SEQUOIA

Socio Economic Impact Assessment for Research Projects

How-to Guide Highlights

Scope and features of the SEQUOIA How-To Guide Highlights

This booklet is an abridged version of the "SEQUOIA Self-Assessment How-To Guide[1]". It helps the reader understand the SEQUOIA methodology and offers support to research projects in the areas of SaaS and IoS in assessing their socio-economic impacts.

In other words, by applying the SEQUOIA methodology, projects will be able to answer the following questions:

- What difference will the project make to the status quo?
- For whom and what is the project is relevant?
- To what extent does the EU investment in the project produce benefits for social and economic actors?
- Where can the project have the greatest impact taking into account the various potential types of impact and where can the project increase its impact?

Clearly, answering these questions in a systematic and well-documented way is not an easy task. The SEQUOIA methodology and this How-To Guide can assist the reader in this process; however, he/she should be aware of a few important things:

a) An effective impact assessment should engage various partners (if not the entire project consortium) and should be based on an internal system for gathering the data needed for the impact assessment. The sooner a project starts gathering information and data (even at the stage of proposal writing) the easier it will be to assess its impacts.

b) Conducting an impact assessment requires the interpretation of the methodology described in this guide and its adaptation to project-specific characteristics, as well as the collection and analysis of the required data. If the project's consortium includes a sociologist and/or an economist, these professionals are best suited to apply the SEQUOIA methodology. If the project does not have these skills in the consortium, it may be necessary to consider contracting one or two such professionals.

Having said this, the reader will find next a step-by-step guide for conducting a socio-economic impact self-assessment using the SEQUOIA methodology. More specifically, this guide will help the reader in:

- Defining the areas of impact,
- Defining the stakeholders affected by the project,
- Defining the baseline scenario,
- Describing specific financial, economic, and social impacts generated by the project,

- Quantifying financial, economic and social impacts generated by the project,
- Elaborating on collected data and performing the final assessment.

Moreover, the description of each step will be accompanied by an example that will show, in more practical terms, how to run the assessment. The project used as example (FOREST) is purely fictional, and it is used only to better exemplify the activities to be performed in the various steps.

As said above, this brochure is an overview of the complete "SEQUOIA Self-Assessment How-To Guide": All the specific tools supporting the use of the guide (e.g. tables, questionnaire etc) can be found in the corresponding SEQUOIA deliverable D3.3b available on the project website (www.sequoiaproject.eu).

Content

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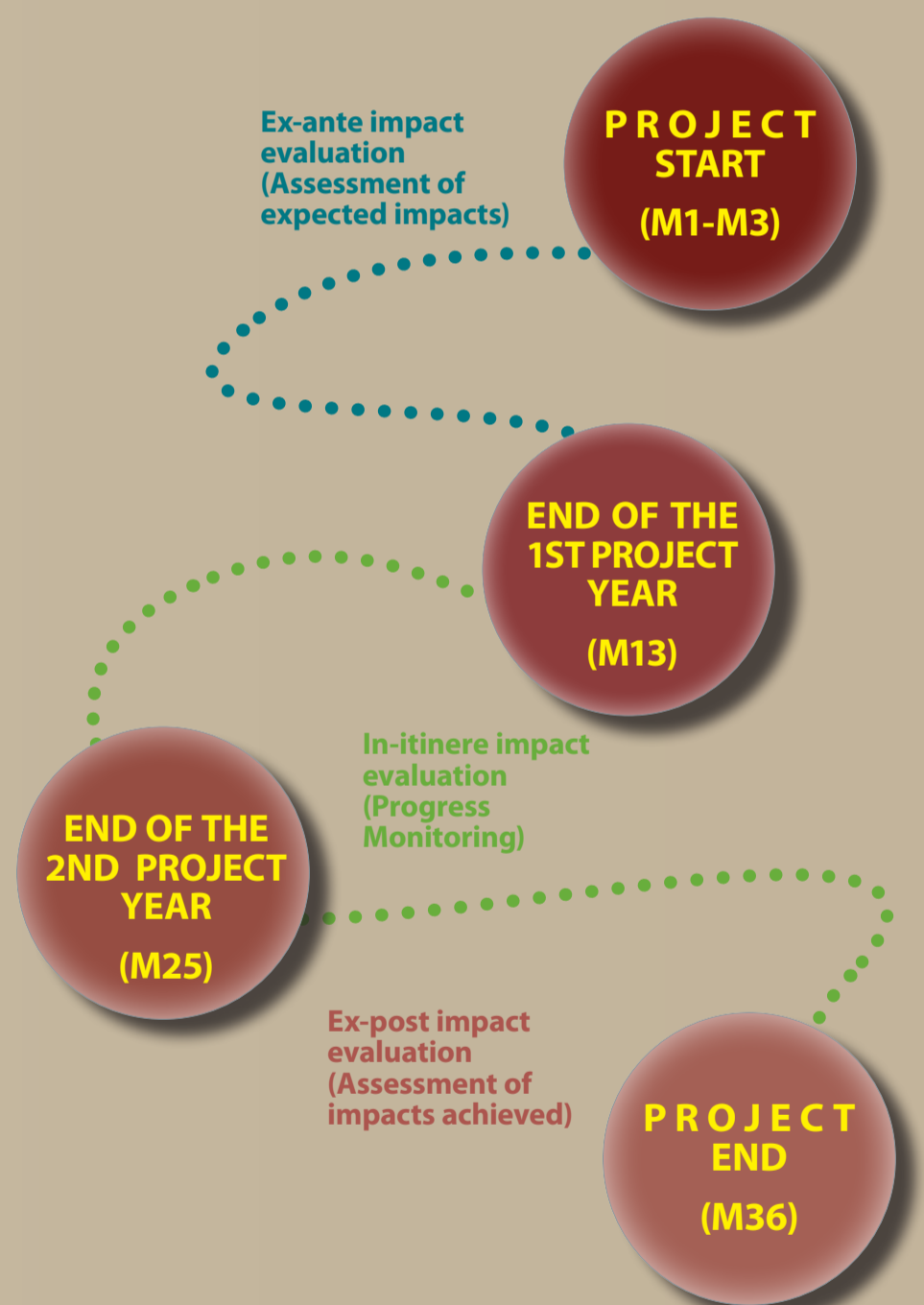
When to use this guide

The SEQUOIA methodology can be used at different stages of a project's life-cycle: the "ideal" procedure for applying the SEQUOIA methodology is to run a self-assessment at the beginning of the project and then repeat the assessment exercise at regular intervals during the project. Let's assume the project to be assessed will last 3 years. Following this usage schema, the evaluator will run an ex-ante impact assessment (at the beginning of the project), two in-itinere[2] impact assessments (at the end of Year 1 and of Year 2), and an ex-post impact assessment at the end of the project.

