training courses organised, but the project also organised an online training course and a Summer School, as discussed earlier. Training materials were created within each WorkPackage, and some modules will be used by IMSE, which is an Erasmus Mundi Project. It provides a 3-year master course for 28 students (cf. Section 1.2).

[8] S-Cube has outstanding results regarding the scientific production. As explained in the introduction, we present in this report the data available at the moment of the assessment, but the actual data confirm these high results. For example, at the end of the project, it has published more than 25 articles and almost 150 articles have been presented at conferences or proceedings.

Regarding the impact on the project in terms of knowledge sharing on its beneficiaries, the table below shows the result obtained for S-Cube.

S-Cube will:	Strongly disagree	Disagree	Agree	Strongly agree
Make information/knowledge available to a larger number of interested users				X
Support knowledge transfer between universities/research centres and industry/SMEs			X	
Make highly innovative services available to citizens				X
Develop services that will positively impact on citizens' everyday life				X
Make available high-quality knowledge/information to citizens				X
Reduce the digital divide			X	
Support democratic processes/democratisation		X		
Positively impact education				X
Enable diversity and individual expression			X	
Flexibility for personalisation on a large scale/high interface adaptability				X

Tab. 9 - Impact of S-Cube in terms of support to ICT usage for all and to democratic participation

Moreover, all scientific outputs are available on the project website.

Impact on social capital

S-Cube had a positive impact in terms of social capital and networking activities of researchers.

The number of new partnership agreements with other universities, research centres, enterprises, or public bodies is an important indicator. The institutions of these new agreements have become associate partners to the project. Another indicator of the importance of research networking made by S-Cube is the number of new project proposals submitted thanks to the participation in the project. In fact, 17 new collaboration agreements were established with research centres and universities generating 17 new project proposals.

On the contrary, no new collaboration was established with industrial actors. This is not surprising considering the focus of the project.

N. of new collaborations established with industrial actors	N. of new partnership agreements with other universities, research centres, enterprises or public bodies	N. of new project proposals submitted thanks to the participation in the project
0	17	17

Tab. 10 - S-Cube's networking and sustainability activities

The project has also been in contact with the NESSI initiativehttp://www.nessi-europe.com), which aims at uniting a community of over 430 organisations from industry and academia in order to promote the Internet of Services through complementary activities in research, standards, training, education, application and community support. As S-Cube and NESSI have similar objectives, their collaboration can have positive impact for both projects. Moreover, some S-Cube partners belong to NESSI.

Therefore we can consider that the project has developed a large research network, which has a very positive impact on the social capital of its partners/participants.

The project is expected to have also a positive impact on the social capital of its users. The table below shows the results of the self-assessment performed by the project on this aspect.

S-Cube will:	Strongly disagree	Disagree	Agree	Strongly agree
Improve the way in which users communicate and collaborate with each other (the quality of the collaboration)/ facilitate social interaction				X
Improve trust among your target users			X	
Improve citizens' trust in Public administration		X		
Improve citizens' trust in ICT and the Internet			X	
Support network creation/ collaboration of enterprises in the sector				X
Support network creation/collaboration among citizens				X
Support network creation/collaboration in academia				X
Enlarge already-existing networks				X

Tab. 11 - S-Cube's impact in terms of social capital increment for users and beneficiaries

Finally, considering that one of the objectives of S-Cube is to elaborate joint research agendas and roadmaps, the partners have made many contacts with policy makers in the field of the Internet of Services. The project was invited – for example – by the European Union to represent the EU in the EU-Japan summit, which testifies to the strength of the relationship between the project and political actors, at least at EU level. A white paper on the S-Cube vision has also been produced[9]. It presents how the anticipated growth in services and service-based systems that together form the Internet of Services will have a strong effect on business and society, some selected, fundamental cross-cutting research challenges, and how the cooperation of different research disciplines plays an important role. Finally, it describes the research framework S-Cube has adopted to assist in unifying research communities and agendas across Europe to meet the challenges faced in realizing the Future Internet.

[9] Papazoglou M., Pohl K., Metzger A., van den Heuvel W-J, *The S-Cube Research Vision*, Lecture Notes in Computer Science, 2010, Volume 6500/2010, 1-26, DOI: 10.1007/978-3-642-17599-2_1

1.4 Final assessment: S-Cube impact in one page

Calculation of iROI, xROI and tROI

The tables below provide an estimation of the three SEQUOIA indices[10]:

IROI inputs and calculation

S-Cube project cost (€)	5.745.000
Inflow IMSE (€)	237.600
Inflow Summer School (€)	283.500
Total S-Cube inflows (€)	521.100
iROI = (total investment financial inflows – investment financial outflows)/ investment cost	**0,0907**

xROI inputs and calculation

S-Cube project cost (€)	5.745.000
Benefits Knowledge model (€)	16.800
Benefits on employment (€)	2.732.880
xROI =(total S-Cube economic benefits – Socioeconomic costs)/ investment cost	**0,4786**

tROI = (iROI + xROI)	**0,5693**

Tab. 12 – Calculation of iROI, xROI and tROI of the S-Cube project

The iROI indicator provides the results about the financial sustainability of the project by comparing the total inflows and costs of the project. The S-Cube inflows are based on the revenues generated by the IMSE and the Summer School. However the iROI value is just above zero and this means that the financial return estimated over the project output lifetime covers all the expenses that the S-Cube project sustain to run the entire projects, but it does not generate a relevant Internal Return On Investment.

By contrast, the xROI value generated by the S-Cube project is more significant. The xROI measures the net economic benefits that the project generates for the society as a whole. Indeed, the S-Cube project produces a significant socio-economic impact on the Knowledge model and on employment, by increasing the average yearly website visits and sponsoring a high number of PhD and Post-Doc scholarships (for details see Section 1.2). The positive impact of the S-Cube project on the xROI allows to generate a positive tROI value, that quantifies the total monetisable impacts of the research project on society and the consortium.

[10] See Annex 1 for the definition of iROI, xROI and tROI indices.

Calculation of the Multi-Criteria Assessment

The table below presents the results of the multi-criteria analysis, normalised using the maximum values observed in the 30 projects analysed by the SEQUOIA Team, and compared to the average values obtained by these projects[11].

Impacts	Variable	Comparison with SEQUOIA average	TOTAL/ maximum possible value
Technological benefits			**0,86/1**
Impact on employment and work-routines	Impact on general employment		***1,23/2***
	Work positions generated by the project		
	Improvement of working routines		
	Self assessment		
Impact on knowledge production and sharing	Scientific impact		***10,20/11***
	N journal articles		
	N books		
	N books chapters		
	N articles presented at conf. or pub. in proceedings		
	N scientific deliverables		
	Knowledge sharing		
	N knowledge exchange initiatives		
	N scientific collaboration links		
	N training modules		
	N of scientific events where project was presented		
	Availability of papers and del through website		
	Support ICT usage for all and democratic participation		
	Self-assessment		
Impact on social capital	Social capital increment for project participants		***2,85/4***
	New collaboration with research institutes		
	New collaboration with industry partners		
	New project proposals		
	Social capital increment for users and beneficiaries		
	Self-assessment		
TOTAL Impact Multi-criteria Analysis			**15,16/18**

Legend: above the SEQUOIA average; similar to the SEQUOIA average; below the SEQUOIA average

Tab. 13 - S-Cube Multi-criteria analysis

[11] See Annex 1 for a definition of the Multi-Criteria indices.

The project impact is particularly evident in terms of knowledge production and sharing, and this is consistent with the NoE nature of the project. Moreover, the project performance is above the average of other projects analysed on almost all the indicators. This is a very good performance but we have to consider that it is due - at least partially – to the fact that S-Cube was, at the time SEQUOIA conducted its survey, in a more advanced stage if compared with the majority of the projects analysed.

Looking to margin for improvement, we can say that the project should look for more interaction with the industry sector.

RORI

The following table calculates the RORI [12] of the S-Cube project following the weighting system adopted by the SEQUOIA Team[13].

Variable	Weight	S-Cube indicators	Weighted values
iROI	0,15	0,0907	0,0136
xROI	0,35	0,4786	0,1675
Technical benefits	0,10	0,86	0,086
Impact on employment and working routine	0,10	1,225	0,1225
Impact on knowledge production and sharing	0,20	10,195	2,039
Impact on social capital	0,10	2,875	0,2875
		RORI	**2,716**

Tab. 14 - Calculation of the RORI of the S-Cube project

As mentioned before, S-Cube reached very good results in all the indices and variable considered by the SEQUOIA methodology. It would have been interesting to compare S-Cube with more projects from Call 1, but this was not possible due to the difficulties in engaging projects that had ended when the SEQUOIA methodology was ready. However, we can see how S-Cube succeeded in developing outputs that make the networking and the knowledge sharing activities potentially self-sustainable.

One of the key success factors of the project is represented by the diverse – but complementary - sustainability strategies undertaken. In fact the project supported researcher networking and knowledge creation and transfer through different channels, such as an open repository, a summer school, the collaboration with a EU co-funded project (Life-long learning programme) and, of course, through publications. All these channels together make the SEQUOIA team confident about the sustainability of this community of research. We recommend running another assessment one and possibly three years after the end of the project in order to verify this positive assessment.

[12] See Annex 1 for the definition of RORI.
[13] See D.3.3a and D3.3.b for a description of the weighting system.

2 mOSAIC

mOSAIC – Open-Source API and Platform for Multiple Clouds (STREP) – is a Call 5 project that started in September 2010 and will end in February 2013. It aims at developing an open-source platform through which users can specify their requirements and negotiate corresponding Cloud services in a semi-automated way.

2.1 Mapping the areas of impact

Currently, Cloud computing forces users to be stranded into locked, proprietary systems, and developers using a particular Cloud platform for their applications cannot port them on other platforms offered by different vendors. Moreover, users put in the hands of commercial providers applications and data without having the possibility to negotiate service agreements. Often, users introduced to the Cloud find that they cannot find a single Cloud provider that offers all the services that they require, especially when the requirements vary throughout the year. Using the mOSAIC platform, the users will not have to choose a single Cloud provider at the same time; but every time they will use the Cloud services they will be able to access those that best respond to their needs.

With respect to other projects or initiatives similar to mOSAIC, this project offers different technical solutions and has wider objectives. For example, other initiatives provide only an agnostic IPI, whereas mOSAIC offers also a BROKER service and a SLA.

The three main outputs of the project will be:

- The mOSAIC API, a Cloud-based language and platform-independent application programming interface;
- The Cloud Agency, that can be used to broker and manage Cloud resources which are necessary to deploy Cloud applications;
- The mOSAIC platform, that will be able to deploy and manage services on the virtual machines.

Description of the structure of the project's activities

The project is divided in 4 different steps:

- Architecture and API design;
- API Implementation;
- Application design implementation;
- Exploitation, standardization and dissemination.

At the date of the impact assessment, the project was at the API Implementation phase.

Identification of the main stakeholders and of the expected impacts

Considering that the project will have an impact on all the persons that can have an interest in using the Cloud, 4 specific categories of stakeholders have been identified:

- *Developers and software engineers*: the Cloud application developers and maintainers will reduce their development costs thanks to the agnostic Cloud API: mOSAIC offers them an agnostic development environment with respect to the Cloud providers. So they will be able to postpone their decision on the procurement of Cloud services to runtime, and will not have to redo the programming work if they want to change Cloud provider at a later time. Moreover, some activities will take place automatically and the migration from a Cloud to another and the resource choice will be transparent, reducing the work of the developers.
- *Service providers*: they will be able to provide portable applications, and the applications will be able to find Cloud services that best fit their needs. Therefore the service providers will be able to offer more attractive services to end-users.
- *Industry and SMEs*: similarly to the service providers, they will enjoy a more transparent and a simpler mode of access to Cloud computing.
- *Infrastructure providers and TELCO operators, and in particular Cloud providers:* mOSAIC will simplify the access to the infrastructure, increasing the range of customers. Moreover, it will offer more freedom of choice at the programming level as well as the resource level. Therefore the project will have a significant impact on the current market.

The table below synthesises the relation between stakeholders who will benefit from project outputs, the main activities enabled for them by the project, and the expected impacts for each category.

Stakeholders/beneficiaries and relevance score (from 1 to 5[14])	*Main activities possible using mOSAIC's outputs*	*Expected impact*
Developers and software engineers (5)	Cloud Applications development through agnostic Cloud API	Reducing development cost
Service providers (4)	Provide portable applications	Provide more attractive services
Industry and SMEs (4)	Provide portable applications	Provide more attractive services
Infrastructure providers and TELCO operators (4)	Simplify access to the infrastructure	Increase the range of customers

Tab. 15 – mOSAIC's most relevant beneficiaries/users, the activities they will be enabled to do thanks to mOSAIC outputs, and expected impacts

[14] Where 1 is "very relevant" and 1 is "not relevant".

2.2 Economic impact

mOSAIC's total cost is € 2.800.000. The table below shows the total project costs divided by category, in order to identify their effects on cash outflows.

