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***"Socio-Economic Impact Assessment for Research Projects"***

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## 1. INTRODUCTION

The SEQUOIA project was a Support Action tasked with performing an assessment of the potential socio-economic impact of research projects in the area of Software as a Service (SaaS) and Internet of Services (IoS). In addition, it captured and documented this process in order to develop an impact self-assessment methodology for on-going and future research projects to adopt and apply on their own. This final white paper recounts the main learning points and the insights we gained from the project's activities over the past 2 years.

### Policy and Institutional Context

The SEQUOIA project comes in the middle of a European Commission (EC) research policy shift which, from an emphasis in the early Framework Programmes on funding research that is “far from the market”, is leading to an increasing emphasis on the assessment and maximisation of socio-economic impact and exploitation of research results. For example, Horizon 2020 brings together different framework programmes that address not only research but also adoption and deployment:

“Horizon 2020”, the Framework Programme for Research and Innovation, brings together the successor of the 7th Framework Programme for Research, the successor to the Competitiveness and Innovation Framework Programme (CIP, comprising the innovation-related parts of the Entrepreneurship and Innovation Programme (EIP), the Information Communication Technologies Policy Support Programme (ICT-PSP), and the Intelligent Energy Europe Programme (IEE)), and the European Institute of Innovation and Technology (EIT). The decision to bring together all EU research and innovation funding in a coherent, from-research-to-innovation overarching framework was taken on 29 June 2011 by the College in order to make participation easier, increase scientific and economic impact, and maximise value for money. (EC, 2011)

These two emphases are not necessarily mutually incompatible if one allows enough time to elapse between research and innovation. However, the EC seems increasingly concerned with shorter-term observable impact, and this is squeezing the space normally inhabited by fundamental (“blue-sky”) research, which is generally regarded as responsible for the most disruptive kinds of innovation.

This phenomenon could be explained in part by the strong performance in innovation seen coming out of the USA in the last 20 years, which raises questions as to whether a similar performance may be possible in Europe, coupled with the on-going global economic crisis, which is motivating a growing concern with an accurate assessment and the maximisation of EU investment outputs. However, European success stories like Linux, Skype, and Prezi, not to mention the old workhorse GSM, are also significant. Interestingly, they can be argued to have been related not only to *scientific* innovation but by an increasing share of *socio-technical* innovation, consistent for example with the Facebook and Skype phenomena or with the evolution from SMS messaging to Twitter.

Another possible factor can be found in the strong participation of large industry in the consultation processes whereby the EC periodically solicits input for research priorities in upcoming Framework Programmes. The strong influence of large industry (e.g. in the European Technology Platforms) has increasingly blurred the boundary between “fundamental”/potentially disruptive research and industrial R&D with shorter time-horizons dictated by market/marketing requirements. The latter seems to have an increasingly strong influence on EC research policy. Rather than a shortcoming, also this phenomenon can be argued to have been influenced by the growing importance of the social dimension, for instance through the blurring of the boundary between personal and professional spaces as Web 2.0 tools and environments increasingly permeate the (virtual) workplaces of large industry.

Furthermore, it is an oversimplification to claim a dichotomy between academic “blue-sky” research and applied industrial research. There are many academics who are mainly interested in applied research, and there are many companies whose labs are at the forefront of scientific innovation. Likewise, it is tempting to ascribe to academics the ability to engage in truly “fundamental” research, while relegating industry

and business to well-trodden intellectual spaces within accepted epistemological boundaries. This second point may be closer to the truth in Europe, where the gap between academia and industry has traditionally been greater than that found, for instance, in the USA. Be that as it may, we suggest avoiding a dichotomous approach and regarding the research domain as a continuum: in each project there can be a co-presence of blue-sky research and innovative service development, each requiring specific impact assessment instruments. However, over the past 10 years, and within DG INFSO in particular, the growth of the importance of the social dimension in ICT innovation cannot be denied.

With the growing relevance of the Internet as a central-for-all infrastructure, innovation in social media and Web 2.0 in general is clearly within everyone's grasp, it is not merely the province of private or public research institutions. This has changed the environment within which research outputs are judged or assessed. Suddenly the social dynamics *within* a research lab are looking increasingly similar to the social dynamics *outside* the lab. And the coupling between social dynamics and new business models has taken the world by storm. From this point of view, therefore, it is not too difficult to accept that the categories "near the market" and "far from the market" have been superseded by a considerably more complex landscape.