By following this schema, it will be possible to monitor the progress of the project in terms of socio-economic impact and to see, at the end of the project, the extent to which it has succeeded in reaching the expected impacts described in the ex-ante impact assessment. In fact, as stated later in this Guide, the SEQUOIA methodology is based on an ex-ante/ex-post approach. In other words, the SEQUOIA methodology compares the state of the art without the project (called later "baseline scenario") with the situation as it is as a result of the modifications generated by the project; this can of course also be achieved via different timeframes (Fig. 1).

Ideally, in order to map the achieved impacts of a project it would be necessary to run an impact assessment activity one to three years after the end of the project. In fact, research projects tend to deliver (at the end of the project life-cycle) outputs that are not yet ready to be fully exploited by the final users. However, unfortunately, due to the way in which EU research projects are planned and executed, it would be difficult to run an impact assessment after the funded lifetime of a project (project partners will be engaged in other activities, they will not have the necessary resources/interest for running such an assessment, and so on). For this reason, despite the limitations inherent in this approach, we suggest using the SEQUOIA methodology within the project's funded lifetime.

In the following pages, the reader will be guided through the logic of impact assessment and the necessary steps needed to apply the SEQUOIA methodology.

Fig. 1 – When to apply the SEQUOIA methodology (for a typical 3-years project)

Ex-ante impact evaluation (Assessment of expected impacts)

PROJECT START (M1-M3)

END OF THE 1ST PROJECT YEAR (M13)

In-itinere impact evaluation (Progress Monitoring)

END OF THE 2ND PROJECT YEAR (M25)

Ex-post impact evaluation (Assessment of impacts achieved)

PROJECT END (M36)

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2   A in-itinere evaluation is a common term which literally stands for "in-process evaluation" or "intermediate evaluation" and, to some extent, "monitoring".

4

This section offers a brief overview of the analytical process involved in carrying out a robust self-assessment of the socio-economic impacts generated by a research project in the IoS/SaaS domain. It is structured as a proposed agenda and check-list for the research consortium partners or for external evaluators, to assess the socio-economic impacts generated by the project's outputs.
The process of project impact self-assessment has five steps (Fig. 2):

1. Mapping the areas of impact
2. Baseline identification
3. Ex-post scenario description
    *   economic impact
    *   social impact
4. Ex-post scenario quantification
5. Final assessment analysis: calculation of iROI, xROI, tROI and RORI

In the following sections each assessment step is described in terms of its main aims and the key features of the evaluation approach/technique to be used.

Mapping the areas of impact	Baseline Identification	Ex-post Scenario Description	Ex-post Scenario Quantification	Final Assessment Analysis
1	**2**	**3**	**4**	**5**

Fig. 2 – Process of project impact assessment

STEP-BY-STEP GUIDE
Mapping the areas of impact

1

In practice...

FOREST is a 3-year project. The main problem the project aims to solve is the lack of interoperability related to mobile devices. FOREST's main objective is, therefore, to develop a platform capable of automatically migrating services from one mobile device to another.
The list of stakeholder categories impacted by FOREST's outputs is as follow:

- Developers and software engineers
- Service providers
- Infrastructure providers
- TELCO operators
- Researchers and research communities
- Industry and SMEs
- Citizens/consumers/end-users

All the above-mentioned stakeholders will be affected by the project's outputs but not to the same extent. In order to define which categories of stakeholders will experience the greatest impacts, the evaluator attributes a value from 1 to 5 to each stakeholder category where 1 is not very relevant and 5 is very relevant.
As a result, developers and software engineers, service providers and SMEs emerged as the most relevant stakeholders. In the table below the evaluator describes the expected impacts for each category of stakeholders.

Stakeholder categories	Expected/experienced impacts
Developers and software engineers	They will experience significant time-savings. In fact, once a service for a device is developed they will be able to deploy the service also on other devices and other operating systems.
Service providers	They will be able to reach more users by deploying services on different devices with reduced adaptation costs.
SMEs	SMEs from the software sector will take advantage of FOREST's outputs because they will be allowed to focus their efforts on the development of new services instead of spending resources adapting a service to various devices. In addition, they will be less dependent on infrastructure providers.

The first step of the project assessment aims at the identification of the objectives of the project, in order to understand whether the project will generate some form of socio-economic value.
This step asks the evaluator to define what kind of impacts can be expected from the project and on whom these impacts will have an effect. More specifically, in this step the evaluator will need to:
- briefly describe the project objectives (the "problem" the project is expected to resolve and how the project outputs did/will resolve it);
- map the project stakeholders;
- select those stakeholders that are more relevant for the project under assessment;
- for each stakeholder clearly describe the expected/experienced impacts.

The figure below shows the activities to be performed in this step.

Define Project Objectives → Map Project Stakeholders → Select most relevant Stakeholders → Describe for selected Stakeholders expected / experienced impact
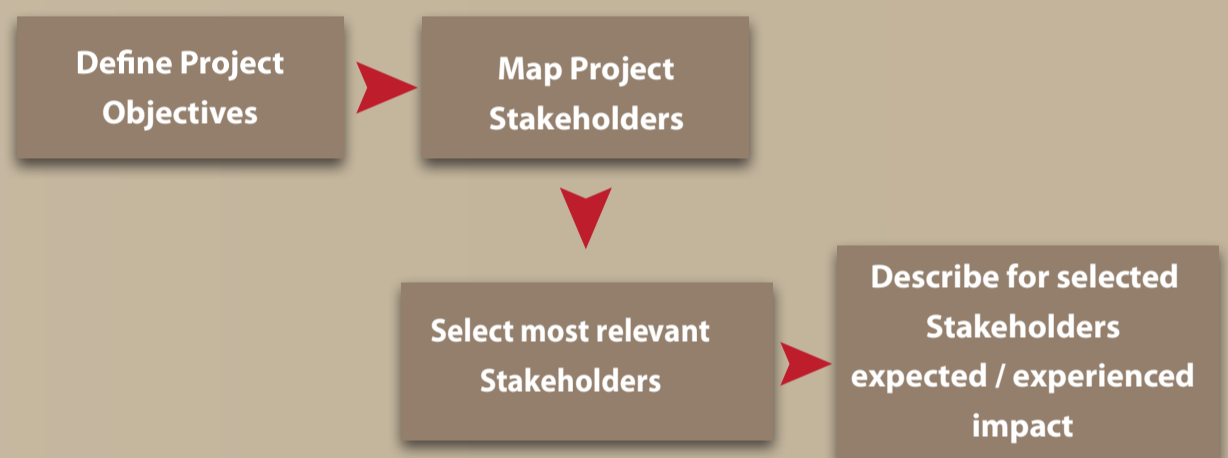
Fig. 3 – Activities to be performed in Step 1

It is important to take into consideration not only the stakeholders that are directly affected by the project's intended outputs, but also to consider:

a) the stakeholders that could be indirectly affected by its intended outputs;
b) the stakeholders that could be directly affected by its unintended outputs[1];
c) the stakeholders that could be indirectly affected by its unintended outputs.