Cost categories	Euros
Personnel (not counting personnel costs related to management and to dissemination)	1.623.060
Training	0
Use case running	0
Subcontracting	9.000
Travel	55.000
Dissemination costs (personnel plus other costs)	125.000

Tab. 16 - mOSAIC's costs divided by categories

With reference to the economic impact of the mOSAIC outputs, the project will facilitate competition between Cloud providers by reducing vendor lock-in, making it possible to reach customers they could not reach before. Starting from the improvement of existing services and systems, the project is expected to produce different indirect benefits on stakeholders, such as the following categories:

Expected benefits	
Improve service/product/system quality	X
Reach more users	X
Lower entry barriers in a specific economic sector	
Improve the access to large amounts of data. Improve the possibility to exploit large amounts of data (more efficient data analysis)	
More efficient data exchange	
Improve scalability	
Expand the range and the typologies of research activities and services made available to research communities	
Cost reductions	X
Reduce the time needed to deliver a service (reduce the time-to-market period)	
Reduce the time needed to deploy a service over the network/the architecture	
Keeping pace with competitors/with the research in the field	
Ability to better target users/beneficiaries' needs	X
Increment the optimisation of resources/improve efficiency	X
Other	

Tab. 17 – mOSAIC's expected benefits

The effects on cash inflows are strictly related to cost reductions, and more specifically to reduced hardware costs, to lower software development costs, to the increment in software re-usability, and to improvements in the test-deploy-rework cycle management.

At the time of the assessment, the project had not yet identified a commercial exploitation plan and had not drafted a Business Plan. mOSAIC is based on an Open Source approach, but the project is interested in knowing more about economic exploitation possibilities related to OSS. For this reason, after the SEQUOIA assessment, the project will run a business models analysis.

The mOSAIC project outputs are not expected to produce a relevant positive impact on the environment. In terms of efficiency, the quality of the mOSAIC's outputs is expected to increase considerably the efficiency and the interoperability of Cloud Computing technologies and services.

The project has already attracted considerable public investments at national level and is expected to generate 16 new partnership agreements with other universities and 10 new project proposals in order to build a strong sustainability plan. The most relevant impact of the project is expected to be experienced 1 year after the end of the project.

Evaluation of mOSAIC economic impact on employment

During its life, the mOSAIC project has generated relevant effects on the labour market by sponsoring 8 PhD scholarships and 1 post-doctoral scholarship, thereby determining a positive benefit deriving from the potential exploitation of the resulting highly-trained students by the new economy.

To see how the proxy of employment impact is calculated please see Annex 1.

The following table shows the details of the effects of the mOSAIC project on the labour market:

Impact on employment	
N° of PhD scholarships sponsored	8
N° of Post-Doc scholarships sponsored	1
Time frame of a PhD sponsored	36 months
Time frame of a Post-Doc sponsored	24 months
Average income of a PhD holder (€)	2.752
Average income of a Post-Doc holder (€)	3.128
Total value of impact on employment (€)	867.648

Tab. 18 - Inputs and assumptions used in this assessment exercise of the impact on employment

The values calculated in Section 2.2, and 2.1.4., together with the information regarding the social impacts (see next Section), will be used in Section 2.4 to calculate the project's global indices (iROI, xROI and tROI), summarizing the project performance in terms of expected socio-economic impact.

2.3 Social impact

As we mentioned above, mOSAIC will have an impact on the market of Cloud computing and on the services that use the Cloud. The platform developed does not regard specifically one sector of society, it offers tools that will enable the development of services for any sector of society. Therefore, the project is expected to have a wide social impact.

mOSAIC, through its activities and outputs, contributes to some of the goals of the European Digital Agenda 2020. First of all, it should allow SMEs to enter new markets by reducing not only the vendor lock-in, but also the cloud provider lock-in as it will facilitate the migration from one cloud to another.

The project may also increase the interoperability that is often lacking in the Cloud.

Finally, thanks to the platform developed that supports the development of services, mOSAIC is likely to increment eCommerce and increase the demand for ICT-related services.

The project should also have an impact at policy level. It has been presented to the European Parliament and 11 meetings with local, regional, national and European policy-makers have been organised.

Technological benefits

From a technical point of view, the most innovative aspects highlighted by the project are:

- The design of a language- and platform-agnostic application programming interface for using multi-Cloud resources and Cloud usage patterns;
- The building of an open-source and portable platform for using Cloud services based on the proposed API and Cloud usage patterns;
- The design of a generic agent skeleton for representing various stakeholders, e.g. Cloud vendors and their resources, Cloud users of various types, and collection of modules that can be used to adapt agent skeletons to support needed functionalities;
- The design of user-centric service level agreements, a Cloud ontology and mechanisms for dynamic negotiation of resources based on multi-agent technologies and semantic data processing;
- The building of proof-of-concept applications with a special emphasis on data intensive applications.

The self-assessment of its technological benefits made by the project shows that the technical project's outputs are of high quality in terms of portability. They are characterised also by a good efficiency and functionality (especially for its very high interoperability and suitability). On the contrary, the quality in use obtained a lower score, except for the aspect linked to the productivity (see figure below). The average score obtained by the project regarding its technological benefits amounts to 5,45, on a scale from 1 to 10.

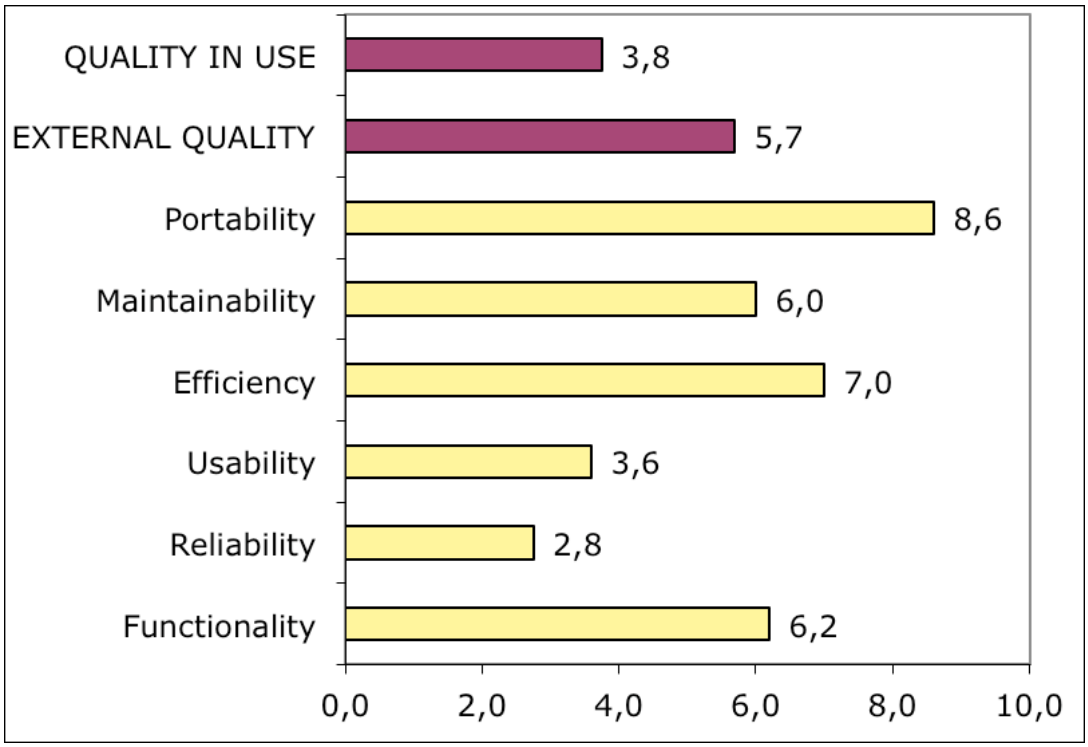

Fig. 2 - Technical benefits of the mOSAIC project[15]

The technological impact assessment detected a low relevance of external products' quality in use and the factors that could limit the project's outputs are mostly connected to security and privacy aspects.

Impact on employment and working routines

mOSAIC will not have a high impact on employment, but is likely to impact working routines. For the project's implementation, about 62 persons have been employed, and between 15 and 25 additional researchers were recruited for the project.

From a gender equality point of view, about one-fifth of the persons working on the project are women, equally distributed among the different positions. This data is lower than the EC target (40% of participation of women in research activities), but quite positive if considering the project's field of activity.

The project will not have an impact on the employment rate in the territory represented by the consortium; in fact, the project benefits should be considered at European level and not related to a specific territory.

Finally, mOSAIC is expected to have an impact on the quality of work and the working routines of its users. In fact, the project provides the developers and software engineers solutions that reduce their work, as some actions are automated, and helps them work more efficiently. In particular, it provides tools to simplify the migration from a cloud to another (so that it is not necessary to do again 50 to 99% of the programming work). It helps them also in the choice of the resources.

[15] In "red" the two macro variables used for the technological impact self-assessment and in "yellow" the micro variables that compose them.

Impact on knowledge production and sharing

Even if the project is not yet finished, it has already produced a positive impact in terms of knowledge production. It has published 1 article, 3 book chapters and it has presented 16 articles at conferences or proceedings concerning Cloud computing. Moreover, the project has drafted about 15 scientific deliverables (see table below).

Journal articles	Articles presented at conferences or proceedings	Books	Chapters of books	Scientific Deliverables
1	16	0	3	15

Tab. 19 - Scientific production of mOSAIC at the date of impact assessment

mOSAIC is doing a noticeable effort also in terms of knowledge sharing inside the scientific community. Even if at the moment most of the articles published are not provided with open-access, open access will be provided through the mOSAIC platform by the end of the project.

The project has participated to 20 knowledge exchange initiatives and has established 13 new collaboration links. It has participated also in many scientific conferences and seminars, and has presented its activities on 17 occasions.

Moreover, in order to transfer the project's outputs also to future researchers, the project is organising an significant number of training sessions (between 21 and 30) on the following issues:

- Mobile Agents based Services Provision from High Performance Computing to Pervasive Environments
- mOSAIC concepts and architecture
- Life demo of services for Earth Observation running on mOSAIC resources
- Status of platform services
- Competence Centre for Cloud
- Simulations in the cloud

The project is making efforts to transfer its scientific results also outside the scientific community. The project is organising various activities to raise awareness of potential user communities that can use its outputs. It has in fact participated in about 100 communication or dissemination initiatives.

In general mOSAIC supports a wider usage of ICT in society. It makes information and knowledge available to a larger number of interested users. Thanks to the platform developed, the project will make also highly innovative services available to citizens. Finally, it promotes flexibility for personalization on a large scale and high interface adaptability.

The project website provides access to the scientific outputs, but this could be improved, for instance by providing direct access to project deliverable and by facilitating the access to open access papers that are currently on demand.

The table below shows the self-assessment made by mOSAIC regarding the impact on the project in terms of knowledge sharing on its beneficiaries.

mOSAIC will:	Strongly disagree	Disagree	Agree	Strongly agree
Make information/knowledge available to a larger number of interested users			X	
Support knowledge transfer between universities/research centres and industry/SMEs		X		
Make highly innovative services available to citizens			X	
Develop services that will positively impact on citizens' everyday life		X		
Make available high-quality knowledge/information to citizens	X			
Reduce the digital divide		X		
Support democratic processes/democratisation	X			
Positively impact education		X		
Enable diversity and individual expression	X			
Flexibility for personalisation on a large scale/high interface adaptability			X	

Tab. 20 - Impact of mOSAIC in terms of support of ICT usage for all and of democratic participation

Impact on social capital

mOSAIC is likely to have an large positive impact on the social capital of its participants (see table below). A more complete assessment will be possible at the end of the project, but the partners have already established 16 new partnership agreements with other research centres. Moreover, even if no new collaboration with economic actors has been officially established, the project has taken contacts with multi-national companies and organized seminars for industry. This demonstrates that the partners have widened a lot their network of contacts both in the research and the industry communities and that the project strengthens their social capital.

Another significant aspect is the number of new project proposals presented (about 10). This datum shows that mOSAIC partnership is strong and intends to carry further the work done in the project

N. of new collaborations established with industrial actors	N. of new partnership agreements with other universities, research centres, enterprises or public bodies	N. of new project proposals submitted thanks to the participation in the project
0	16	10

Tab. 21 – mOSAIC's networking and sustainability activities

By contrast, according to the self-assessment made by the project, it is likely to have a very limited impact on the social capital of its users and beneficiaries (see table below). This is due to the nature of the service that the project is developing that has a limited "social" focus at least in terms of direct impacts.

mOSAIC will:	Strongly disagree	Disagree	Agree	Strongly agree
Improve the way in which users communicate and collaborate with each other (the quality of the collaboration)/ facilitate social interaction	X			
Improve trust among your target users	X			
Improve citizens' trust in Public administration	X			
Improve citizens' trust in ICT and the Internet	X			
Support network creation/ collaboration of enterprises in the sector		X		
Support network creation/collaboration among citizens	X			
Support network creation/collaboration in academia		X		
Enlarge already-existing networks		X		

Tab. 22 – mOSAIC's impact in terms of social capital increment for users and beneficiaries

2.4 Final assessment: mOSAIC impact in one page

Calculation of iROI, xROI and tROI

The tables below provide an estimation of the three first monetary indicators for the mOSAIC project.

iROI inputs and calculation[16]

mOSAIC project cost (€)	2.800.000
Public Investment Inflow (€)	1.000.000
iROI = (total investment financial inflows – investment financial outflows/ investment cost)	**0,3571**

xROI inputs and calculation

mOSAIC project cost (€)	2.800.000
Benefits on employment (€)	867.648
xROI = (Socioeconomic benefits – Socioeconomic Costs/ Investment cost)	**0,3098**

tROI = (iROI + xROI)	**0,6669**

Tab. 23 – Calculation of the iROI, xROI and tROI of the mOSAIC project

The MOSAIC project has generated a relevant value in terms of iROI, even higher than the xROI value. These results allow the SEQUOIA team to say that the mOSAIC project has achieved a good financial sustainability. However, at the time of the SEQUOIA evaluation, the project was still in its first year, hence the iROI value cannot consider sales inflow that certainly will produce high returns, especially in the exploitation phase of Cloud Computing services deployment. In terms of xROI, mOSAIC has significant value, however it is lower than iROI because of the nature of the project that is more oriented towards economic than to the social impact. With reference to the Total Return on Investment (tROI), we can say that mOSAIC has already produced positive socio-economic impacts.