It is this landscape that SEQUOIA has traversed, documenting our findings and observations along the way in a number of deliverables, reports, and presentations. In the rest of this Introduction we hint at a theoretical framework that may help make sense of the increasingly complex interactions between the social and economic dimensions on the one hand, and the individual vs. institutional perspectives on the other, and that we hope will help the reader make sense of the main findings as summarised in the remainder of this paper.

### The Perspective of Economic Anthropology

The development of criteria by which the value generated by research projects can be assessed, as faced by SEQUOIA, had to distinguish between verifiable current impact and potential future impact, with most observations relating to the latter. Furthermore, monetisable and non-monetisable impacts had to be recognised and, where possible, quantified. This was a very challenging exercise that is discussed in depth in deliverable D3.1 (Monacciani et al., 2012).

As discussed in some detail in Dini et al. (2012), it is helpful to introduce the perspective of economic anthropology because – by not identifying the economy only with the market – it does not make a strict separation between "economic value" and "social value". For example, Gudeman (2001) discusses how all economies strike a balance of market or commodity-based production and exchange and non-market and commons-based production, sharing, and exchange. As shown in Figure 1, Gudeman proposes a more granular classification of value domains which, importantly, is also dependent on scale: (1) base or commons, (2) social relationships, (3) accumulation or capital, and (4) trade or market. The first two are prevalent at smaller scales and are closely associated with community, whereas the latter two tend to involve longer-distance interactions and are more impersonal. However, the domain of accumulation or capitalisation is equally important for community and for the market.

These concepts can be mapped to the SEQUOIA context as shown in Figure 2. The figure shows how direct funding by the EC of market activity or capitalisation is not allowed. By funding the domain of research and knowledge creation the EC strengthens the cultural base and the commons that underpin the many collaborative research communities that by now crisscross Europe. Whether or not these research outputs then find their way to the market is mostly an open question, and one to which SEQUOIA paid particular attention. However, especially in the area of ICT we can see how the domain of social relationships plays a pivotal role in bridging from the base to the market and capitalisation.

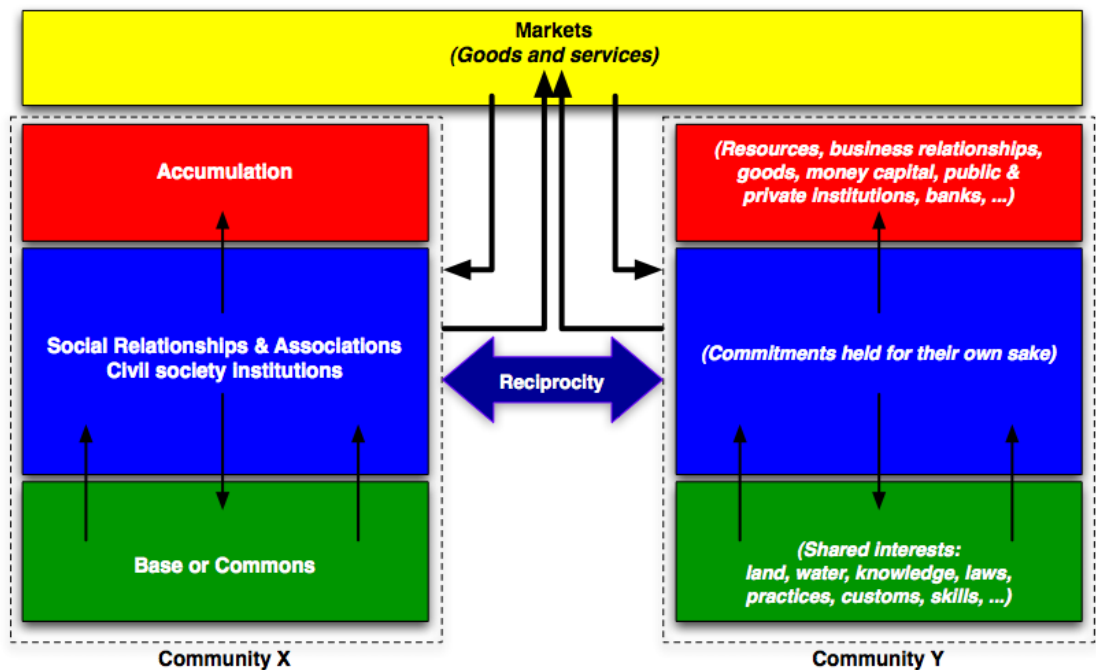


Figure 1: The four domains of value of the Economy according to economic anthropology