The example in the box on the left may be of help in understanding the level of detail that is preferable in this step.

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1   The unintended outputs can be defined as the "collateral effects" of the project (generally negatively affecting some groups of stakeholders) which are not identified in the project's main objectives, but which could be, at least, broadly foreseen during the implementation of the project.

2

Once the areas of impact have been mapped, the next step consists in verifying whether the project outputs have brought/may bring some improvements to the social/economic welfare of its intended beneficiaries/target audience (who are a sub-set of the stakeholders mapped in the previous stage). The basic approach of such an assessment is to compare the situation with and without the output(s) of the project.

The situation without the project output(s) could be defined as the "baseline scenario". This will usually be a forecast of the future without the project outputs or, in other words, a sort of no-investment forecast of what will happen in the future in the context under consideration without the project under assessment.

The evaluator should map all commercial and non-commercial initiatives that have some similarities with the project under assessment and/or that a potential user can see as an alternative to the project under analysis. He/she should, then, describe such initiatives and their outputs and possibly highlight the similarities between the project under analysis and the initiatives identified.
Fig. 4 visualises the activities to be performed in order to define the baseline scenario.

In practice...

There are two initiatives that are similar to FOREST in terms of target audience and objectives. Both are commercial. The first one is called OCEAN and its main output is a middleware that enables data and applications to automatically migrate from Apple to Android smartphones. The second one is called DESERT and its main output is an analytical software programme that quantifies the hours of work needed in order to adapt a service to a mobile device other than the one for which the service was originally designed.
Both the initiatives are only partially similar to FOREST. Synthetically, FOREST is more than the sum of these two initiatives.
The service provided by OCEAN costs 5 Euro for each MB transferred from a device to another.
The DESERT service costs 10 Euro for each service analysed.
In any case, an SME who developed a game for iPhone and wishes to transfer it to an Android device will need more than the services offered by OCEAN and DESERT. So, the hypothetical SME will spend 30 Euro for using the service offered by OCEAN (10 Euro x 3 MB of data to be transferred), plus 10 Euro for taking advantage of DESERT's analysis. Such analysis indicates that the SME will need to invest 30 hours for adapting the game developed for iPhone to the Android platform. Considering the average hourly cost for a game programmer as 100 Euros, the labour cost for adapting the game to the new device is of 3,000 Euros. The total cost for adapting the game to a device other than the one for which it was originally designed is consequently 3,040 Euros.

OCEAN service	+	DESERT service	+	Game progammer labour cost	=	Total cost
(30 Euros)		(10 Euros)		(3,000 Euros)		(3,040 Euros)

This is the baseline scenario for the main output of FOREST.

Map already-existing initiatives that are similar to the project under assessment	▶	Describe the mapped initiatives and their outups	▶	Highlight the similarities between the already existing initiatives and the project under analysis

Fig. 4 – Activities to be performed in Step 2

In order to better understand what a "baseline scenario" is, how to construct it, and how to use such estimation for the further impact analysis, the box on the left provides an example.

STEP-BY-STEP GUIDE
Ex-post scenario description

3

This step aims at describing/forecasting the situation after project's completion and after the exploitation of the research outputs.

In the ex-post scenario, the evaluator must try to describe the changes brought by the SaaS/Ios project outputs. The evaluator should consider the possible application of project outputs to real life and, therefore, should describe the way in which such outputs can be used in practice. More specifically, the evaluator should identify all project outputs, describe how each of them works in practice (e.g. how it will be used by the beneficiaries) and then compare the advantages brought by each project output compared to the situation described in the baseline scenario.

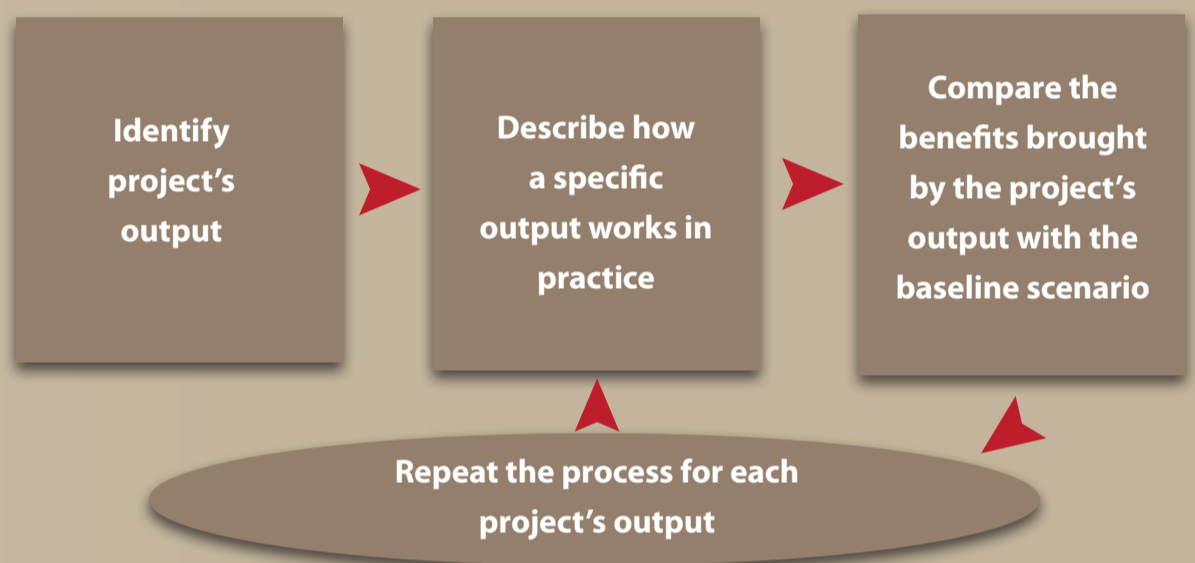Fig. 5 synthesises the activities to be performed in this step.

| Identify project's output | → | Describe how a specific output works in practice | → | Compare the benefits brought by the project's output with the baseline scenario |

Repeat the process for each project's output

Fig. 5 – Activities to be performed in Step 3

In practice...