[16] See Annex 1 for iROI, xROI and tROI definitions.

Calculation of the Multi-Criteria Assessment

The table below shows the normalised values obtained for the mOSAIC project in the multi-criteria assessment and their comparison with the SEQUOIA average values[17].

Impacts	Variable	Comparison with SEQUOIA average	TOTAL/ maximum possible value
Technological benefits			**0,55/1**
Impact on employment and work-routines	Impact on general employment		***0,86/2***
	Work positions generated by the project		
	Improvement of working routines		
	Self assessment		
Impact on knowledge production and sharing	Scientific impact		***2,9/11***
	N journal articles		
	N books		
	N books chapters		
	N articles presented at conf. or pub. In proceedings		
	N scientific deliverables		
	Knowledge sharing		
	N knowledge exchange initiatives		
	N scientific collaboration links		
	N training modules		
	N of scientific events where project presented		
	Availability of papers and del through website		
	Support ICT usage for all and democratic participation		
	Self-assessment		
Impact on social capital	Social capital increment for project participants		***1,87/4***
	New collaboration with research institutes		
	New collaboration with industry partners		
	New project proposals		
	Social capital increment for users and beneficiaries		
	Self-assessment		
TOTAL Impact Multi-criteria Analysis			**6,18/18**

Legend: above the SEQUOIA average
similar to the SEQUOIA average
below the SEQUOIA average

Tab. 24 - mOSAIC's Multi-criteria analysis

[17] For a definition of the Multi-criteria analysis please see Annex 1.

mOSAIC's performance is above average in terms of new job positions generated by the project, number of collaborations with research institutes and networking events, training modules developed, and new project proposal submitted. However the scientific impact was not very high at the time in which we gathered the data; exchange of information occurred after that period shows that the situation has improved already and is likely to maintain a positive trend until its end in 2013.

RORI

The following table shows the RORI[18] of the mOSAIC project following the weighting system adopted by the SEQUOIA Team.

Variable	Weight	mOSAIC indicators	Weighted values
iROI	0,15	0,3571	0,0536
xROI	0,35	0,3098	0,1084
Technical benefits	0,10	0,545	0,0545
Impact on employment and working routine	0,10	0,855	0,0855
Impact on knowledge production and sharing	0,20	2,9	0,58
Impact on social capital	0,10	1,87	0,187
		RORI	**1,069**

Tab. 25 – Calculation of the RORI of the mOSAIC project

mOSAIC is a project with a clear focus, clear beneficiaries and clear outputs. These are important aspects that made the assessment particularly straightforward. In addition, the potential impact of the project on Cloud computing experts and users could be particularly significant; special attention should be paid in the near future to possible positive impacts on SMEs working in the sector. One of the positive expected impact of the project, in fact, is the reduction of vendor lock-in in cloud computing. This should be monitored in the next phase of the project.

Moreover, the project shows an interesting attention for the knowledge triangle that links research, industry and training system. In fact the project is investing in networking activities and in the development of training modules.

Room for improvement is especially related to the identification of the sustainability plan and of ad hoc business models. The OSS nature of the project should not limit its outputs exploitation.

[18] See Annex 1 for a short definition of RORI.

3 CumuloNimbo Project

CumuloNimbo – Highly Scalable Transactional Multi-Tier PaaS – is a project founded by the European Union through the Call 5 for FP- ICT-2009.1.2: Internet of Services, Software and Virtualisation. The project started in October 2010 and will end in September 2013.

3.1 Mapping the areas of impact

The main objective of the CumuloNimbo project is to develop transactional frameworks such as Java EE, through a new generation of Cloud Platforms as a Service (PaaS). One of the most important problems in this area is the lack of scalability of transactional support. CumuloNimbo aims at filling this gap by providing a highly scalable transactional system for the Cloud. CumuloNimbo will also guarantee full transactional consistency of its platform. Indeed, the applications developed on top of CumuloNimbo will provide full transactional guarantees and can be used by developers with modest IT skills.

In general terms, CumuloNimbo's services are aimed at developing a new virtual infrastructure and at improving the existing one by developing and improving the existing design process and methodologies. The project will also improve the existing standards and languages. More specifically, as stated by the project, CumuloNimbo aims to create the following kinds of services:

- *JBoss:* is a Java EE application server;
- *Hibernate:* is a persistency server;
- *Derby:* is a relational database;
- *HBase:* is a key-value column-oriented data store;
- *Zookeeper:* is a reliable registry;
- *Bookepeer:* is a reliable log;
- *HDFS:* is a parallel distributed file system.

Description of the structure of the project's activities

The CumuloNimbo project is organised around the following structure of activities:

- Architecture of the platform;
- Initial implementation;
- Initial integration;
- Initial evaluation;
- Complete implementation;
- Complete integration;
- Complete evaluation.

The project – at the time of writing – is in its fourth stage, i.e. initial evaluation.

Identification of the main stakeholders and of the expected impacts

The following categories of stakeholders of the CumuloNimbo project are the most relevant in terms of expected impact: service providers, infrastructure providers, industry and SMEs, and researchers and research communities. The stakeholders category with a lower expected outputs' impacts are citizens, consumers and end-users that will be indirect beneficiaries of the project, but in fact this is currently hard to predict.

The detailed specification of the CumuloNimbo project's output impacts on direct and indirect stakeholders is as follows:

- *Developers and software engineers*: the use of the project's outputs is related to developing applications on top of the CumuloNimbo PaaS.
- *Service providers*: with reference to the capability of providing services on top of CumuloNimbo as PaaS.
- *Infrastructure providers*: the project's output is related to the data management services developed as PaaS which allow to improve the scalability and the flexibility of resources, in order to reach more clients.
- *Industry and SMEs*: the use of the project's outputs allows industry and SMEs to use and/or develop applications running on top of the CumuloNimbo platform.
- *Researchers and research communities*: the use of the project outputs is related to the extension of the research performed in CumuloNimbo that will transform the current way of attaining highly scalable transactional processing.
- *Citizens, consumers, end-users*: the use of the project's outputs allows to run applications on top of the CumuloNimbo platform.

The table below summarizes the relationships between the different stakeholders, the main activities enabled for them by the project, and the expected impacts for each category.

Stakeholders/beneficiaries and relevance score (from 1 to 5[19])	Main activities possible using CumuloNimbo' outputs	Expected impact
Researchers and research communities (5)	Extend the research performed in CumuloNimbo that will transform the current way of attaining highly scalable transactional processing	Transformation of the understanding of how to scale transactions
Service providers (5)	Provide services on top of CumuloNimbo as PaaS	Due to the transparent scalability and elasticity they will be able to attract many clients
Infrastructure providers and TELCO operators (5)	Provide CunuloNimbo as PaaS and as a core service for data management in TELCO infrastructures	Telco operators will be able to simplify the service due to the transparency of CumuloNimbo. Ability to combine analytical processing with the elastic online transactional processing to reduce the number of computational resources needed
Developers and software engineers (5)	Develop applications on top of CumuloNimbo PaaS	They will be able to scale their applications transparently without having to change them
Industry and SMEs (5)	Use and/or develop applications running on top of CumuloNimbo	Benefit from scalable transactional applications
Citizens, consumers and end users (4)	Use applications running on top of CumuloNimbo	Lack of anomalies despite the scalability thanks to its transparency. Good QoS during peak periods thanks to the scalability and elasticity

Tab. 26 – CumuloNimbo's most relevant beneficiaries/users, the activities they will be enabled to do thanks to CumuloNimbo's outputs, and the expected impacts

It should be noted that developers, software engineers, project partners, industry and SMEs, Infrastructure providers, and TELCO operators are also represented in the project consortium, so that their requirements can easily be considered during development activities. Hence, CumuloNimbo offers services and support to research institutions and companies that are also represented in the consortium. All other typologies of users are external to the project consortium.

[19] Where 1 is "very relevant" and 1 is "not relevant".

3.2 Economic impact

CumuloNimbo's total cost is € 4.700.000. The table below shows the effects on cash outflows, by providing details about the project's costs divided by category[20].

Cost categories	Euros
Personnel (not counting personnel costs related to management and to dissemination)	3.000.000
Training	0
Use case running	0
Subcontracting	0
Travel	100.000
Dissemination costs (personnel plus other costs)	10.000

Tab. 27 - CumuloNimbo's costs sub-divided by categories

The project's outputs mainly provide economic impacts in terms of effects on cash inflows, specifically related to cost reductions. Indeed, the project's outputs expect to produce 10% of hardware cost reductions, 10% maintenance cost reduction, 10% of software development costs, 10% of cost reduction due to increment in software re-usability, and 10% of cost reduction due to less frequent process breaks and system failures. Hence, the effects on cash inflows are strictly related also to the effects produced on technological advances.

With reference to the general economic impacts of the CumuloNimbo outputs, starting from the improvement of existing services and systems, the project is expected to produce different indirect benefits on stakeholders, such as lower entry barriers, improvements in scalability, and greater ability to keep pace with competitors.

[20] The total cost reported in the table are not equal to € 4.700.000, due to a lack of data.

Expected benefits	
Improve service/product/system quality	X
Reach more users	X
Lower entry barriers in a specific economic sector	X
Improve the access to large amounts of data. Improve the possibility to exploit large amounts of data (more efficient data analysis)	X
More efficient data exchange	
Improve scalability	X
Expand the range and the typologies of research activities and services made available to research communities	
Cost reductions	
Reduce the time needed to deliver a service (reduce the time-to-market period)	X
Reduce the time needed to deploy a service over the network/the architecture	X
Keeping pace with competitors/with the research in the field	X
Ability to better target users/beneficiaries' needs	X
Increment the optimisation of resources/improve efficiency	X
Other	

Tab. 28 – CumuloNimbo's expected benefits

Even if, at its present early stage, it is not possible to have a complete view of the future of the PaaS sector, this assessment exercise will try to give, at least, a partial evaluation and quantification of the economic benefits brought by some of the short-term outputs already produced by CumuloNimbo.

In terms of effects on welfare derived from technological advances, CumuloNimbo expects to generate a positive environmental impact. The project, in fact, is expecting to produce 30% of savings in kWh and 30% of savings in storage-related costs. The positive environmental impact of the project is also related to the increase of several technological advances variables, such as effects on efficiency. Indeed, the most important category of the technical project's outputs quality is related to this variable.

The CumuloNimbo project has identified a potential commercial exploitation of its outputs and has already drafted a Business Plan. The project expects up to 50 persons to work on the commercial exploitation of its outputs. CumuloNimbo has also identified its global target market:

- Applications requiring high scalability for transactional workloads:
- Applications that are willing to migrate to the cloud but only if it does not require changes to the applications itself:
- Applications that currently are complex due to the non-transparent scalability mechanisms used and want to get simplified via the CumuloNimbo transparent scalability solution.

The project provided also a list of its potential competitors showing the willingness to exploit its outputs in the near future: Amazon megastore, Amazon simpleDB, Microsoft Azure, IBM CloudBurst, Oracle cloud edition.

The CumuloNimbo project, unlike many other projects assessed by SEQUOIA, has demonstrated an understanding of the relevance of economic performance since its

early stages. The fact that CumuloNimbo has already drafted a Business Plan makes the project a good example for all the European research projects.

Moreover, it is important to highlight that the project already applied for 2 patents IPR Trademarks showing to have a clear plan for knowledge exploitation and outputs sustainability.

Evaluation of CumuloNimbo economic impact on employment

During its life, the CumuloNimbo project has produced a great effect on welfare in terms of effects on labour market, by sponsoring 15 PhD scholarships and 5 post-doctoral scholarships, thereby determining a positive benefit deriving from the potential exploitation of the resulting highly-trained students by the new economy. To see how the proxy of such benefit is calculated please see Annex 1 where the proxy used for calculating impact on employment is described.

Impact on employment	
N° of PhD scholarships sponsored	15
N° of Post-Doc scholarships sponsored	5
Time frame of a PhD sponsored	36 months
Time frame of a Post-Doc sponsored	24 months
Average income of a PhD holder (€)	2.752
Average income of a Post-Doc holder (€)	3.128
N° of additional EU employees	10
Time frame of new contracts	36 months
Average gross annual earning of a EU employee	2.148
Total value of impact on employment (€)	2.634.720

Tab. 29 - Inputs and assumptions used in this assessment exercise of the impact on employment

The values calculated in Section 3.2, together with the information regarding the social impacts (see next paragraphs), will be used in Section 3.4 to calculate the project's global indices (iROI, xROI and tROI), summarizing the project performance in terms of expected socio-economic impact.

3.3 Social impact

CumuloNimbo is likely to have an impact on different sectors of society: on the ICT industry in general, but also on eGovernment and eInfrastructure. In particular, thanks to the project, data management, which is an activity required by all the ICT industry, is expected to face fewer scalability issues. Moreover, applications running on the CumuloNimbo infrastructure will be able to migrate without requiring any change, preserving their original semantics and scaling transparently. Finally, eGovernment applications will be able to run seamlessly on the CumuloNimbo Platform and will benefit from the underlying scalable, flexible, and high-availability infrastructure.