Therefore, whereas most of the SEQUOIA work was carried out using more traditional categories for conceptualising the social and economic value generated by the SaaS/IoS projects we worked with, in hindsight it seems that the perspective of economic anthropology could be quite helpful for understanding and rationalising ex post especially the potential-impact categories, which we have found to be strongly associated with the social dimension.

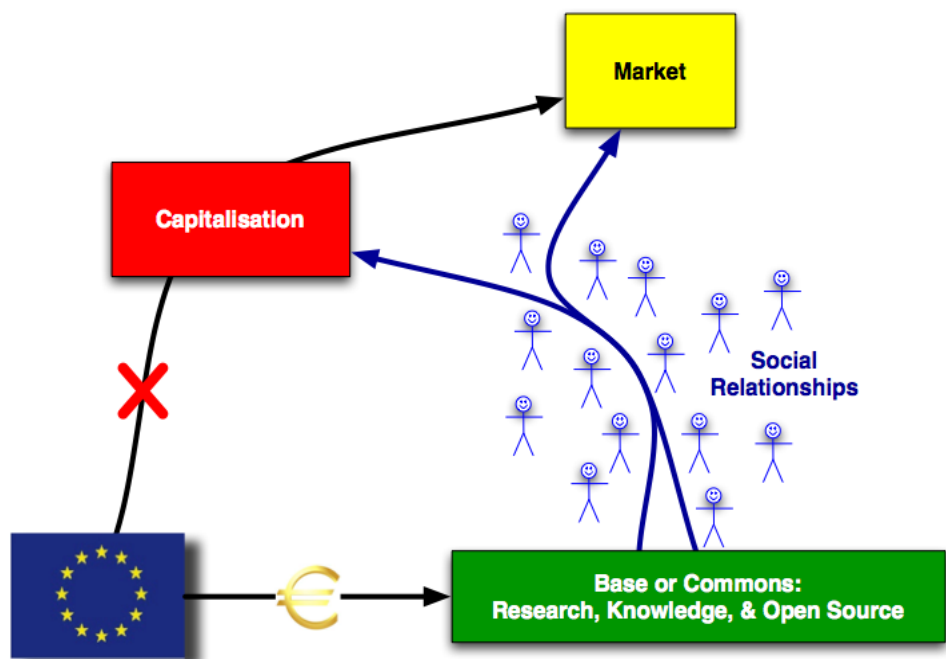


Figure 1: Gudeman's domains of value in the context of EU projects

## 2. SEQUOIA AND THE IMPORTANCE OF AN IMPACT ASSESSMENT “CULTURE”

The project as an organisational entity is understood by management and organisation scholars as a temporary organisational form and is increasingly prevalent in contemporary society. While some consider such forms of organisation as the ‘organizational equivalent of a one-night stand’ (Meyerson et al. 1996: 167), others view the project as a temporary organisation ‘to which resources are assigned to undertake a unique, novel and transient endeavour managing the inherent uncertainty and need for integration in order to deliver beneficial objectives of change’ (Turner and Müller, 2003: 7). Moreover, research has shown that a temporary nature does not necessarily equate to a lack in culture. Generally, for the duration of a project, it can be said that projects are organised following an accepted system of meanings, have certain values, and have an operating philosophy that is embedded in the relationships established within a given consortium (cf. Turnley, 2002). The concept of culture highlights the role of individuals and their actions in an organisational context underpinning the improvement of their working capacity (Schein, 1992).

It goes without saying that if a project’s organisational culture offers unreserved support for its strategic processes, and if these in turn provide a valid response, then a robust foundation is laid for successful performance (Bakker, 2010; Schein, 1992). In other words, project culture seems to have an impact on its strategic development associated with setting priorities and processes. And, while it cannot be claimed that culture precedes strategy, it does seem to underlie the uptake rate of strategic goals. Aptly put by Küng (2000: 108): ‘Culture not only governs how environmental developments are perceived, but also defines the acceptability of strategic responses to those developments, and, by extension, determines the level of commitment to achieving those responses’.