FOREST will generate the following outputs:

• FOREST platform (for the automatic migration of services between mobile devices)
• FOREST online course

The FOREST platform will enable its users to automatically migrate services from one mobile device to another. The platform works as a PaaS, is Open Source, and is free of charge for the users. A tangible example would be a game programmer being able to migrate a game from iPhone to Android in 3 hours. If we compare this data with the baseline scenario (that required 30 hours for the game migration), we see that the benefit for the user in term of time savings is significant and is equal to 27 hours saved.

As stated before, in addition to the platform, FOREST will also generate an online training course for software developers. The online training course will be freely available for everybody, so it will not generate any financial revenue for the project. However, it will give a benefit to its users by improving their knowledge and in building a community with shared interests. The FOREST online course is totally new and no similar initiatives are available at EU level. Consequently the benefits for the users cannot be compared with other similar initiatives. Asking the users to describe and evaluate the quality/quantity of knowledge provided and the relevance of the networking aspect of the course may help assess the benefits. If this is not possible, the evaluator can count the hours of training delivered and the learning modules developed; he/she can use these values as a qualitative measure of the knowledge produced for the benefit of the users.

The evaluator should try not to limit prematurely the concept of "output" generated by the research to the "direct product", but should also think of the wide range of exploitation possibilities that could be achieved by third parties (both within and outside the research consortium), in their own specific domains of action.

Another way to tackle this issue is to think about the case studies, pilots, or use cases that have been/must be performed during the life of the research project. This should help identify at least one use case in which substantial (operational) differences are likely to emerge between the assessed research project outputs and the baseline scenario.

A correct evaluation of the research project outputs should always be made in "differential" or relative terms. The costs and the benefits brought by each specific research project output could be captured by looking at the differences (rather than the absolute values) introduced by the project outputs with respect to the original baseline scenario.

The evaluator should keep in mind that a comprehensive and exhaustive quantitative assessment is almost impossible. In order to understand what the main financial and socio-economic impacts generated by the project outputs are, and really understand the most important welfare changes brought by the project, a very wide number of fields should be investigated.

Furthermore, considering the diversity of the components, the SEQUOIA methodology recommends that the evaluator focus on a specific set of micro-economic variables that will be introduced in the next sections.

Another important consideration to keep in mind is related to the complexity of most of the SaaS and IoS projects. Each project will deliver more than one output; in addition, each project normally develops several technological components that may have different impacts and may follow different exploitation paths. This complexity should be respected in the project assessment. Thus, we suggest dividing the project in its main outputs/components and running the assessment on each specific component. Each component will have specific stakeholders, and a specific baseline scenario, as well as clearly defined social and economic impacts. The box on the left provides an example that may support the evaluator in better understanding how to define the ex-post scenario.

7

4

In this step, the evaluator will be guided in transforming the qualitative information gathered so far into quantitative data. Therefore, detailed information needs to be gathered to quantify two kinds of impacts generated by the projects:

- Economic impacts
- Social impacts

The economic impacts of the IoS/SaaS research projects

The table below shows the data that will be gathered in this step for quantifying the economic impacts. As the evaluator will notice, the data are divided in two categories: monetisable and non-monetisable. This division will be useful in the next step; in fact, the two categories of data will be treated differently and will provide different outputs in terms of impact indexes.

Monetisable data
Project total cost
Cost for running the outputs of the project after the formal end of the project
Project revenue
Cost for running a single operation without the project outputs (accordingly to the baseline scenario)
Cost for running a single operation using the project outputs
Energy needed for running a single operation without the project outputs (according to the baseline scenario)
Energy needed for running a single operation using the project outputs
Number of PhD students sponsored/funded by the project
Number of post-doc researchers sponsored/funded by the project
Number of employment positions generated by the project through collaboration agreements with enterprises and third parties and/or through the creation/enlargement of spin-offs
Non-monetisable data
Technological advances

The formula used for reaching this figure (in green) is shown in the table below[1].

Personnel cost	+	Maintanace cost	=	Total operational cost
(343,860 Euros)		(88,772 Euros)		(412,632 Euros)

All the data needed for quantifying economic impacts is shown below.

Monetisable data	
Project total cost (IMP.1)	3,200,000 Euros (EU funding + partners' co-funding)
Cost for running the outputs of the project after the formal end of the project (IMP.2)	412,632 Euros
Project revenues (IMP.3)	None (no commercial exploitation planned)
Cost for running a single operation without the project outputs (accordingly to the baseline scenario)	3,040 Euros
Cost for running a single operation using the project output	300 Euros
Energy needed for running a single operation without the project outputs (accordingly to the baseline scenario)	90 KWh
Energy needed for running a single operation using the project outputs	30 KWh
Number of PhD students sponsored/funded by the project	6
Number of Post-Doc researchers sponsored/funded by the project	2
Number of employment positions generated by the project through collaboration agreements with enterprises and third parties and/or through the creation/enlargement of spin-offs	0
Non-monetisable data	
Technological advances (IMP.4)	7

In practice...

We said that by using FOREST's main output (the FOREST PLATFORM) a potential user will save 27 hours when adapting a game developed for iPhone on Android. Now we have to transform this benefit (time savings) into monetary terms. To do this we can multiply the hours saved by the average hourly salary of a game programmer (100 Euros). Consequently, the savings in terms of labour costs is 2,700 Euros. This result is based on the fact that the game programmer will need only 3 hours (100 Euros * 3 hours, in red in the table below) for adapting the service to the new platform. However, the total cost of the baseline scenario was of 3,040, which included the cost of using DESERT and OCEAN services that are no longer needed. Consequently the total savings for one operation will be:

$$3,040 – 300 = 2,740 \text{ Euros}$$

In order to be more precise, it is necessary to multiply this benefit (2,740 Euros) by the number of FOREST users, and by the number of operations to be performed on a yearly basis by each user. Let us assume that FOREST is on-going but that, thanks to a pilot case run in the game sector, the evaluator estimates a number of users equal to 100. Each game programmer will migrate 50 games each year.
Consequently, we can calculate IMP. 5, which is the difference between the cost of performing activities between the baseline and the ex-post scenario, by multiplying the cost savings for one operation by the total number of operations executed annually. Imp. 5 will be as follows:

$$2,740*5000 = 13,700,000 \text{ Euros}$$

With reference to the cost of running the project's outputs after the formal end of the project, FOREST is not planning to create a spin-off or to sell its outputs, but the University leading the project will provide the maintenance of FOREST outputs and will further develop them. It will also support the users by providing assistance. The FOREST consortium foresees that 10 people will be doing these activities, mainly PhD holders (7 persons) and Post-Doc researchers (3 persons). The labour cost for running the outputs of the FOREST project will be, therefore, of 34,375 Euros/month. That is equal to 343,860 Euros on an annual basis.