Therefore, CumuloNimbo is expected to impact society at large, but it does not seem to directly target end-users or citizens or to work towards reducing the digital divide or to enable to support diversity and individual expression. Citizens and end-users are, as mentioned earlier, indirect beneficiaries of the project.

Social groups can benefit in the longer term from this project, if CumuloNimbo will be applied to sectors such as eHealth or eGovernement by providing easier programming, consistency, and scalability of services. At the same time, CumuloNimbo outputs can result in an architecture that can be used to enable European stakeholders in service platforms, such as SAP, to position themselves in the Cloud computing market with a competitive advantage.

Regarding the contribution of the project to the fulfilment of some of the 2020 European Digital Agenda goals, it appears that it will support the following political goals: “Allow SMEs to enter new markets by lowering entry barriers for SMEs /lowering resource costs”, “Increase ICT related Services demand”, “Increase interoperability at a more general level”, and “Increment eCommerce”.

More specifically, CumuloNimbo will contribute to increase ICT-related service demand by providing better QoS thanks to its scalability, and lower cost thanks to its flexibility and transparent migration to the Cloud. In the context of interoperability CumuloNimbo seeks to increase the interoperability thanks to the support of existing standards such as Java EE and SQL and providing transparent scalability to them. It will also contribute to increment eCommerce by enabling a faster development of eCommerce applications due to the support of traditional software development stacks such as JEE and SQL.

Lastly, regarding the creation of content and borderless services, CumuloNimbo’s scalability will contribute to borderless services by providing the scalability needed for a high number of users coming from many different countries.

Technological benefits

From a technical point of view, the most innovative aspects of the project regards the transparent scalability of its transactional systems. The self-assessment of its technological benefits made by the project shows that the technical project’s outputs are of high quality in terms of efficiency. Furthermore, the quality in use of technologies allows to increase the usability and functionality of the CumuloNimbo project’s outputs. The average score self-assessed by the project regarding its technological benefits amounts to 8,77 on a scale from 1 to 10.

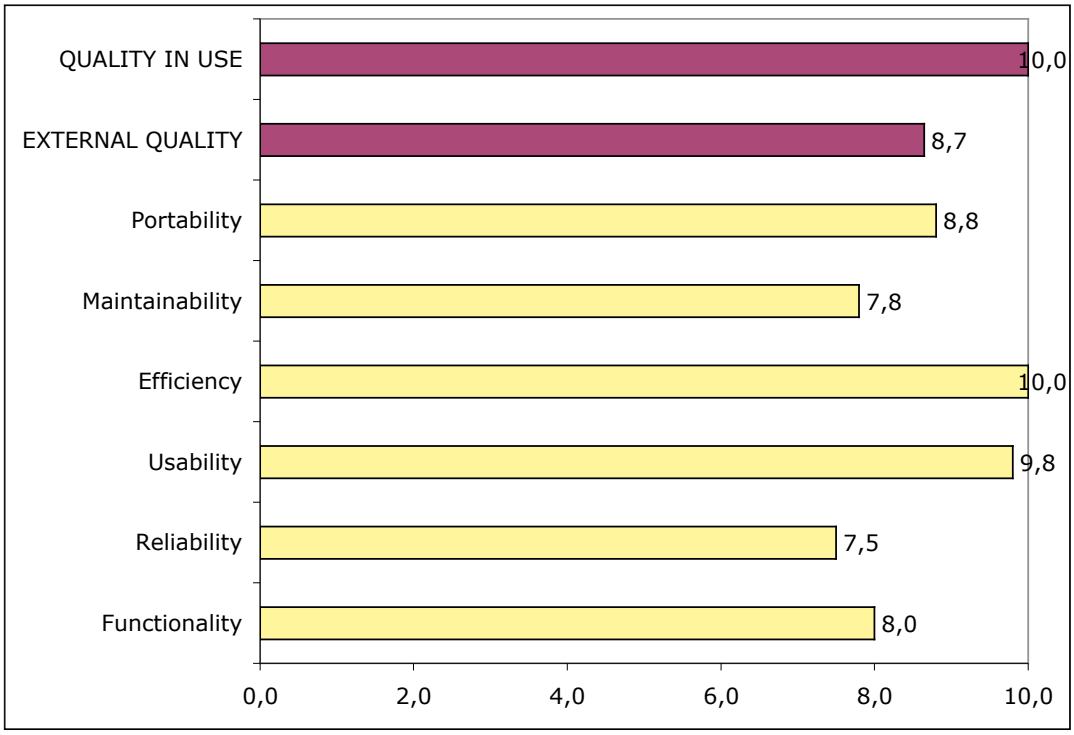

Fig. 3 - Technical benefits of the CumuloNimbo project[21]

With reference to the technical characteristics of the CumuloNimbo project, the technological impact assessment detected a high relevance of external products' quality in use, which is mostly related on the following external products: Derby, HBase, Zookeeper, Bookeeper, HDFS, JBoss, Hibernate.

Impact on employment and working routines

For CumuloNimbo, employment and working routines emerged as the most important social impacts. This seems to correspond to its main objective associated with working routines: Transactional development frameworks such as Java EE are the most common way of building applications today. One of the most difficult problems in that area is the lack of scalability of the transactional support, and in fact the total gap of scalable solutions that scale out (using many nodes). CumuloNimbo aims at filling this gap providing a highly scalable transactional system for the cloud. The positive impact of CumuloNimbo on employment and working routines is a combined examination of more and better job creation during the project and after the project end.

CumuloNimbo has provided jobs for 21 to 40 people. In addition, it sponsored 15 PhD scholarships and 5 post-doctoral scholarships, which is positive sign in terms of the likelihood to positively influence future career opportunities for the students involved while, at the same time, generating highly skilled expert personnel who are likely to benefit society.

It is also interesting to analyse the project's impact on employment from a gender equality point of view. This has turned out to be fairly unbalanced. In total, 5 women and 29 men participate in CumuloNimbo. The group of contributing women consists

[21] In "red" the two macro variables used for the technological impact self-assessment and in "yellow" the micro variables that compose them.

of 2 PhD students, 2 experienced researchers and 1 support role. So no WP leaders are women. This unbalanced division is a rather negative signal to the EC target/guideline of 40% female participation in committees, groups and panels. However, it can be explained by a general tendency of a low female participation in this area of work. Nonetheless an effort should be made by the project to attract a higher number of female participants in all roles.

Furthermore, 20 people were specifically recruited for the project. Also, CumuloNimbo operates on a national, European and International level, which is likely to underpin its impact on employment rates in multiple territories.

As CumuloNimbo aims at developing a radically new Platform as a Service that will provide high scalability (100+ service nodes) without sacrificing data consistency and ease of programming, the project is likely to have a high impact on working routines at the local level and cross-border due to the nature of the PaaS.

Knowledge production and sharing

CumuloNimbo has a relatively positive impact in terms of knowledge production and sharing. At the time of assessment, 30 scientific deliverables, 3 scientific articles/conference proceedings, and 1 journal article have been produced.

Topic	Journal articles	Articles presented at conferences or proceedings	Books	Chapters of books	Scientific Deliverables
Joint publications on service engineering, evolution, adaptation, and quality assurance, as well BPM, service composition and service infrastructures (incl. Cloud)	1	3	0	0	30

Tab. 30 - Scientific production of CumuloNimbo

The knowledge produced by CumuloNimbo has been shared and diffused at 6 events so far. Newspaper articles have been written for the general public, the website addresses various targets (but it is not constantly updated and the deliverable are not publicly available). Several meetings with representatives of the industrial sector have been organized. At the time of data gathering, no new collaboration agreements have been established yet or training modules developed.

N. of knowledge exchange initiatives	N. of new collaboration links established thanks to the participation in the project (in terms of exchange, ect.)	N. of scientific conferences and seminars in which your project has been presented
0	0	6

Tab. 31 - Scientific knowledge diffusion activities of CumuloNimbo

The table below shows the self-assessment made by CumuloNimbo regarding the impact on the project in terms of knowledge sharing on its beneficiaries.

CumuloNimbo will:	Strongly disagree	Disagree	Agree	Strongly agree
Make information/knowledge available to a larger number of interested users	X			
Support knowledge transfer between universities/research centres and industry/SMEs				X
Make highly innovative services available to citizens				X
Develop services that will positively impact on citizens' everyday life				X
Make available high-quality knowledge/information to citizens	X			
Reduce the digital divide	X			
Support democratic processes/democratisation	X			
Positively impact education		X		
Enable diversity and individual expression	X			
Flexibility for personalisation on a large scale/high interface adaptability			X	

Tab. 32 - Impact of CumuloNimbo in terms of support to ICT usage for all and to democratic participation

The project supports the transfer of knowledge between research centres and industry. The project will also promote the development and the availability of highly innovative services that will positively impact citizen's everyday life. Finally, CumuloNimbo will promote flexibility for personalization on a large scale and high interface adaptability.

Social Capital

CumuloNimbo seems not to have a positive impact on the social capital of its participants. In fact, at the time of data gathering no new partnership agreements with other universities, research centres, enterprises, or public bodies were established. Similarly, no new project proposals were submitted giving the possibility to enlarge the collaboration network within and "around" the project consortium.

At the same time, the project is expected to have a positive impact on the social capital of its users and beneficiaries (see table below). First of all, it will support the creation of networks and the collaboration between the enterprises of the sector and inside academia. Moreover, it will improve the way in which users communicate and collaborate with each other, facilitating social interaction. The last important impact of the project is that it will improve the trust of citizens towards ICT and the Internet, and towards Public Administrations, as it will reduce the number of anomalies and increase the transparency and the quality of the services using its platform.

CumuloNimbo will:	Strongly disagree	Disagree	Agree	Strongly agree
Improve the way in which users communicate and collaborate with each other (the quality of the collaboration)/ facilitate social interaction				X
Improve trust among your target users	X			
Improve citizens' trust in Public administration			X	
Improve citizens' trust in ICT and the Internet				X
Support network creation/ collaboration of enterprises in the sector				X
Support network creation/collaboration among citizens	X			
Support network creation/collaboration in academia				X
Enlarge already-existing networks	X			

Tab. 33 – CumuloNimbo's impact in terms of social capital increment for users and beneficiaries

3.4 Final assessment

Calculation of iROI, xROI and tROI

The tables below provide an estimation of the three first indicators for CumuloNimbo project.

iROI inputs and calculation[22]

CumuloNimbo project cost (€)	4.700.000
Inflows (€)	1.000.000
iROI = (total investment financial inflows – investment financial outflows/ investment cost)	**0,2127**

xROI inputs and calculation

CuNim project cost (€)	4.700.000
Benefits on employment (€)	2.634.720
xROI = (Socioeconomic benefits – Socioeconomic costs/ investment cost)	**0,5605**

tROI = (iROI + xROI)	**0,7732**

Tab. 34 – Calculation of the iROI, xROI and tROI of the project CumuloNImbo

Due to the short lifetime of the project (CumuloNimbo at the time of the assessment was in the initial evaluation phase), the iROI value is not very significant, because there are no financial returns. Instead, the xROI value is higher than the iROI, as the CumuloNimbo project expects to produce very relevant socio-economic benefits for several categories of stakeholders, such as service providers, infrastructure providers, large industry and SMEs, as well as researchers and research communities. As a result of the iROi and xROI values, the Total Return on Investment (tROI) of the CumuloNimbo project is remarkable for the consortium partners, for the different stakeholders, and for society as a whole.

[22] See Annex 1 for short definition of iROI, xROI and tROI.

Calculation of the Multi-Criteria Assessment

The table below shows the normalised values obtained for the CumuloNimbo project in the multi-criteria assessment, and the comparison between the values obtained by the project and the SEQUOIA average[23].

Impacts	Variable	Comparison with SEQUOIA average	TOTAL/ maximum possible value
Technological benefits			**0,87/1**
Impact on employment and work-routines	Impact on general employment		**1,15/2**
	Work positions generated by the project		
	Improvement of working routines		
	Self assessment		
Impact on knowledge production and sharing	Scientific impact		**1,29/11**
	N journal articles		
	N books		
	N books chapters		
	N articles presented at conf. or pub. In proceedings		
	N scientific deliverables		
	Knowledge sharing		
	N knowledge exchange initiatives		
	N scientific collaboration links		
	N training modules		
	N of scientific events where project presented		
	Availability of papers and del through website		
	Support ICT usage for all and democratic participation		
	Self-assessment		
Impact on social capital	Social capital increment for project participants		**0,69/4**
	New collaboration with research institutes		
	New collaboration with industry partners		
	New project proposals		
	Social capital increment for users and beneficiaries		
	Self-assessment		
TOTAL Impact Multi-criteria Analysis			**4/18**

Legend: above the SEQUOIA average; similar to the SEQUOIA average; below the SEQUOIA average

Tab. 35 – CumuloNimbo's Multi-criteria analysis

[23] See Annex 1 for a short definition of the Multi-Criteria Analysis.

The results of the multi-criteria analysis show that the project is below the average in terms of knowledge creation, with the exception of scientific deliverables. This is consistent with the technological focus of the project on the one hand and with the early stage of the project when the data gathering took place, on the other. We can expect the project to increase its scientific production and we recommend investing in making their results publicly available. This can be done by increasing, at the same time, the effort in networking within the scientific community but also with industry and especially SMEs.