The SEQUOIA team is less interested to validate those claims associated with the dynamics of leveraging culture and strategic planning; rather, our research has yielded evidence where there is disequilibrium between the elements involved. From SEQUOIA’s research we have learned that there is a lack of assessment of projects’ socio-economic impacts in their various stages from proposal writing to the evaluation phase. While mechanisms of quality control such as activity-execution monitoring, deliverable internal/external review, etc are in place in most projects, impact assessment tends not to be considered as a visible organisational process. Moreover, project culture seems to mainly operate by reporting of activities and costs, according to an ex-post logic.

However, such a strategy is less desirable from a more future-oriented approach, which is needed for aiming at and realising sustainable and maximum potential impacts. An explanation for this may be related to poor definitions of what impact is or entails, as well as ‘methodological confusion’ due to a lack of a clear-cut approach or widely acknowledged guidelines (Turnley, 2002). This has raised questions concerning the replicability, validity and credibility of the work. In particular, the issue of bias became apparent as a weak research design makes it harder to control for it, i.e. conducting the investigation and documenting the findings (Goldman & Baum, 2000). Also, in some cases there seems to be some resistance to socio-economic impact assessment as it tends to use data that generally is gathered for other purposes, and which must be used by individuals with little or no formal training in the social sciences (Burdge & Johnson, 1998).

It is our belief, however, that with an increasing recognition of the complexity of society and policy there is an increasing need for socio-economic assessment as it is intended to assess prevailing socio-economic conditions under scrutiny; analyse the impacts of the prevailing conditions on the socio-economic structure of the research site or project; and to develop a set of guidelines for establishing viable projects.<sup>1</sup> Consequently, the SEQUOIA team saw the need to establish a standard impact assessment methodology that should be flexible and modular so as to be able to adapt to different types of projects (IP, STREP, etc) and to the great diversity that characterises the Saas/IoS domain. A standard methodology will allow the EC to have the kind of data that is useful when analysing the socio-economic impact of a domain or of a

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<sup>1</sup> Examples of “viable” projects are the 5 “best practices” projects discussed further below, but further variables for better defining “viable projects” can be defined by the EC looking at new policy objectives.

funding programme. In parallel, it will help projects in positioning themselves on the continuum that goes from blue-sky research to product/service development.

Generally, socio-economic conditions tend to be hard to identify and assess because of human characteristics and dynamic variables. However, there is a number of sets of socio-economic impacts that were developed in the SEQUOIA project: for example, we took into consideration impact on employment and working routines, impact on knowledge creation and diffusion, and impact on social capital. Moreover, the SEQUOIA methodology also considered some of the 2020 Digital Agenda goals as points of reference for recognising expected impacts.

Our research found that some of the strategic development tasks associated with assessment were “outsourced” to non-social science experts. This meant that some of these people within the projects under scrutiny were not privy to underlying reasoning processes involved in assessment exercises. As a result, in some cases, a limited exposure to the underlying socio-economic rationale for the strategic planning of the project proposal and execution phases was detected. The new strategy of socio-economic impact assessment meant re-assessing many of its intrinsic beliefs and values which seemed to strengthen the project culture. And consequently, strategic planning and execution that are intended to highlight an increased and realistic understanding of the project’s potential impact seem to necessitate such socio-economic responses.

The establishment of a robust and well-executed socio-economic assessment culture therefore requires:

- Analytical rigour (critical for replicability and credibility) including a clear problem statement; explicit definition of the targeted community; clear methods and assumptions; etc.
- Repetition at several intervals of socio-economic assessment throughout all stages of the project, accounting for the emergent properties of what is truly a dynamic society
- A data collection methodology that accounts for and supports the analysis of differences in impacts
- A dedicated budget (small but adequate) to ensure a proper fulfilment of the task

This underscores the importance of the involvement of a specialist or expert skilled in this type of analysis, who will be familiar with these types of research designs and methodologies. SEQUOIA’s How-To Guide offers a good starting point for supporting non-experts in understanding how socio-economic impact assessment works in practice. However, we recommend the inclusion in project consortia of socio-economic experts who are able to translate the ICT research language into measurable (potential) socio-economic impacts.