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1   The personnel cost has been calculated as follows.

Personnel cost = (cost of one PhD student * n. of PhD students) + (cost of one Post-doc researched * n. of Post-doc students)

Personnel cost = [(2.753*7) + (3.128*3)] * 12 = 343.860 Euros
Maintanace cost are quantified as the 20% of the personnel costs.

STEP-BY-STEP GUIDE
Ex-post scenario quantification

Below is a checklist of the main economic impacts that should be considered for the assessment:

1. Effects on cash inflows/outflows
   • Total cost of the research project being evaluated (IMP. 1)
   • Total cost for running the output(s) of the project (IMP. 2)
   • Revenues obtainable by exploiting the project outputs (IMP. 3)

2. Effects on technological advances

The evaluator can measure such technological advances in a qualitative way, by rating, on a scale of 1 to 10, the improvement realised by the project outputs in terms of the following characteristics: Functionality, Reliability, Usability, Efficiency, Maintainability, Portability, and Quality in Use. The global technological effect (IMP. 4) can be obtained by calculating the mean value of the above ratings. The unit of measurement for the technological impact, therefore, is a score on a scale of 1-10.

3. Effects on welfare derived from technological advances.

3a. Effects on efficiency
To measure this kind of benefit, the evaluator should estimate, for each project output and related use-case scenario, the cost of performing the activity before (baseline scenario) vs. after project output exploitation. The differences in costs will then be the benefit generated by the project itself. (IMP. 5)

3b. Effects on environment
The use of project outputs may bring a reduction in energy consumption for performing user activities and calculate the difference in energy costs between the baseline and the ex-post scenarios (IMP. 6)

3c. Effects on labour market
In addition to other more indirect impacts on quality of life, that the evaluator should take into consideration in the social part of the analysis, that one of the most important social impacts could be the creation of new jobs/roles. These could be measured, for example, in terms of the number of PhD students and post-doctoral researchers sponsored by the project, but also in terms of the number of new employment positions generated through collaboration agreements with enterprises and third parties and through the creation/enlargement of spin-offs.
These benefits on the labour market (IMP. 7) can be quantified by multiplying the number of new jobs generated by the average income of each. Alternatively, the evaluator can use the European average salary for skilled personnel, which for a PhD student is equal to 2,753 Euros/month and for a post-doc researcher 3,128 Euros/month.

3d. Other effects on welfare
Each project output may also generate other specific effects (IMP. 8) that the evaluator should try to capture, describe and monetise by using the most appropriate proxies.
Note that this task exceeds the scope of this Guide, the main aim of which is to provide basic instructions for performing a standardised assessment for each research project in the IoS/SaaS domain. A customised assessment, therefore, requires a case-by-case analysis.

The social impacts of the IoS/SaaS research projects
For most projects it can be very difficult to imagine and map social impacts. On the one hand, this may be due to the interdisciplinary background of SaaS and IoS project partners, who are not necessarily accustomed to thinking about social issues; or, on the other hand, to the fact that most of these projects are developing enabling technologies/solutions that may have very diverse and partially not-predictable applications and uses.
Clearly, these difficulties need to be taken into consideration when applying the SEQUOIA methodology, but we suggest making an effort to map potential social impacts. From a methodological point of view, the SEQUOIA team tried to keep the social impact variables as concrete and close to the context of research projects as possible. As described in the SEQUOIA methodology (D3.3a), social impacts have been articulated in three main categories:
• Impact on employment and working routines
• Impact on knowledge production and sharing
• Impact on social capital

We will discuss each category separately in the following paragraphs. We anticipate in the table below the data that the evaluator will need to gather in order to perform the quantification of social impacts.

Data required for quantifying social impacts
Work positions generated by the project
Improvement of users' working routines
Number of journal articles published or submitted in peer-reviewed journals
Number of books published
Number books chapters edited
Number of articles presented at conference or published in proceedings
Number of scientific deliverables produced
Number of knowledge exchange initiatives performed
Number of new scientific collaboration links established
Number of training modules created
Number of scientific events where project has been presented
Availability of papers and deliverables through project website
Improvement in supporting ICT usage for all and democratic participation
Number of new collaboration links established with research institutes
Number of new collaboration links established with industry partners
Number of new project proposals submitted
Social capital increment for users and beneficiaries

Impact on employment and working routines
First of all, we have to remember that the ability of a project to generate new employment positions has already been considered in the economic impact. Here we will only consider those variables/aspects related to employment that cannot be transformed into monetary value. In order to estimate these impacts, the evaluator should consider the number of persons working on the project and the number of additional researchers recruited for the project.
Additionally, the evaluator should analyse the ability of the project to impact on the working routines of the project's users/beneficiaries. Ideally, the evaluator should get in touch with project users and ask them to describe how and to what extent the project outputs will/do improve their work routines. If this is not possible, the evaluator should self-assess those improvements.

Impact on knowledge production and sharing

For any research project, the ability to produce knowledge and systematise it in scientific outputs and diffuse it within and outside the scientific community is crucial. The evaluator who wishes to assess the project impact in this way should analyse the number of scientific materials produced by the projects (in terms of journal articles, articles presented at conferences or published in proceedings, articles presented at conferences or published in proceedings, books, chapters in books, and scientific deliverables).

In order to evaluate the impact on knowledge sharing, the evaluator should first count the number of knowledge exchange initiatives organised, new collaboration links established thanks to the participation in the project, and scientific conferences and seminars at which the project has been re/presented.

He/she should also analyse the number and typology of new training modules, online courses and seminars developed by the project.

Finally, the evaluator should check if the scientific outputs generated by the project are publicly available on the project website or in other open repositories.

The above aspects are strictly related to project activities, while the following ones ask the evaluator to consider benefits provided by the project outputs to the project's stakeholders/ beneficiaries. Ideally the evaluator should contact or monitor the project stakeholders/beneficiaries in order to have more effective data on this important aspect. If this is not possible, the following section can support the evaluator in gathering information about the project's ability (as perceived by the project itself) to support ICT usage for all and to foster democratic participation by the users.

Impact on social capital

The last aspect to consider in assessing the social impact of the project is related to social capital. One of the most important values added by EU co-funded projects is, indeed, that of reinforcing and enlarging research networks and, by doing so, strengthening the European Research Area. Social capital represents the non-material wealth generated by the fact of belonging to multiple relational networks. In other words, we will see how SaaS and IoS can support project partners and project outputs' beneficiaries in enlarging and making their social networks denser. In addition to this, we will consider the impact on trust, considering trust as one of the most important components of social capital.