The project is above average in the expected impact on working routines and in the impact on ICT usage by citizens. However, the most important impact will be the technological one. In this sense it is important to remember that the project consortium represents all the stakeholders needed in order to assure a high impact of its research activity and possibly also an effective commercial exploitation.

RORI

The following table calculates the RORI of the CumuloNimbo project following the weighting system adopted by the SEQUOIA Team.

Variable	Weight	CumuloNimbo indicators	Weighted values
iROI	0,15	0,2127	0,0319
xROI	0,35	0,5605	0,1962
Technical benefits	0,10	8,77	0,877
Impact on employment and working routine	0,10	1,15	0,115
Impact on knowledge production and sharing	0,20	1,29	0,258
Impact on social capital	0,10	0,69	0,069
		RORI	**1,5471**

Tab. 36 – Calculation of the RORI of the project CumuloNimbo

The most relevant characteristic of the project is that it answers to a clear demand of the ICT sector. The project was created with a clear idea of the needs of its stakeholders and its most relevant impact will be at the technological level. It is important to remember that the project developed a clear exploitation and sustainability plan and put in place an internal evaluation system with which the SEQUOIA approach can be integrated. Moreover, the project submitted 2 requests for IPR trademarks, another signal that makes us feel optimistic in terms of project sustainability. Finally, the project will have a positive impact on employment and working routines and on citizens' ICT usage.

In order to increase its socio-economic impact the project should invest more effort in disseminating its research results both within the scientific community and outside it. Specifically, the project should work more on the creation of networking opportunities for its partners and develop strategic links that may better support knowledge sharing

within the sector and towards other audiences such as industries and the general public.

4 SocIoS

SocIoS – Exploiting Social Networks for Building the Future Internet of Services – is a STREP project co-founded by the European Union under the objective FP- ICT-2009.1.2: Internet of Services, Software and Virtualisation. The project started in September 2010 and will end in February 2013.

4.1 Mapping the areas of impact

The main objective of the SocIoS project is to build a layer exposing a functionality of data from a variety of social networks (SNS: Social Network Sites such as Facebook, Twitter, Flickr, etc.[24]), in order to democratise service lifecycle management. The SocIoS system first tries to homogenize and to group data and functionality, and secondly it provides tools that basically leverage them.

Some applications on top of that layer allow to identify events that appear in the social network insights, apps that help to search through this multitude of social network insights in a single way and building layer after layer eventually end up satisfying various application domain needs. These application domains are designed for generalist end-users and TV commercial production companies, in order to address the value chain from end to end.

In general terms, the SocIoS services are aimed at developing a new virtual infrastructure and at improving the existing one by developing and also improving the design process. More specifically, the SocIoS project will create three kinds of services:

- *SocIoS API:* An API that aggregates functionality from multiple underlying SNS; APIs for the application development and deployment. The main aim of this service is to support the interoperability, sustainability and the extendibility of the SocIoS platform
- *FlexiPrice:* A component that attempts to implement various business models by assessing the (subjective) value of information, in order to support also the integration of the applications developed for a service provisioning market
- *Workflow management:* A component that allows the usable composition of workflows to be restful or SOA-based.

Description of the structure of the project's activities

The SocIoS project is organised around the following structure of activities:

- *State of the art and baseline technologies specifications:* analysis of grey literature and identification of SocIoS's ontology, Object Model, API analysis, middleware, *services and application scenarios;*

[24] For a more specific definition of SocIoS terminology, please refer to http://www.sociosproject.eu/Overview/TechInfo/SocIoSGlossary/tabid/355/language/en-US/Default.aspx

- *Iterative design and development for constant end-user involvement:* by developing a SOA infrastructure, a toolset for supporting the business extensions of the applications, SLA support, an API for a single point access to users, a user interface to simplify the use of the SocIoS API, a toolset for third-party services support, and definition of the different end-user categories.

The project – at the time of data gathering – was in its second stage, "First iteration of design and development".

Identification of the main stakeholders and of the expected impacts

According to the opinion of the project, the most relevant categories of stakeholders of the SocIos project are industry, SMEs, and project partners. The following categories will directly or indirectly benefit from the project, but the impact on them will be lower: citizens, researchers and software engineers. The less relevant category of stakeholders is that of service providers.

In particular, SocIos project's output will have the following impacts on direct and indirect beneficiaries:

- *Developers and software engineers:* the use of project's output will allow developers to create new services leveraging SNS functionalities.
- *Researchers and research communities:* the use of project's outputs will allow researchers to better conduct experiments through its API.
- *Industry and SMEs:* the use of SocIos outputs will allow industry and SMEs to build applications that leverage UCC (User Created Content) and SG (Social Graph).
- *Citizens, consumers and end-users:* the use of the project's outputs will allow citizens and end-users to be involved in a business value chain.
- *Project partners:* the potential expected impact of the project's outputs is related to reduced cost for commercials production and to increase the timely identification of events and news.

The table below summarizes the relationships between the different beneficiaries, the main activities enabled for them by the project, and the expected impacts for each category.

Stakeholders/beneficiaries and relevance score (from 1 to 5[25])	*Main activities possible using SocloS' outputs*	*Expected impact*
Industry and SMEs (5)	Build applications that leverage UCC and SG	Create new business opportunities
Project partners (5)		Reduced costs for commercials production (for casting and location scouting) and timely identification of events as well as capability to double-check sources of news
Developers and software engineers (4)	Develop services leveraging SNS functionality from various SNS'	Develop novel services where SNS users are the data providers leveraging user created content (UCC) and social dynamics (SD)
Researchers and research communities (4)	Use the SocloS API to access the data residing in SNS so as to conduct experiments	Improvements in social computing
Citizens, consumers and end users (4)	Become data providers, get involved in a business value chain.	Use better services and be incentivized to provide data

Tab. 37 – SocloS's most relevant beneficiaries/users, the activities they will be enabled to do thanks to SocloS's outputs, and the expected impacts

It should be noted that developers, software engineers, project partners, industry, and SMEs are the project's users too. Hence, SocloS offers services and support to research institutions and companies that are also inside the consortium. All other typologies of users are external to the project consortium.

[25] Where 1 is "very relevant" and 1 is "not relevant".

4.2 Economic impact

SocIos's total cost is € 4.086.000.

With reference to the economic impacts of the outputs, the project contributes to the Future Internet in terms of service development, management, and interoperability to develop technological advances in software/service engineering and new software technologies for improving scalability and predictability of distributed systems, improving responsiveness and throughput.

The most important output of the SocIoS are mainly divided in two categories:

- *The platform:* that provides the basic functionalities on top of which developers and users can build the applications they need. The end-users of the platform are the developers (who want to build applications and sell them on the market);
- *The implementation of the applications*: the end-users of the applications are the generalists or the news broadcasting agencies and commercial producers (people who want to hire extras for the commercials or to find a required location).

The economic impact of the project's outputs is related to the development of a more competitive environment, including infrastructure operators moved up the value chain with innovative – more scalable - service offerings. Another potential benefit is related to the possibility to lower the entry barriers for service providers, to develop services through standardized Open Source platforms and interfaces at a considerable reduced cost. Moreover, the capability to lower the massive uptake of high value-added services through innovative service front-ends, to create online communities through platforms enabling "third-party generated services" and technologies tailored to meet key societal and economic needs.

Expected benefits	
Improve service/product/system quality	X
Reach more users	X
Lower entry barriers in a specific economic sector	X
Improve the access to large amounts of data. Improve the possibility to exploit large amounts of data (more efficient data analysis)	X
More efficient data exchange	
Improve scalability	
Expand the range and the typologies of research activities and services made available to research communities	X
Cost reductions	X
Reduce the time needed to deliver a service (reduce the time-to-market period)	
Reduce the time needed to deploy a service over the network/the architecture	
Keeping pace with competitors/with the research in the field	X
Ability to better target users/beneficiaries' needs	
Increment the optimisation of resources/improve efficiency	
Other	

Tab. 38 – SocIoS's expected benefits

Even if, at the present early stage, it is not possible to have a complete view of the future of the project, this assessment exercise will try to give a partial evaluation and quantification of the economic benefits brought by some of the short-term outputs already produced by SocIoS.

The SocIoS project conducted an analysis of potential commercial exploitation opportunities of its outputs, but it has not yet drafted a business plan. The most relevant economic impact of the project is related to the effects on technological advances, especially in terms of potential cost reductions achievable through the commercialisation of its outputs. The project is expected to reduce software development costs by 70%. This 70% cost reduction is related to the increment in software re-usability and reduction of cost related to compliance with regulatory/legal-business and legislation/policies constraints. Moreover, the project expects to save 80% of costs and time reduction for accessing the data due to the easy and controlled access to a vast amount of data sources.

Hence, In general, in terms of technological advances impact, the quality of technologies allows to increase the functionality and the efficiency of SocIoS's outputs.

In terms of effects on welfare and more specifically on the environment, the project has not produced a relevant positive impact.

At the current stage of the project, SocIoS' researchers are not yet able to identify the potential market share achievable, however, they identified the project's main competitor: "Hootsuite", a platform that aggregates data from social networks and displays them to the users. The SocIoS project is able to provide more tools for people to actually modify the shared data than "Hootsuite".

Finally, with reference to the economic sustainability plan, the project's outputs had attracted €15.000 of public investments beside that of the EU and it has already generated the submission of 2 new project proposals. The most relevant substantial economic impact will be presumably obtained 1 year after the end of the project.

Evaluation of SocIoS economic impact on employment

Up to the time of SEQUOIA data gathering, the SocIoS project has produced a remarkable positive effect on welfare in terms of labour market improvement, by sponsoring 6 PhD scholarships and 1 post-doctoral scholarships, thereby determining a positive benefit deriving from the potential exploitation of the resulting highly-trained students by the new economy. To see how the proxy of such benefit is calculated please see Annex 1.

Impact on employment	
N° of PhD scholarships sponsored	6
N° of Post-Doc scholarships sponsored	1
Time frame of a PhD sponsored	36 months
Time frame of a Post-Doc sponsored	24 months
Average income of a PhD holder (€)	2.752
Average income of a Post-Doc holder (€)	3.128
N° of additional EU employees	6
Time frame of new contracts	30 months
Average gross annual earning of a EU employee	2.184
Total value of impact on employment (€)	1.062.624

Tab. 39 - Inputs and assumptions used in this assessment exercise of the impact on employment

The values calculated in Section 4.2, together with the information regarding the social impacts (see next section), will be used in Section 4.4 to calculate the project's global indices (iROI, xROI and tROI), summarizing the project performance in terms of expected socio-economic impact.

4.3 Social impact

Knowledge production and sharing emerged as the most important social impact of the SocIoS project. This seems to correspond to SocIoS's focal point to expose the functionality and assets of social networking sites as a service underpinning its provision of the necessary tools to common Internet users allowing them to compose, provide and consume application services over abstract resources on the Web.

But, before we take a closer look at the results, what sectors does SocIoS possibly impact, and society, more generally? The table below shows that while SocIoS does not directly provide a dedicated solution for the sectors considered, it is likely to impact eInfrastructure, eLearning and the ICT industry at large.

Social relevant sectors	
eGovernment	
ICT industry in general	X
eHealth	
eEnvironment	
ICT support to efficient transport and better mobility	
eInfrastructure	X
eLearning	X
Other	
The project does not directly provide/create a solution for these sectors, but it enables the creation of various solutions.	X

Tab. 40 - Socially relevant sectors on which SocIoS will have an impact

The project describes the expected impact on the selected fields as follows:

- Provision of an API that will aggregate functions and data from various SNS (Social Networks Sites);
- Provision of a platform to allow users to use the aforementioned API and deploy services that provide the intelligence to the business processes implemented; and,
- Provision of a new platform for deploying services that leverage social content and dynamics.

In general, SocIoS is expected to impact society at large. However, it does not seem to directly work towards reducing the digital divide or to support diversity and individual expression. In any case, it is likely that social groups can benefit from SocIoS's outputs in the longer term when the project has proven to have successfully provided incentives such as tools for cross-platform application development and deployment, by allowing home users to build applications that have a business character and utilize – if not generate - the UCC (User Created Contents) and social graph.

Regarding the project's contribution to the fulfilment of some of the 2020 European Digital Agenda goals, SocIoS will mostly support the following political goals: "Increase ICT related Services demand" and "Increase interoperability at a more general level", and to a lesser extent with the creation of new (digital) markets and by supporting eCommerce more generally.

Technological benefits

From a technological point of view, the most technologically innovative aspect of the SocIoS project is related to the aggregation of SNs (Social Networks) functionality and content, and in particular to the capability to automatically combine API methods with web services into workflows.

The self-assessment of its technological benefits made by the project shows that the project's technical outputs are of high quality in terms of portability of technologies and of usability and maintainability of infrastructures. Furthermore, the quality in use of technologies allows increasing the functionality and the efficiency of SocIoS's outputs (see figure below).

The average score of the project regarding its technological benefits amounts to 8,62 on a scale from 1 to 10.