### **3. THE MAXIMISATION OF SOCIO-ECONOMIC IMPACT BY SAAS/IOS RESEARCH PROJECTS**

In this section we briefly summarise the activities performed by the SEQUOIA team. We summarise the main findings and identify those aspects that the projects in the SaaS/IoS domain should take in consideration for maximising their socio-economic impacts.

The SEQUOIA methodology was developed with the support of SaaS/IoS projects by using a participatory approach. Face-to-face and online meetings were organised in order to present the methodology to the projects, and for gathering their feedback. The collaboration with the projects was very important in defining the final set of indicators and for understanding the “shared culture” of this scientific community. The SEQUOIA methodology was applied to 30 projects, co-financed by the EC in two separate calls (Call 1 and Call 5). This assessment exercise showed that the research community has a weak “assessment culture”. At the time of our assessment only two projects were performing any sort of impact assessment activities; thus monitoring and evaluation in general were very rare. Consistent with this, only very few projects had business plans and a concrete sustainability strategy at that time. This can be partially explained by the fact that the projects were at the early stages at the time of the assessment; however the lack of a future-oriented strategy in the consortia we analysed is a risk and more effort should be invested in fostering an impact assessment culture.



Another important observation that emerged from our analysis is that most of the projects target mainly developers and software engineers, while the wider society is not their main focus. Only 10% of the projects see citizens and end-users as relevant stakeholders in their activities. It was difficult for many of the people engaged in the assessment to reflect on the potential impact of their research outputs at the social level. This highlighted to us the need to maintain an explicitly interdisciplinary outlook and to foster the emergence of a common language between social scientists and technologists. SEQUOIA supported the projects in reflecting more on societal impacts, but more needs to be done in this direction. As the link between technology, research, and social goals is clearly stated in the Digital Agenda 2020, more attention should be dedicated to its objectives when writing and carrying out a project in the SaaS/IoS domain.

Moreover, technology development is oriented towards the Open Source approach, and it is difficult for SaaS/IoS consortia to identify appropriate business and revenue models for future exploitation. It is, therefore, necessary to support the SaaS/IoS consortia in learning more about the business models associated with Open Source software and to support them in linking this with the appropriate choice of licences and organisational models. In parallel, also a future development of the SEQUOIA methodology should include a more accurate analysis of Open Source approaches to exploitation.

The early/immature stage of most of the projects was an important factor in carrying out only an ex-ante assessment; we recommended to all the projects that collaborated with SEQUOIA to run a new assessment at the end of their projects. To do so in an autonomous way they can refer to the SEQUOIA deliverables and especially the How-To Guide developed by the project consortium (D3.3b) and presented in a brochure (both available on the project's website, [www.sequoiaproject.eu](http://www.sequoiaproject.eu)). Finally, we recommend that projects dedicate more effort to defining – from the very beginning of their activities – their stakeholders (particularly end-users) and specific case studies/pilots to test the application of their outputs in concrete scenarios. This would provide useful feedback both for understanding the exploitation features of the projects' main findings and for assessing the economic value generated by the projects.

In addition to the assessment of the 30 projects, the SEQUOIA team wrote a report dedicated to the 5 projects with the highest expected socio-economic impact. The Best Practices Report (D3.2) uses a case-study approach to better describe the potential social and economic impact of the 5 projects that scored highest in the assessment. The analysis of the 5 projects can be seen as “best practices” because they appear to know their stakeholders’ needs and expectations and engaged with them in development activities from the beginning of their projects to a greater degree than the other 25 projects. Moreover, these projects, even if research-driven, have a clear idea of the SaaS/IoS market and know their potential competitors. In this sense the link between academia and industry is a positive one, as testified to by the attention given to collaborations and to the definition of bilateral agreements with industrial partners.

In addition, we analysed the weighted average score of the five best practices projects, calculated on the basis of the following formula:<sup>2</sup>

$$\frac{\Sigma(\text{project cost} \cdot \text{tROI})}{\Sigma(\text{project cost})}$$

The weighted average is 0.6244, hence at the time of the SEQUOIA evaluation, the five projects had generated a fairly good financial return relative to the total lifetime of the projects’ outputs and had covered the costs required to run the projects. Considering that all the 5 best practices projects are research projects, this value is acceptable in terms of socio-economic impact. We need also to consider that most of the projects at the time of the SEQUOIA evaluation were in their early stages and had not yet commercialised their outputs (this qualification is mostly relevant to economic impact).