In assessing the impact of the project on the social capital of the project partners, the evaluator should take into consideration the number of new collaboration links established with industrial actors, the number of new partnership agreements established with other universities, research centres, enterprises or public bodies and the number of new projects proposals submitted thanks to the participation in the project.

In assessing the impact of the project on the social capital of the project beneficiaries and end-users, the evaluator should take into consideration the impact of the project on the way users collaborate, the way it supports the creation and enlargement of networks and the way it improves trust among the users.

In the box that follows, the evaluator can find the data gathered with reference to the example we used so far to illustrate the SEQUOIA methodology.

STEP-BY-STEP GUIDE
Ex-post scenario quantification

In practice...

The first data required when quantifying social impacts is related to the number of persons that worked on the project. The SEQUOIA methodology suggests using full-time equivalent.
Considering the entire duration of the FOREST project, and all the partners, 62 persons were engaged in research and administrative activities. However, not all worked on a full-time basis on the project. More specifically, 20 persons worked full-time, 30 worked part-time and 12 worked 5 days per month. All of them where employed for the entire duration of the project (3 years). Adding these figures the evaluator obtains the following result: 38 is the total number of persons that worked on the project each year. The calculation made for reaching this result is:
$20 + (30/2) + (12/4) = 38$ (the evaluator considered a person-month to be composed of 20 working days)
No additional researchers were recruited specifically for the FOREST project.
Then, the evaluator considered the project's ability to improve users/beneficiaries' working routines. Unfortunately, FOREST did not have the budget needed for directly engaging its users in the assessment of social impacts; consequently, the table below shows the evaluator's opinions on the subject.

The project will:	Strongly disagree	Disagree	Agree	Strongly agree
Provide solutions for working efficiently and conveniently for all sizes of organisations			X	
Reduce the work of the users (more operations will be automated)				X
Allow your users to do their everyday work more quickly				X

As we have said before, FOREST's main output considerably reduces the time needed for migrating an application from one device to another, so we can see the project's benefit in terms of improving the working routines of its users. The evaluator should now transform his/her evaluation using the 0-4 scale suggested (see Question 29) and calculate the average value:

$$(3 + 4 + 4) / 3 = 3,6$$

Once the impact on employment and working routines has been considered, the evaluator should consider the project impact on knowledge production and sharing. The related data is shown below:

Number of journal articles published or submitted in peer-reviewed journals	4
Number of books published	1
Number books chapters edited	2
Number of articles presented at conference or published in proceedings	20
Number of scientific deliverables produced	20
Number of knowledge exchange initiatives performed	10
Number of new scientific collaboration links established	5
Number of training modules created	12
Number of scientific events where project has been presented	13

All the scientific outputs are available. The evaluator should transform this information into a number; 1 is the value to be attributed to the project if all the outputs are publicly available as in this case.

Finally, the evaluator should express his/her opinion on the following statement, transform the results in a 0-4 scale, and calculate the average:

Your project 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		
Promote flexibility for personalisation on a large scale/high interface adaptability			X	

As evident, FOREST project do not have a high direct impact on the dimension considered in the table above.
The evaluator followed the same process in analysing FOREST's impact on social capital and discovered that the project did not invest too much in this aspect. In fact, no collaboration links were established by FOREST's partners with industrial actors, no partnership agreements were signed with universities outside the FOREST consortium, and only one project proposal was submitted as a follow-up to FOREST. The FOREST project showed a low ability to enlarge its partners' networks and, similarly, did not influence the social capital of its users even if – thanks to the summer school – it facilitated the social interaction of researchers and software developers in the area of mobile devices.
We will see in the next steps how to use the data gathered so far.

Once all the information regarding the economic and social impacts of the research project have been generated and collected, the last step is to process this data to assess the project's performance globally with the use of aggregated and synthetic indices.
Specifically:

- All the information regarding the economic impacts (except the technological ones) should be used by the evaluator in order to perform the Economic Impact Assessment, which aims at understanding whether the project output(s) is able to improve the total welfare of society by measuring, in economic terms, the range of direct and indirect impacts affecting both the users and non-users of the project outputs. The final output of the economic assessment, then, will be condensed into three indices: the iROI, the xROI and the tROI.

- All the data related to social impacts, instead, should be used by the evaluator to perform the social impact assessment, which aims at understanding the improvement made by the project in terms of impact on employment and working routines, knowledge production and sharing, and social capital. The final output of the social assessment, then, will be a multi-criteria and multidimensional description of the attained impacts in the social sphere. In other words, the evaluator will have an index for each of the three social dimensions just mentioned (working routines, knowledge production and sharing and social capital).

- Finally, the economic indices (iROI, xROI and tROI) and the multi-criteria description of the social impacts will be condensed into a global indicator called RORI.

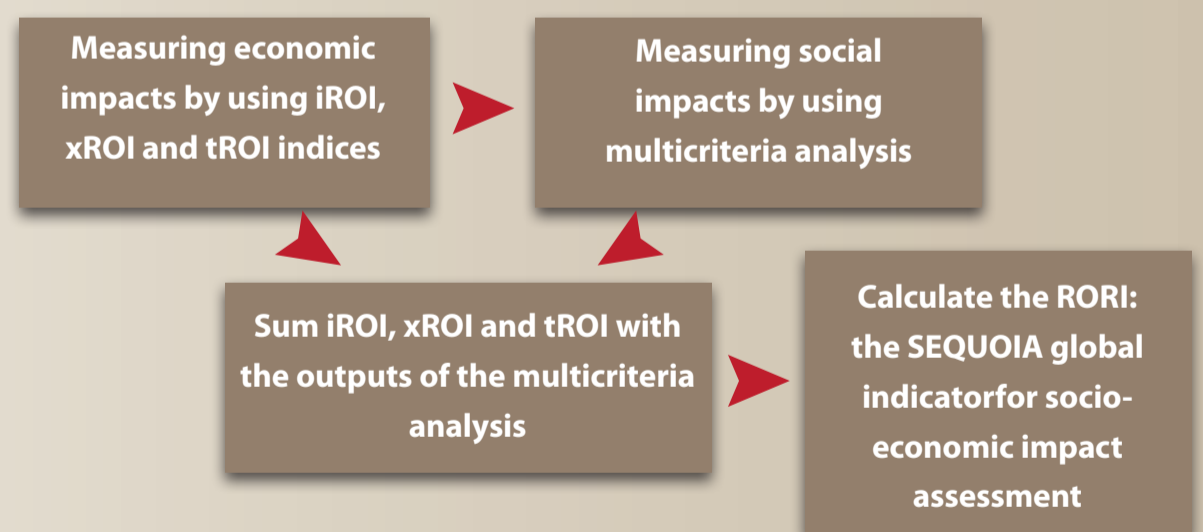Fig. 6 shows the activities to be performed in this step.