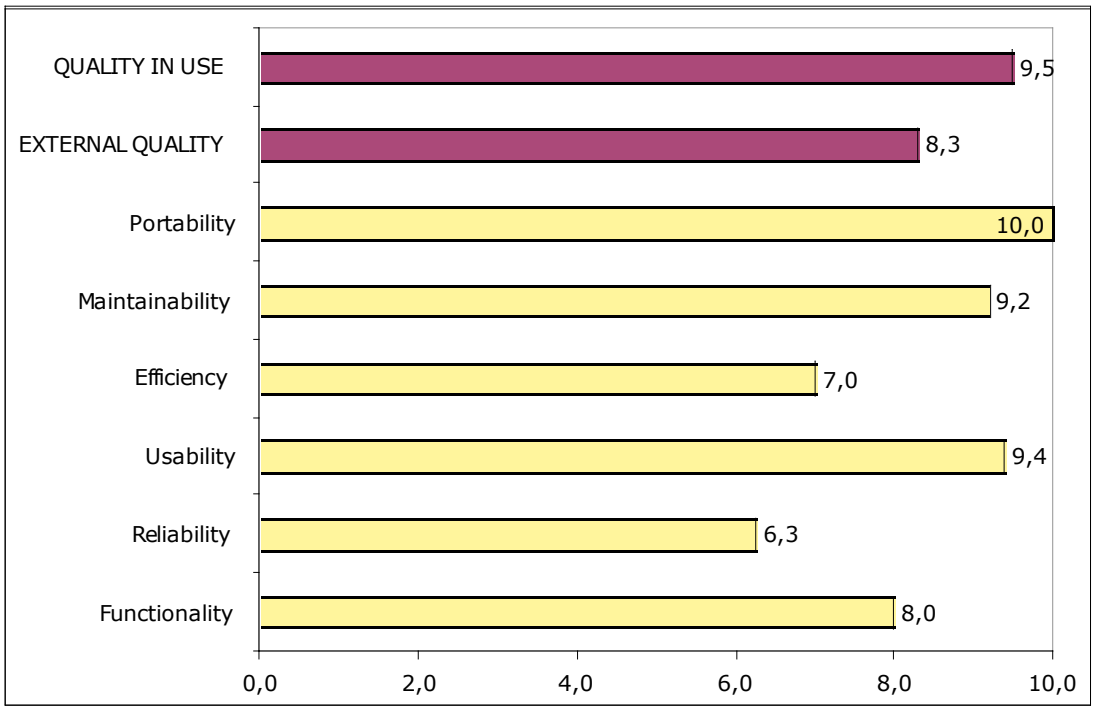

Fig. 4 – Technological benefits of SocIoS project[26]

Impact on employment and working routine

For SocIoS's impact on employment and working routines we examined whether the project has created more and better jobs and whether its outputs will create more and better jobs in the future. This was followed by how SocIoS may impact and possibly improve the working routines of its users/beneficiaries.

SocIoS has provided jobs for 21 to 40 people. In addition – as mentioned earlier - it sponsored 6 PhD scholarships and 1 post-doctoral scholarship, which is a positive sign in terms of the likelihood to positively influence future career opportunities for the

[26] In "red" the two macro variables used for the technological impact self-assessment and in "yellow" the micro variables that compose them.

students involved while, at the same time, generating highly-skilled expert personnel which are likely to benefit society.

It is also interesting to analyse the project's impact on employment from a gender equality point of view. In total, 12 women participate and 18 men contribute to SocIoS. The scientific coordinator is a woman. Further, the numbers show an almost balanced gender division of labour: 3 experienced researchers are women and 3 men, 3 female versus 5 male PhD students, 2 female and 2 male WP leaders. Such a division is a positive signal as it far exceeds the EC target/guideline of 40% female participation in committees, groups and panels.

Furthermore, 6 people were specifically recruited for the project, i.e. 6 new working positions were created by the project. At the time of data gathering, the project was unsure how it will impact employment rates in various territories.

The project is likely to impact positively the working routine of its users. In particular, researchers will benefit from more awareness for the need of cross-disciplinary work, a better integration with other European researchers, and richer collaborations and a wider access to research results.

Impact on knowledge production and sharing

It is difficult to assess the impact on knowledge production of the SocIoS project as, at the time of data gathering, it was still at an early stage of its activities. The only readily available documents were 9 deliverables and 3 scientific articles/conference proceedings.

Topic	Journal articles	Articles presented at conferences or proceedings	Books	Chapters of books	Scientific Deliverables
Joint publications on service engineering, evolution, adaptation, and quality assurance, as well BPM, service composition and service infrastructures (incl. Cloud)	0	3	0	0	9

Tab. 41 - Scientific production of SocIoS

However, the project seems to have a very positive impact in terms of knowledge sharing. Even if the data shown in the table below are rather low, because no data was available at the time of data gathering, we note that the knowledge produced by the project has been shared and disseminated at 17 events in 2011 and 1 was planned (so far) for 2012. At the time of data gathering, no new collaboration agreements were established yet. The website is a good channel for dissemination, but the access to paper can be improved. Lastly, knowledge is also diffused by the development of different training modules.

N. of knowledge exchange initiatives	N. of new collaboration links established thanks to the participation in the project (in terms of exchange, ect.)	N. of scientific conferences and seminars in which your project has been presented
		4

Tab. 42 - Scientific knowledge diffusion activities of SocIoS at the time of the assessment

In addition to the diffusion of knowledge among the scientific community, SocIoS seems to have a high impact in the diffusion of ICT in the society. Dealing with social networks, SocIos may have an important impact on the use of ICT by all citizens. The objective of this project is to make information and knowledge, but also highly innovative services, available to a larger number of interested users, and to enable the development of services that will positively impact citizens' everyday life. In fact, the focal point of the project is the provision of the necessary tools to common Internet users that allow them to compose, provide and consume application services.

SocIos will also support the transfer of knowledge between research centers and SMEs; it will impact positively on education and promote flexibility for personalization on a large scale and high interface adaptability.

The table below shows the self-assessment made by SocIoS regarding the impact of the project in terms of knowledge sharing on its beneficiaries.

SocIoS will:	Strongly disagree	Disagree	Agree	Strongly agree
Make information/knowledge available to a larger number of interested users				X
Support knowledge transfer between universities/research centres and industry/SMEs			X	
Make highly innovative services available to citizens				X
Develop services that will positively impact on citizens' everyday life				X
Make available high-quality knowledge/information to citizens			X	
Reduce the digital divide		X		
Support democratic processes/democratisation		X		
Positively impact education			X	
Enable diversity and individual expression		X		
Flexibility for personalisation on a large scale/high interface adaptability			X	

Tab. 43 - Impact of SocIoS in terms of support of ICT usage for all and of democratic participation

Impact on social capital

The last sub-category to examine the social impact of SocIoS is social capital and research networking which may deserve more attention in the next phases of the project.

In fact, the impact on partners' social capital is quite low, due to a lack of partnership agreements with actors outside the consortium such as research centres, universities, SMEs, and the industrial sector in general. However, the project submitted 2 new project proposals that can, on the one hand, support its sustainability and, on the other hand, represent a good opportunity for enlarging the collaboration networks of the partners.

N. of new collaborations established with industrial actors	N. of new partnership agreements with other universities, research centres, enterprises or public bodies	N. of new project proposals submitted thanks to the participation in the project
0	0	2

Tab. 44 – SocIoS's networking and sustainability activities

SocIoS's impact on the social capital of its users seems, by contrast, more positive. First it will support the creation of networks and promote the collaboration not only in academia but also among the citizens, facilitating their social interactions. It will also improve the trust among the users, and the trust of the citizens in ICT and the Internet (see table below).

SocIoS will:	Strongly disagree	Disagree	Agree	Strongly agree
Improve the way in which users communicate and collaborate with each other (the quality of the collaboration)/ facilitate social interaction			X	
Improve trust among your target users			X	
Improve citizens' trust in Public administration		X		
Improve citizens' trust in ICT and the Internet			X	
Support network creation/ collaboration of enterprises in the sector		X		
Support network creation/collaboration among citizens			X	
Support network creation/collaboration in academia			X	
Enlarge already-existing networks			X	

Tab. 45 – SocIoS's impact in terms of social capital increment for users and beneficiaries

4.4 Final assessment

Calculation of the iROI, xROI and tROI

The tables below provide an estimation of the three first indicators for the SocIoS project.

iROI inputs and calculation[27]

SocIoS project cost (€)	4.086.000
Inflow (Public Investment) (€)	15.000
iROI = (total investment financial inflows – investment financial outflows/ investment cost)	**0,0036**

xROI inputs and calculation

SocIoS project cost (€)	4.086.000
Benefits on employment (€)	1.062.624
xROI = (Socioeconomic benefits – Socioeconomic costs/ investment cost)	**0,2600**

tROI = (iROI + xROI)	**0,2636**

Tab. 46 – Calculation of the iROI, xROI and tROI of the project SocIoS

The SocIoS project at the time of the evaluation was in its second stage, "First iteration of design and development", hence the iROI value is not significant. The project does not cover the total expenses of the consortium, it has not entered the development and commercialization phase, hence is too early to expect a positive iROI.

The xROI value is significantly higher than the iROI: this value shows that the SocIoS project develops socio-economic benefits that impact on the consortium and the society as a whole, especially in terms of employment.

Since the project at the time of the assessment was in its early stage, we can consider that the xROI value is fairly good, even if it is far below 1. However, we expect that the project will develop the main socio-economic benefits at its final development stages. However, a subsequent long-term assessment of the project's impact is needed, as Social Networking technologies require more time to produce socio-economic benefits and the SocIoS project in the long-term can generate an higher xROI value.

[27] For a short definition of iROI, xROi and tROI see Annex 1.

Calculation of the Multi-Criteria Assessment

The table below shows the normalised values obtained through the multi-criteria assessment of the SocIoS project, and the comparison with the SEQUOIA average values[28].

Impacts	Variable	Comparison with SEQUOIA average	TOTAL/ maximum possible value
Technological benefits			**0,86/1**
Impact on employment and work-routines	Impact on general employment		***0,98/2***
	Work positions generated by the project		
	Improvement of working routines		
	Self assessment		
Impact on knowledge production and sharing	Scientific impact		***1,40/11***
	N journal articles		
	N books		
	N books chapters		
	N articles presented at conf. or pub. In proceedings		
	N scientific deliverables		
	Knowledge sharing		
	N knowledge exchange initiatives		
	N scientific collaboration links		
	N training modules		
	N of scientific events where project presented		
	Availability of papers and del through website		
	Support ICT usage for all and democratic participation		
	Self-assessment		
Impact on social capital	Social capital increment for project participants		**0,81/4**
	New collaboration with research institutes		
	New collaboration with industry partners		
	New project proposals		
	Social capital increment for users and beneficiaries		
	Self-assessment		
TOTAL Impact Multi-criteria Analysis			**4,04/18**

Legend: above the SEQUOIA average; similar to the SEQUOIA average; below the SEQUOIA average

Tab. 47 – SocIoS's Multi-criteria analysis

[28] For more info on the Multi-Criteria Assessment see Annex 1.

The expected benefits are particularly positive in terms of technological improvement and impact on users' working routines. However, the project is below average in terms of knowledge production and sharing and of social capital. This is of course mainly due to the early stage at which the project was when we assessed it, but we recommended monitoring this variable and improving in order to increase the chances of good performance in this sense.

Moreover, it is important to highlight that SocIoS is one of the most promising projects in terms of potential impact on society in general. Its attention to social media and the willingness to empower the generalist end-user is a point of strength that can lead to interesting exploitability options.

RORI

The following table calculates the RORI of the SocIoS project following the weighting system adopted by the SEQUOIA Team.

Variable	Weight	SocIoS indicators	Weighted indicators
iROI	0,15	0,0036	0,00054
xROI	0,35	0,2600	0,091
Technical benefits	0,10	8,62	0,862
Impact on employment and working routine	0,10	0,975	0,0975
Impact on knowledge production and sharing	0,20	1,397	0,2794
Impact on social capital	0,10	0,805	0,0805
		RORI	**1,41094**

Tab. 48 – Calculation of the RORI of the project SocIoS

As mentioned earlier, SocIoS is particularly interesting for the potential impact it can have on the citizens and because it address the web 2.0 phenomenon by addressing its innovation needs. The fact that the project attracted additionally funding is a good indicator of the attention this project can attract and of its potential sustainability. Another interesting aspect of this project is represented by the good balance between men and women in the consortium and by the capability of creating new working opportunities.

However, due to the early stage in which the assessment was conducted we cannot go much further in the analysis; we recommend paying more attention to knowledge production and sharing and to networking and collaboration opportunities.

5 I2Web

I2Web is a Call 5 STREP project that aims at developing services for an inclusive Future Internet. The tools under development are dedicated to social groups with special needs such as disabled and older persons. The project started in November 2010 and will end in April 2013. It has a total cost of 2,7 M€.

5.1 Mapping the areas of impact

The recent evolution of the Web from primary static pages to inter-related interactive applications and participatory environments presents new challenges, especially for people with accessibility difficulties, such as elderly or disabled people. I2Web aims at developing tools in order to enable the Future Internet to be extensively accessible to all. It will deliver an open, scalable and dependable service platform architecture and online spaces enabling automatic service description, discovery, composition and negotiation with different inclusive services. It will prototype these developments in different application domains: Web 2.0, Ubiquitous and Mobile Web, and IPTV/iTV.