However, the aggregated analysis of the best practices hides relevant information. The results of the aggregated analysis have revealed that the projects can be divided mainly into three categories:

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<sup>2</sup> tROI (total Return on Investment) is taken as the sum of iROI (internal ROI) and xROI (external ROI).

1. In the first category we find projects that achieved the highest iROI value among all the projects analysed by developing a relevant financial return on investments for the consortium partners, almost reaching the break-even point and leaving us to assume that in the next year they can generate substantial internal returns on investment. Indeed, the iROI of these projects in general contributes to 80-90% of their tROI value. In terms of xROI, these projects have not produced significant external positive results in the form of socio-economic benefits, hence they are mostly focused on internal return on investment.
2. In the second category we find projects that are mainly aiming to generate a high xROI value, by producing relevant external returns on investment in terms of socio-economic benefits for the project consortium and for society as a whole. In general, we note that these projects reached a higher xROI. Mostly they have not produced significant internal returns on investment and this result demonstrates an excessive focus only on socio-economic impacts, rather than on the internal return on investment and on the projects' financial sustainability.
3. In the third group we find projects that are the most balanced in terms of financial and socio-economic sustainability. Indeed, the difference between the iROI and the xROI values is not very remarkable, with each in the range of 40-50% of tROI. This result shows that these projects are not overly focused only on the financial aspects or on the socio-economic ones; rather, they aim at achieving a good balance between the internal and the external total return on investment.

Hence, the results generated by the SEQUOIA socio-economic impact assessment demonstrate that the methodology can constitute a useful instrument in terms of future investment decisions for the phase of the full development and exploitation of SaaS/IoS projects. It is able to distinguish the potential categories of project investments. In line with the objectives of the investors and decision-makers, from the aggregated analysis of the 5 projects, we can estimate the characteristics of projects in terms of financial and socio-economic sustainability. The best practices report also demonstrates that the SEQUOIA methodology is very useful for accurately evaluating the areas of impact under which the EC can analyse whether the objectives of each projects have been achieved.

In the next section, we touch on how the SEQUOIA methodology and impact assessment approaches in this field generally can be improved.

#### 4. THE NEED TO IMPROVE IMPACT ASSESSMENT METRICS/METHODS

The first challenge of impact assessment is related to data availability. The SEQUOIA approach involves setting up a self-assessment protocol supported by a qualitative-quantitative questionnaire. In order to avoid duplication, some of the questions that the EC already asks the projects as part of their Final Report<sup>3</sup> were included in the SEQUOIA questionnaire. In this way, projects can collect the information once and use it both for assessing their expected impacts and for reporting their achievements to the EC. This can be seen as a first attempt to build a stable database to support the EC and the projects when analysing their expected impacts. This first attempt calls for more actions to reduce the burden for the projects and to build a database that will be useful for the analysis of socio-economic impact at European level and on a Framework Programme basis. In addition to this challenge, there are issues that are specific to the SaaS/IoS domain and that call for greater attention.

The main difficulty in assessing the socio-economic impact of SaaS/IoS projects is related to the nature of the “project” as a time-limited and process-oriented institutional form. In order to perform an effective impact assessment, data need to be gathered from the beginning of the project (or even at the proposal stage) and after project completion. SEQUOIA results showed that very few of the funded projects were prepared for a data gathering activity aimed at assessment. A dedicated task for data collection and assessment should be planned at the proposal/negotiation phase. There is a need not only for a standard

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<sup>3</sup> We refer here to the questionnaire each project coordinator has to fill in at the end of its project. The questionnaire is divided into several sections, including information workforce statistics, information about scientific outputs and dissemination activities performed. See “Template for Project Final Report” at [http://ec.europa.eu/research/participants/portal/page/fp7\\_documentation](http://ec.europa.eu/research/participants/portal/page/fp7_documentation).

methodology and data gathering process but also for a formal commitment of project consortia in order to gather data during and after the end of the projects.

By interacting with the SaaS/IoS projects, we found that scientific impacts are expected to be observable in the timeframe that goes from the end of the projects to one year after that, while economic impacts are expected to emerge 2-3 years after project end and social impacts after 5 years. It is evident that – in order to describe concrete impacts – it would be necessary to interact with project partners and coordinators after the end of their work. This is a complex task in itself and particularly for a Support Action such as SEQUOIA that focused its activities mainly on *potential* or *expected* impacts.