Fig. 6 – Activities to be performed in Step 5

The next sections describe in greater detail the meaning of each indicator/index and show the inputs to be included and formulas to be used for calculating such indicators/indices.

iROI (Internal Return On Investment)
This indicator provides information about the financial sustainability of the project, by measuring the (potential and/or future) financial return for the consortium partners. 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

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Final assessment analysis

for the consortium partners, deriving mainly from selling the output(s) produced. The formula for the iROI calculation is the following:

$$iROI \ = \ \frac{\text{Investment financial inflow - investment financial outflows}}{\text{Investment cost}}$$

In order to better identify what data must be included for the iROI calculation, the above formula can be "described" using the symbols that have been introduced in the previous sections, thereby obtaining the following:

$$iROI \ = \ \frac{IMP.3 - IMP.2}{IMP.1}$$

An iROI higher that zero means that the financial returns estimated over the project output lifetime cover the expenses that the consortium itself must sustain in order to run the project, both during the research phase and during the exploitation of the results phase.
Such an indicator is measured as a percentage e.g. if iROI = 5 % or 0.05, this means that the financial net benefits are 5% of the investment costs. Given that many research project outputs are provided as open source or as a free service/tool to the end-users, and many possible exploitations of the research outputs are not foreseeable at the end of research project life-cycle, the evaluator can normally expect an average iROI somewhere between 0 and 5%.

xROI (External Return On Investment)
This indicator quantifies the net economic benefits (other than the financial ones) that the project generates in society as a whole (considering both users and non-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[1].
The formula for xROI calculation is the following:

$$xROI \ = \ \frac{\text{Socio Economic Benefits - Socio Economic Costs}}{\text{Investment cost}}$$

In order to better identify what data must be included for xROI calculation, the above formula can be "described" using the symbols that have been introduced in previous sections, thereby obtaining the following:

$$xROI \ = \ \frac{(IMP.5 + IMP.6 + IMP.7 + IMP.8)}{IMP.1}$$

An xROI higher that zero means that the economic benefits estimated over the project's lifetime are higher than the economic costs society has to pay for enjoying the outputs of the project itself.
The xROI should be normally higher than the iROI, given the wider meaning of project costs and benefits than a project's inflows and outflows. Therefore, the evaluator should normally expect an average xROI somewhere between 5% and 20%; values higher than 20% would denote, therefore, a very high economic impact of the project.
Note that, in some cases, especially for research projects that are not close to the market (i.e. closer to basic research than applied research), the xROI value could be negatively affected by the underestimation of the project's total long-term intangible and highly unpredictable benefits. For this reason, xROI values lower than 5% can be considered acceptable as well.

tROI (Total Return On Investment)
This indicator quantifies the total monetisable impacts of the research 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.
The formula for xROI calculation, therefore, is the following:

$$tROI \ = \ iROI + xROI$$

The average expected tROI is somewhere between 5% and 25%. However, values lower than the average can be considered acceptable in some specific cases (see above).

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[1] Some economic benefits are intrinsically non-monetizable (e.g. the technological advances - par. 2.4) and, therefore, should not be included into the xROI. On the contrary, such effects must be measured on their own most suitable metric and included into the multicreteria analysis and in the RORI index (see par. 2.5).

Multi-criteria assessment

As discussed above, not all the impacts generated by the projects can be measured in monetary terms: the impact on the environment, on working routines, on knowledge production and sharing, and on social capital, or even the technological improvements brought by the project outputs, in fact, cannot be easily transformed into economic/financial values.

According to the SEQUOIA methodology, therefore, the evaluator should assess such impacts through the use of the Multicriteria Techniques (MCA), according to which, where monetisation is not possible, each impact must be expressed in its most appropriate and suitable unit of measurement (see also D3.3a).

The main impacts to be considered in the MCA, with an indication of the most suitable metric to be used for their measurement, are:

1. Technological benefits (scale 1 -10)[2]
2. Impact on employment and working routines (absolute values and scale 0-4)
3. Impact on knowledge production and sharing (absolute values, scale 0-4 and scale 0-1)
4. Impact on social capital (absolute values and scale 0-4)

RORI

Once all the information about the financial (iROI) and economic (xROI) performance of each project is summarised and after the assessment of other non-monetisable impacts through the use of the MCA, the last step consists of calculating a global index, synthesising 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 Return On Research Investment.

The issue, here, is to put together all the information generated during the analysis, both qualitative and quantitative, both monetary (or monetisable) or not. The resulting index, therefore, does not have a strict economic meaning but, at least, it provides a measure of the whole performance of a IoS/SaaS research project at a given moment. It is useful for comparing the project performances in different time-frames, and it allows the comparison with other projects.

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.

The formula for the calculation of the RORI is the following: $RORI = \sum_{n=1}^{N} X_n w_n$

where:

n = 1, ..., N (N is the number of variables)
w are the indicators weights[3] $\sum_{n=1}^{N} w_n = 1$

X are the normalised indicators synthesising the following impacts:

* Financial (iROI)
* Economic (xROI)
* Technological benefits
* Impact on employment and working routine
* Impact on knowledge production and sharing
* Impact on social capital

As mentioned above, it is necessary to attribute to each variable a proper weight; the weights express the relative importance of each impact assessed.

A way for defining the weights could be to select a panel of experts and follow their indication. At the present stage, the SEQUOIA team suggests the weighting system reported in the table below that assigns equal relevance to monetisable and non-monetisable impacts.

iROI	xROI	Technical benefits	Impact on employment and working routine	Impact on knowledge pro-duction and sharing	Impact on social capital
0,15	0,35	0,10	0,10	0,20	0,10
0,5		0,5			

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2 The technological benefits are calculated as the average of Functionality, Reliability, Usability, Efficiency, Maintainability, Portability and Quality in Use, all of them already originally expressed into a 1-10 scale.
3 Weights express the relative importance of each variable assessed. The sum of all weights must be equal to one.

In this section we briefly examine what to do after the calculation of the SEQUOIA indices: iROI, xROI, tROI, multi-criteria indices and RORI.

Evaluating your performance using the SEQUOIA average RORI

We have seen in Section 1 that projects can use the SEQUOIA methodology in different time-frames. If a project follows the ideal process (assessing ex-ante, in-itinere and ex-post impacts) this section can be skipped. Such a project will not need an external benchmark to evaluate its progress. This is because even if such a project will not have a benchmark at the time of the ex-ante assessment, it will have it later on, when the ex-ante assessment will become the benchmark for the subsequent assessment exercises.