The three main outputs of I2Web will be:

- Applications, Devices and User Model Frameworks: Application MetaModels and abstractions that can deal with information aggregation, cloud computing applications, Semantic Web, and mobile/ubiquitous Web 2.0 systems, based on existing models such as WAI-ARIA, OpenAjax, and Open Social. Extension of existing Mobile Device Models in order to be able to deal with the needs of other devices: standard desktops, consumer electronics devices, and inclusive services. User Models based on an analysis of user requirements for disabled and older people in relation to the target applications combined with existing accessibility standards such as WCAG 2.0 and UWEM.
- eAccessibility Web Compliance tools: Incorporation of Web Compliance Tools into existing development environments and their standard development workflows, which will provide to the target user groups feedback on accessibility/usability issues, enabling at design/runtime feedback on DfA issues.
- Integration into operational services: The developed frameworks and tools will be integrated into operational services for adaptive banking services, enterprise content management systems, multichannel delivery platforms, IPTV applications, and accessible content provision.

Description of the structure of the project's activities

I2Web can be divided into 5 steps:

- Collecting eAccessibility user requirements and awareness, as well as Interaction Data from representative groups of real users.

- Researching, specifying appropriate User/Interaction, Device & Application Models.
- Developing appropriate Accessibility Expert Viewer & Visualization Tools.
- Integrating the tools into 4 application domains (Social Web, CMS, eBanking, and IPTV.
- Evaluating the use of these services with representative groups of real users.

The project - at the time of data gathering - was at stage 2, “Researching, specifying appropriate User/Interaction, Device & Application Models”.

Identification of the main stakeholders and of the expected impacts

Considering that I2Web will create tools to develop inclusive Future Internet services, four general categories of beneficiaries have been identified:

- *Developers and software engineers*: they will be able to create ubiquitous and mobile web applications that are more easily accessible and to determine automatically the accessibility of websites and fully interactive eServices and devices.
- *Services providers*: they will be able to access a larger number of users, including older and disabled persons. As the costs related to compliance with accessibility rules will be lowered, they will be able to provide services at a reduced cost.
- *Citizens, in particular older and disabled persons*: they will have access and they will be able to use more online interactive services, which normally are not accessible to persons with special needs. The number of persons that could be affected by the I2Web approach could amount to 40% of the European population by 2025.
- *Industry and SMEs*: they will be able to provide services more accessible to the users as they will be provided with tools and frameworks that support seamless accessibility integration in distributed development environments. To this category we can add also the public sector.

In order to define better the needs and requests of its beneficiaries, the project organised trials with users on user requirements during the first months of its activities.

The table below synthesises the relations between beneficiaries, main activities enabled for them by the project, and expected impacts for each category.

Stakeholders/beneficiaries and relevance score (from 1 to 5[29])	Main activities possible I2Web's outputs	Expected impact
Developers and software engineers (5)	IDE tools to assess and offer design-for-all advice on the accessibility of interactive online services they are developing	More eAccessible Services.
Service providers (5)	Assess the Accessibility of the online services that they commission and provide.	More eAccessible Services.
Citizens/consumers/end-users (5)	Access to more services.	Access and use of more online interactive services.
Older and disabled persons (5)	Access to more services	More involvement in mainstream FI services.
Industry and SMEs (4)	Provide services that will be more accessible to more of the population.	More use and revenues from the services.

Tab. 49 - I2Web's most relevant beneficiaries/users, the activities they will be enabled to perform thanks to I2Web outputs, and the expected impacts

[29] Where 1 is "very relevant" and 1 is "not relevant".

5.2 Economic impact

I2Web's total cost is € 2.700.000. The table below shows the effects of the project on cash outflows, by describing in detail the project's costs subdivided by category.

Cost categories	Euros
Personnel (not counting personnel costs related to management and to dissemination)	1.900.000
Training	40.000
Use case running	450.000
Subcontracting	10.000
Travel	150.000
Dissemination costs (personnel plus other costs)	150.000

Tab. 50 - I2Web's costs subdivided by categories

With reference to the general impacts of the outputs, the project will enable users to create accessible ubiquitous and mobile IPTV/iTV and Web 2.0 applications. The project is expected to produce different indirect benefits on stakeholders, such as the following:

Expected benefits	
Improve service/product/system quality	X
Reach more users	X
Lower entry barriers in a specific economic sector	
Improve the access to large amounts of data. Improve the possibility to exploit large amounts of data (more efficient data analysis)	X
More efficient data exchange	
Improve scalability	
Expand the range and the typologies of research activities and services made available to research communities	
Cost reductions	X
Reduce the time needed to deliver a service (reduce the time-to-market period)	X
Reduce the time needed to deploy a service over the network/the architecture	
Keeping pace with competitors/with the research in the field	
Ability to better target users/beneficiaries' needs	X
Increment the optimisation of resources/improve efficiency	
Other	

Tab. 51 - I2Web's expected benefits

In terms of the economic impact produced by I2Web, the most remarkable effects are related to the technological advances that allow to generate positive effects on cash

inflows, especially related to cost reductions: 10% savings are related to reduction of costs associated with compliance with regulatory and policy constraints.

The I2Web project will certainly develop an exploitation of its outputs and it has drafted an initial Business Plan. They expect that between 51 and 100 persons will work on the commercial exploitation of the project's outputs.

Moreover, in terms of effects on cash inflows for economic sustainability, the project has already succeeded in attracting additional private and public investments for a spin-off. The most relevant substantial impact of the project is expected to be experienced 3 years after the end of the project.

With reference to the effects on the environment produced as a consequence of technological advances, unfortunately the I2Web project is not expecting to produce any relevant positive impact as the technological impact will not affect efficiency of resources, even if the quality of the I2Web services will considerably improve the usability of technologies.

Evaluation of I2Web economic impact on employment

Even if at an early stage, the I2Web project has already produced an appreciable effect on the welfare in terms of positive impact on the labour market, by sponsoring 2 PhD scholarships and 2 post-doctoral scholarships, thereby providing a positive benefit derived from the potential exploitation of the resulting highly-trained students by the new economy. To see how the proxy of such benefit is calculated please see Annex 1.

Impact on employment	
N° of PhD scholarships sponsored	2
N° of Post-Doc scholarships sponsored	2
Time frame of a PhD sponsored	36 months
Time frame of a Post-Doc sponsored	24 months
Average income of a PhD holder (€)	2.752
Average income of a Post-Doc holder (€)	3.128
N° of additional EU employees	4
Time frame of new contracts	28 months
Average gross annual earning of a EU employee	2.148
Total value of impact on employment (€)	408.432

Tab. 52 - Inputs and assumptions used in this assessment exercise of the impact on employment

The values calculated in Section 5.2, together with the information regarding the social impacts (see next section), will be used in Section 5.4 to calculate the project's global indices (iROI, xROI and tROI), summarizing the project performance in terms of expected socio-economic impact.

5.3 Social impact

I2Web is likely to have a large impact on society in general, reducing the accessibility divide between end-users and allowing all citizens to access interactive and participatory services offered by the Future Internet. Therefore the project will have a very high social impact.

The sector which it is likely to impact the most is eAccessibility. In fact, I2Web will be a complete, open, innovative, and state-of-the-art service that will improve the accessibility not just of websites, but also of fully interactive eServices and devices. It will be thus positioned as a more functional and holistic multi-device service, that will in particular address WCAG 2.0 compliance. The tools developed will be integrated in commercial products, so that the developers will concretely use them in their everyday work.

In addition, the project should also have an impact on eLiteracy and eInclusion, as it will empower a large fraction of Europe's population, that will be older or disabled, to easily compose, share, and use internet-linked services and engage in the mainstream Future Internet. For example, in the case of eBanking, these services are very difficult to use for elderly people and more accessible services must be developed for them. Disabled people (for example blind people) will be able to communicate and interact through the web.

In doing so, I2WEB responds to several of the goals of the European Digital Agenda 2020. First of all it will help create content and borderless services, increasing eCommerce and the demand for ICT-related Services. Moreover, it will promote a better definition and use of standards, as it will promote new dynamic standards for disabled people. Finally, to a lesser degree, it will allow SMEs to enter new markets by lowering entry barriers for them.

Finally, I2Web is expected to have an interesting policy impact at national and local levels regarding eAccessibility. The project partners are participating for example in the elaboration of the eAccessibility 2020 Agenda. The project will have a policy impact also regarding the use of standards for disabled people. Actually they are very static and need to be more dynamic to respond to the challenges of the Future Internet.

Technological benefits

Form a technological viewpoint, I2Web is operationalising eAccessibility for Future Internet Services, and therefore it is improving existing software, existing methodologies, design processes, and existing standards. The most technological innovative aspect of the I2Web project is related to User, Device & Application Models and Web Compliance Tools for fully interactive multimedia Future Internet Services.

The self-assessment of its technological benefits shows that the tools and the service platform architecture developed are characterised by a high usability (especially in terms of usability compliance, understandability and operability) and a rather high quality in use, portability and suitability (see figure below), even if they rely on different external products such as ECLIPSE, eBanking, CitizenScape, Promedia and imergo®.

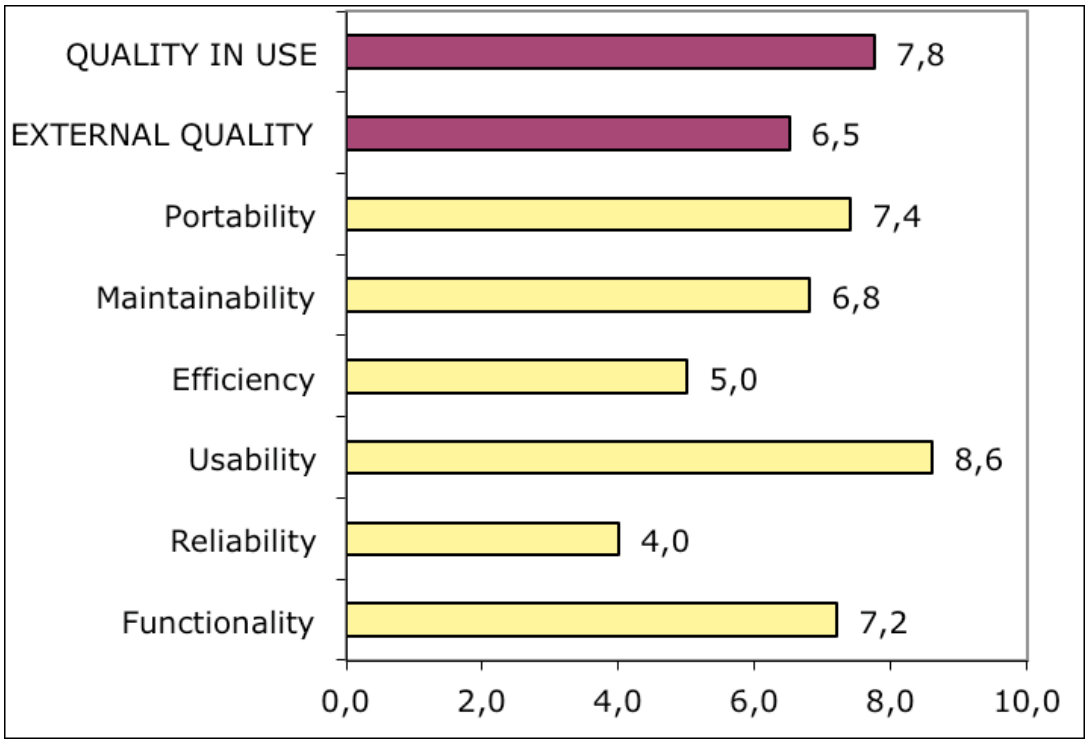

Fig. 5 - *I2Web technological benefits*[30]

Different aspects could limit or present a problem to the project from a technological point of view:

- Technologies could be immature and unstable,
- The tools could face difficulties in interoperating with other systems,
- Privacy issues could arise,
- The tools could be incompatible with customers' or suppliers' information systems, or
- Development or maintenance costs could be higher than expected.

In total, the project scored 6,84 in terms of technological benefits on a scale from 1 to 10.

Impact on employment and working routines

Regarding the impact on employment of the project implementation, between 21 and 40 persons are working on I2Web, most of whom are men.

The project's results are expected to have also an impact on the employment rate in Europe, as the project foresees that more than 200 job positions will be generated as a consequence of its work. For example, the project will promote the creation of new professionals and will make SMEs more competitive, enabling them to look for more employees.

Finally, the project is likely to have an impact on the working routines of its users. It will allow them to do their everyday work more quickly, as it will become easier for them to become WCAG-compliant.

[30] In "red" the two macro variables used for the technological impact self-assessment and in "yellow" the micro variables that compose them.

Impact on knowledge production and sharing

As for all Call 5 projects that were completing the first year of activities at the time of data gathering, it is still early to have a full assessment of the scientific impact of I2Web. Nonetheless, some data are already available regarding its knowledge production. Four scientific deliverables had been written by the date of the assessment, and an article had been presented at a conference. These results are quite low, but that can be explained by the fact that the research activities are still ongoing.

Journal articles	Articles presented at conferences or proceedings	Books	Chapters of books	Scientific Deliverables
0	1	0	0	4

Tab. 53- Scientific production of I2Web

In terms of knowledge sharing, great attention is being given by the project to the exchange and diffusion of its scientific results. In fact, it has participated in 2 knowledge exchange initiatives and it has established 3 new collaboration links. A training module on WCAG 2.0 compliance has also been developed by the partners.

Another important aspect is the availability and diffusion of the project's results: all of the scientific material produced by I2Web is available on its website and the project has organised different communication events targeted at its users. This demonstrates that the project gives importance to the diffusion of its results to the rest of the scientific community in order to ensure wide future application of the tools developed.