Even with a formal agreement, the ex-post impact assessment exercise is not easy considering the fact that after the end of a project the consortium is no longer operational, participants act as separate entities no longer committed to the project, and researchers may change affiliation over time, making the data gathering process even more difficult. Moreover, many research impacts are unexpected and difficult to quantify, so the reasonable expectation of having numerical, clear, and comparable results needs to be counterbalanced with qualitative, in-depth analysis better able to spot unexpected, soft elements and better able to re-construct the “life” of research outputs after the end of the project that generated them.

Another important characteristic of the SaaS/IoS domain is that it groups projects that are very different: different in terms of funding instrument (IP, STREP, Network of excellence, etc), different in terms of research typology (closer to or farther from the market), different in terms of topics (developing languages, services, infrastructures, etc), and so forth. This diversity is the richness of the domain and needs to be considered when developing impact assessment methodologies; consequently methodologies need to be developed in a modular way, allowing each project to select those metrics that best fit the typology to which it belongs. Clearly, this leads to a certain level of methodological complexity and to a more time-consuming, knowledge-intensive data gathering process. The investment is rewarded by a richer set of data and more precise outputs able to orient and guide project partners when developing their sustainability and exploitation plans.

Finally, there is a need to define at community level (i.e. within the SaaS/IoS community) the categories of impact that it is reasonable to consider, and how to measure them. The SEQUOIA methodology considers various categories, among which are economic efficiency, economic return on investment, scientific excellence, social capital, and others. Although these categories were discussed with the community in a participatory way, it is important to remain open to adapting such categories to the needs of the EC as part of future activities that may be seen as necessary.

Similarly, the spectrum of scientific outputs should also be extended beyond the classical centrality of patents and impact factors. For example, when analysing economic impact new business models such as those linked to Open Source Software (OSS), which appears to be especially relevant to the SaaS/IoS domain, should be added to more traditional ones.

## 5. SUMMARY AND CONCLUSION

Over the life of the EC Framework Programmes, government policy has led to greater investment in fundamental research. Current policy aims to increase the potential impact of research on the market and on society, thus maintaining a long-standing contradiction. However, the growing importance of the social dimension of innovation, observed since the advent of the web in many areas of science and technology, has the potential to mitigate this contradiction. For example, the wider definition of “economy” afforded by economic anthropology offers a pattern of interaction whereby EC investment can be seen as strengthening the commons and the social relationships domains of the economy which, in turn, then can be expected to have an impact on the market and capitalisation domains. This increases the legitimacy of policy as well as EC expectations for measurable potential socio-economic impact.

In hindsight, the qualitative aspects of the SEQUOIA methodology acquire greater relevance in their complementary roles next to the quantifiable/monetisable economic impacts. In order to fully benefit from this perspective, however, a greater awareness of the importance of socio-economic assessment – and the ability to perform it – is also required on the part of the research projects. An “impact assessment culture” needs to be cultivated, encouraged, and strengthened by the Commission and by all the stakeholders of research projects.

In the specific assessment exercise that SEQUOIA performed on 30 SaaS/IoS projects, the 5 projects that scored the highest were strong in three different ways: one group maximised the internal ROI, a second group maximised the external ROI, and a third group was able to strike a balance between the two. These case studies (D3.2) are probably the most valuable output of SEQUOIA, since any present or future projects will be able to see, by example, what initiatives, activities, and strategies worked best. Our interpretations for why these projects did well are discussed and explained in D3.2 and D3.3b, on the basis of a detailed explanation of the methodology in D3.1. Looking to the future, the assessment methodology needs to be better integrated within each project. Each project needs to feel that they “own” their self-assessment methodology, and that they have optimised it for the specific institutional, organisational, and epistemological requirements and peculiarities of their own projects.

In conclusion, SEQUOIA’s assumption that in the development of an effective socio-economic impact assessment methodology it is important to integrate the social and economic dimensions of potential impact was verified and validated through an ex-post rationalisation informed by economic anthropology, by the usefulness of our quantitative model, and by the empirical evidence obtained through in-depth qualitative and quantitative data gathering techniques.

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