If this is not the case, and the evaluator needs an external benchmark in order to be able to "read" the impact assessment outputs, the evaluator can use the average values calculated by the SEQUOIA team. The average values that have been calculated by analysing 30 SaaS and IoS projects are presented below. The evaluator can use them to know if the project he/she is assessing is in line with other projects, if it is below average, or above average.

More information about the average performance of the 30 projects assessed by the SEQUOIA team can be found in D3.1.

In the next section we will see how to organise an impact assessment report.

The socio-economic impact report

After performing all the stages described in previous pages, you will have a completed socio-economic impact analysis. However, the process is not finished yet. There is a final important stage: reporting the results of the analysis to the various stakeholders. The evaluator's findings may be for internal management use, for public distribution, or the basis for discussions with various stakeholders. Preparing a report is useful to make recommendations, which can influence what happens as the research project moves forward.

The following quantitative and qualitative information is usually also included in a comprehensive socio-economic assessment report:

- Information related to the research project, including a discussion of its targets, key stakeholders and structure;
- Description of the main outputs and a qualitative description of the advances (benefits) brought about by the project for society;
- Case studies/use cases, or quotes from participants/users that illustrate particular findings;
- Details of the calculations, and a discussion of any estimates and assumptions.

Projects assessment and best practices

The SEQUOIA socio-economic impact assessment methodology, described in this guide, was applied to 30 research projects (9 from Call 1 and 21 from Call 5 of ICT-FP7) co-financed by the European Commission in the domain of Internet of Services (IoS) and Software as a Service (SaaS).

The instruments used for data gathering were, essentially, two:

- A structured questionnaire, composed of 55 questions, which was published through the Eurokleis survey tool2 and advertised on the SEQUOIA website in the period between 13th and 25th of April, at first, and then extended to the end of October 2011 and which had to be completed remotely by the target projects and further sent via e-mail to the SEQUOIA evaluation team. The decision to extend the data gathering window was helpful, as we gathered several more questionnaires by extending the deadline and by offering to the projects different ways of filling it in (online, via email, by phone/Skype call, in person). The questionnaire, divided into 8 sections, aimed to collect general information about the projects and to identify and quantify the potential impacts generated in different fields such as technology, science, society, the environment and the economy.

- The second tool used for data gathering was a series of Skype interviews of about 45 minutes each, arranged in order to connect two socio-economic experts from the SEQUOIA team with a representative from each project. Such interviews were aimed at both gathering the data missing from the questionnaire , in order to have a complete and homogeneous data-set that could be further analysed, and a better understanding of the specificities of each project, so as to more correctly assess the potential of each, in a more informed way. These interviews were also structured in such as way as to find a "common language" to be shared between the evaluators (social scientists) and the project representatives (generally engineers or ICT technologists), with the aim of both spreading the culture of evaluation among the projects themselves and of better helping the projects understand the impacts they could generate – beyond the technological field – on society as a whole.

Before the launching of the questionnaire a series of online focus group sessions introduced to the projects the SEQUOIA approach and gathered some background information about the projects. The SEQUOIA team used the focus group sessions to also validate the questionnaire and fine-tune the methodology.

The deliverable "Deliverable 3.1 – Call 1 and Call 5 Project Assessment Report" contains the results of the projects assessment in aggregated way, first, while in the last part of the document a short analysis of single project assessments is reported.

The 5 projects that scored highest have been defined as "best practices". The selected projects[1] are S-Cube, mOSAIC, CumuloNimbo, SocIoS, I2Web. A deeper analysis of the socio-economic impacts of these 5 projects will be presented in D3.2 "Best Practices Report" which will be released at the end of March 2012 on the SEQUOIA website.

Conclusions

The evaluator, at this point, should have a clear idea about the SEQUOIA methodology and he/she should be ready to deepen the socio-economic impact assessment reading deliverable D3.3b "SEQUOIA Self-Assessment How-To Guide".

To learn more about its theoretical foundations, the evaluator can refer to D3.3a "SEQUOIA Final Self-assessment Methodology", which is available on the project website: www.sequoiaproject.eu. In addition, a short animated description of the SEQUOIA impact assessment methodology is available here: http://prezi.com/jm1zsr2vphv7/sequoia-self-assesment-how-to-guide/.

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[1]   www.s-cube-network.eu, www.mosaic-cloud.eu, http://cumulonimbo.eu/, http://www.sociosproject.eu/, http://i2web.eu

SEQUOIA

At a glance

SEQUOIA
Socio-Economic Impact Assessment for Research Projects.

Project Coordinator
Dr Paolo Dini (p.dini@lse.ac.uk)

Duration
May 2010 – April 2012

Website
http://www.sequoiaproject.eu

LSE THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

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Maximising the socio-economic impact of Software as a Service (SaaS) and Internet of Services (IoS) research projects. The SEQUOIA Support Action is defining a systematic socio-economic framework in support of exploitation practices to be advantageously pursued by projects to assess their socio-economic impact.

Today's socio-economic circumstances have put increased pressure on funding bodies to demonstrate that resources are spent in the most effective and efficient manner. Confirming this, the Europe 2020 Flagship Initiative 'Innovation Union' communication suggests reforms in innovation systems in order "to get more value for money". The definition of an adequate research evaluation model is on national political agendas both inside and outside Europe. Better evaluation methods are needed to identify what works and what does not, and why, as well as what could and should be scaled up.
What can research projects do to contribute to European priorities such as promoting socio-economic growth?

Today, research projects need to engage more with objectives that go beyond technological achievements. According to the ICT work programme 2009-2010, technologies developed under Challenge 1 (Pervasive and Trustworthy Network and Service Infrastructures) are expected to be tailored to meet key societal and economic needs. Furthermore, the socio-economic implications of new technological solutions need to be assessed at an early stage.

SEQUOIA is a support action co-funded by the European Commission under the Unit 'Software & Service Architectures and Infrastructures' which aims to translate these generic statements into more specific socio-economic objectives. It develops a self-assessment methodology by which research projects in the SaaS and IoS areas can assess the impact of their project outputs against the social and economic dimension of their target beneficiaries. Through its methodology SEQUOIA helps projects focus more on the creation of value and aims at giving them qualitative and quantitative value information to help them become more aware of their social and economic innovation capabilities. In this way, the new projects will be able to self-evaluate their potential output in terms of socio-economic benefits, and possibly reorient their activities in order to improve such impact.