Finally, it appears that I2Web will also have a very positive impact on the use of ICT by all and on democratic participation. Its outputs will enable the development of highly innovative and interactive services for citizens that will positively impact their everyday life, and will make these services available to a high number of persons who could be otherwise excluded (for example for eBanking and eGovernment services). It will make also information and knowledge available to these citizens, leading to a reduction of the digital divide. It will enable diversity and individual expression across all the European population and it will impact positively on education. The project will also promote flexibility for personalization on a large scale and high interface adaptability (see table below).

I2Web will:	Strongly disagree	Disagree	Agree	Strongly agree
Make information/knowledge available to a larger number of interested users				X
Support knowledge transfer between universities/research centres and industry/SMEs			X	
Make highly innovative services available to citizens				X
Develop services that will positively impact on citizens' everyday life				X
Make available high-quality knowledge/information to citizens			X	
Reduce the digital divide				X
Support democratic processes/democratisation			X	
Positively impact education				X
Enable diversity and individual expression				X
Flexibility for personalisation on a large scale/high interface adaptability				X

Tab. 54 - Impact of I2Web in terms of support of ICT usage for all and of democratic participation

Impact on social capital

The last aspect of the multi-criteria analysis regards the impact of the project on the social capital of its participants and of its users and beneficiaries.

Regarding the impact of I2Web on the social capital of its participants, it is still early to have a full assessment. Nonetheless, the project tried to estimate the impact it will have during the implementation of its activities. It has foreseen that I2Web will establish 5 new commercial collaborations and 3 new partnerships agreements with other research centres. The partners are expected to present also together 4 new project proposals (see table below). These data demonstrate that the partners expect to widen their networks both at industrial and academia level thanks to I2Web's activities.

N. of new collaborations established with industrial actors	N. of new partnership agreements with other universities, research centres, enterprises or public bodies	N. of new project proposals submitted thanks to the participation in the project
5	3	4

Tab. 55 – I2Web's networking and sustainability activities

Regarding the impact of the project on the social capital of its users and beneficiaries, it is expected to be positive as well. I2Web will improve the trust of citizens towards ICT and the Internet as important services will be more accessible

and easy to use (for example services of eBanking or services provided by public administrations).

It will also facilitate social interactions and support the creation of networks among the citizens, through the use of services and tools to which they would otherwise not have access. In fact, it will give the possibility to an entire category of citizens (elderly and disabled people) to use interactive applications that otherwise they would not have access to. Moreover, the project aims also at having an impact at political level at national and local level, with the promotion of innovative standards regarding eAccessibility.

I2Web will:	Strongly disagree	Disagree	Agree	Strongly agree
Improve the way in which users communicate and collaborate with each other (the quality of the collaboration)/ facilitate social interaction				X
Improve trust among your target users			X	
Improve citizens' trust in Public administration			X	
Improve citizens' trust in ICT and the Internet				X
Support network creation/ collaboration of enterprises in the sector			X	
Support network creation/collaboration among citizens				X
Support network creation/collaboration in academia		X		
Enlarge already-existing networks			X	

Tab. 56 - I2Web's impact in terms of social capital increment for users and beneficiaries

5.4 Final assessment

Calculation of the iROI, xROI and tROI

The tables below provide an estimation of the three first indicators for the I2Web project.

iROI inputs and calculation[31]

I2WEB project cost (€)	2.700.000
Public Investment Inflows (for Spinoff) (€)	400.000
Private Investment Inflows (for Spinoff) (€)	700.000
Expected Inflows (€)	1.166.666
Total Inflows (€)	2.266.666
iROI = (total investment financial inflows – investment financial outflows/ investment cost)	**0,8395**

xROI inputs and calculation

I2Web project cost (€)	2.700.000
Benefits on employment (€)	408.432
xROI = (Socioeconomic benefits – Socioeconomic costs/ investment cost)	**0,1512**

tROI = (iROI + xROI)	**0,9907**

Tab. 57 – Calculation of the iROI, xROI and tROI of the project I2Web

Despite the fact that I2Web at the time of the assessment was at Stage 2 of its lifetime, it produced a significant high iROI value. This very positive result was achieved through the private and public investment inflows for the creation of a spinoff. Unfortunately, the same result was not achieved in terms of xROI. This means that the project should improve the socio-economic impacts, especially in terms of impact on employment. Overall, I2Web has generated the highest Total Return On Investment (tROI) value among the 5 Best Practice projects, almost reaching the value 1. Considering that the project was in its second stage at the time of the evaluation, this is a remarkable result.

[31] For iROI, xROI and tROI defintion see Annex 1.

Calculation of the Multi-Criteria Assessment

The table below shows the normalised value obtained through the multi-criteria assessment of the I2Web project and the comparison of these values with the SEQUOIA average[32].

Impacts	Variable	Comparison with SEQUOIA average	TOTAL/ maximum possible value
Technological benefits			**0,68/1**
Impact on employment and work-routines	Impact on general employment		**0,85/2**
	Work positions generated by the project		
	Improvement of working routines		
	Self assessment		
Impact on knowledge production and sharing	Scientific impact		***2,02/11***
	N journal articles		
	N books		
	N books chapters		
	N articles presented at conf. or pub. In proceedings		
	N scientific deliverables		
	Knowledge sharing		
	N knowledge exchange initiatives		
	N scientific collaboration links		
	N training modules		
	N of scientific events where project presented		
	Availability of papers and del through website		
	Support ICT usage for all and democratic participation		
	Self-assessment		
Impact on social capital	Social capital increment for project participants		***2,22 /4***
	New collaboration with research institutes		
	New collaboration with industry partners		
	New project proposals		
	Social capital increment for users and beneficiaries		
	Self-assessment		
TOTAL Impact Multi-criteria Analysis			**5,74 /18**

Legend: above the SEQUOIA average; similar to the SEQUOIA average; below the SEQUOIA average

Tab. 58 – I2Web's Multi-criteria analysis

[32] See Annex 1 for more information on Multi-Criteria Assessment.

In terms of non-monetisable impacts, the project is particularly effective in terms of social capital improvement for its partners and for its users. Moreover, it is important to remember that the social impact of this project is potentially enormous considering the fact that it addresses a specific target that can represent up to 40% of the European population by 2025.

Moreover, the project has a large impact in fostering democratic participation and access to services and knowledge for groups at risk of social exclusion.

RORI

The following table calculates the RORI of the I2Web project following the weighting system adopted by the SEQUOIA Team.

Variable	Weight	S-Cube indicators	Weighted values
iROI	0,15	0,8395	0,1259
xROI	0,35	0,1512	0,0529
Technical benefits	0,10	0,684	0,0684
Impact on employment and working routine	0,10	0,8175	0,08175
Impact on knowledge production and sharing	0,20	2,02	0,404
Impact on social capital	0,10	2,22	0,222
		RORI	**0,9550**

Tab. 59 – Calculation of the RORI of the project I2Web

I2Web has already reached great results in terms of financial sustainability and is the only project assessed that planned to create a spinoff. This attracted ad hoc funding and will create new work opportunities for highly-skilled employees. Moreover, we considered very positively the engagement of end-users since the very beginning of the project and the use of participatory design methods.

The attention provided by the project in disseminating its outputs is also positive. The self-assessment in terms of technological benefits shows room for improvement and we suggest keeping the related indices under observation for the entire duration of the project. In addition, there is also room for increasing the number of scientific outputs, but this will probably happen in the latest stage of the project.

6 Conclusions

In this Report we presented five case studies selected among the projects analysed during the SEQUOIA project. This report is, therefore, complementary to D3.1 “Call1 and Call 5 Projects Assessment Report” in which 30 projects were analysed.

The five projects described in this report, S-Cube, Mosaic, CumuloNimbo, SocIos and I2Web emerged from the assessment activities as particularly promising in terms of positive impact on users and society as a whole. Of course there are differences among these projects and in this report we accounted the peculiarities of each project stressing their positive results as well as those aspects that ask for improvement.

The aggregated analysis of the economic data of the identified best practices provides some additional information. The weighted average is 0,6244. Therefore at the time of the SEQUOIA evaluation, the five projects generated a fairly good financial return over the total projects’ output lifetime. This positive evaluation take in consideration the research nature of the five projects here presented and the fact that most of them were in their early stage when we run the assessment.

What make these five projects the most promising one, however, is not only their actual and potential return on investment, but also the attention they shown for non-monetisable impacts such as knowledge creation and sharing, improvement in working routines and social capital.

More specifically, we can consider these projects as best practices because, in different degrees, they know stakeholders’ needs and expectations and engage them in development activities since the very beginning of technology development.

Moreover, these projects, even if research driven, have a clear idea of the Saas/IoS market and know potential competitors. In this sense the link between academia and industry is a positive one, as testified by the attention given to collaborations and agreements definition.

Finally, some of the projects drafted an exploitation and sustainability plan already at the beginning of their activities considering innovative business models such as the ones emerging in the Open Source Software domain.

It is also important to highlight the difficulties encountered by the projects during the self-assessment exercise promoted and supported by SEQUOIA. The first difficulty is related to vocabulary and disciplinary boundaries: for some projects it was difficult to understand the logic of socio-economic methodologies. The trust relationship established between SEQUOIA team and projects’ representatives helped in overcoming this initial barrier. Moreover, as declared by some of the projects during the SEQUOIA final conference (see D.6.2), the SEQUOIA team made a conscious effort in adapting the assessment language and processes to projects’ needs.

Another difficulty was represented by the gap perceived between SaaS/IoS research field and social impacts. It is not for chance that, among the five best practices selected, there are at least two projects more closely linked to “social” topics such as online communities and social inclusion.

Finally, there was the difficulty of providing data and, in some cases, estimations. In order to overcome this difficulty it would be necessary to create a standardized assessment methodology and put in place a regular data gathering process.

In this sense, SEQUOIA self-assessment methodology demonstrated to be useful and feasible from the project prospective and it is flexible and modular enough to be further adapted in order to better fit projects and EU necessities.

Annex 1 - Short definition of SEQUOIA indices and proxies

For more information about the SEQUOIA indices and the related formulas please refer to D3.3a and D3.3b.

iROI (**i**nternal **R**eturn **O**n **I**nvestment): this indicator measures the financial return for the consortium partners and, thus, provides information about the financial sustainability of the project. The iROI indicator is based on the financial evaluation of the total cost for performing the research project and on the identification of the financial returns for the consortium partners, deriving mainly from selling the outputs produced.

xROI (e**x**ternal **R**eturn **O**n **I**nvestment): this indicator quantifies the amount of net economic benefits that the project generates in society as a whole (both users and not users of research outputs). In order to be included into the xROI, each impact of the project (positive or negative), other than the financial ones, must be expressed in monetary terms by using appropriate proxies

tROI (**t**otal **R**eturn **O**n **I**nvestment): this indicator quantifies the total monetisable impacts of the project, both those experienced by the consortium's partners and by the whole society. It is calculated by summing up all the information gathered by the iROI and the xROI indices.

MCA (Multi-Criteria Assessment): this indicator assess the impacts generated by the project which cannot be measured in monetary terms (impact on working routines, on knowledge production and sharing, on social capital and the technological impacts), using the most appropriate and suitable unit of measurement. The table below shows all the indicators used in the Multi-criteria Assessment and their related unit of measurements.

Macro variable	Meso variable	Micro variable/indicator	Unit of measurement
Technological benefits			
		Self-assessment	Scale 0-10
Impact on employment and work-routines			
	Impact on general employment		
		Number of persons working on the project	Absolute value (using full-time equivalent)
	Improvement of working routines		
		Self-assessment	Scale 0-4
Knowledge production and sharing			
	Scientific impact		
		N. of journal articles published/submitted	Absolute values

		N. of books published	Absolute values
		N. of books chapters edited	Absolute values
		N. articles presented at conf. or pub. in proceedings	Absolute values
		N. of scientific deliverables	Absolute values
	Knowledge sharing		
		N. of knowledge exchange initiatives	Absolute values
		N. of scientific collaboration links	Absolute values
		N. of training modules	Absolute values
		N. of scientific events where project was presented	Absolute values
		Availability of papers and deliverables through project website	Scale 0-1
	Support ICT usage for all and democratic participation		
		Self-assessment	Scale 0-4
Social capital (trust, collaboration, networking)			
	Social capital increment for project participants		
		New collaboration links established with research institutes	Absolute values
		New collaboration links established with industry partners	Absolute values
		New project proposals submitted	Absolute values
	Social capital increment for users and beneficiaries		
		Self-assessment	Scale 0-4

RORI: once all the information about the financial (iROI) and economic (xROI) performance of each project is summarized and after the assessment of other non-monetisable impacts through the use of the MCA, the last step consists in calculating a global index, synthesizing all the information generated during the assessment, and showing the total performance of each research project. This index is called **RORI,** as it expresses the global **R**eturn **O**n **R**esearch **I**nvestment. The RORI index is calculated as a weighted sum of the iROI, the xROI, and the other non-monetisable impact indicators collected in the multi-criteria table.

Proxy for impact on employment: we calculated the benefit deriving from an increment in employment by multiplying the number of sponsored PhD and Post-Doc scholarships by the average salary of a skilled employee. The proxies used for this assessment have been calculated as the average gross income of PhD holders (2.752 €/month) and of junior lectures/assistant Professor (€ 3.128 €/month), as estimated by the Academic Career Observatory of the European University Institute (www.eui.eu). PhD scholarships sponsored estimated for a 36 months time frame, Post-Doc scholarships sponsored estimated for an average time frame of 24 months.