



Final report on social impacts of research

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Final report on social impacts of research

1. Introduction

Against the background of global competition and the European knowledge economy, politicians, policy-makers and researchers are increasingly calling for social impact assessments. Such assessments are not without risk as there is ample room for misunderstanding the productive interactions between science and society and hence the ways social impact is achieved. The assessment of the social impact of research and of research-funding instruments is difficult but not impossible, and necessary but not without risk. The SIAMPI¹ project has aimed at reducing these risks by enhancing our knowledge of the interactions between science and society and consequently by suggesting innovative mechanisms to assess the social impact of research.

SIAMPI² stands for *Social Impact Assessment Methods for research and funding instruments through the study of Productive Interactions between science and society*. The main goal of the project is to broaden the scope of scientific research evaluation, that is, not only evaluating the outcomes of research for the scientific community, but also the impact of research on society.

Based on a number of case studies in different fields of research and in different countries, SIAMPI now presents a draft approach for the assessment of the social impact of scientific research. SIAMPI claims that through its approach, results of impact assessments can be linked more easily to concrete research activities (projects, programs, institutes) and connected to processes in the context, in policy, in industry, and in the broader society. In the SIAMPI Health case this advantage is recognized by both institutes studied. The boards have decided to use the SIAMPI approach in forthcoming evaluations.

In what follows we present our initial approach (section 2) and some of the major results of our case studies (section 3 and Annex 1). Finally (section 4) we draw some conclusions for adaptation of our approach for assessment of social impact of research. The SIAMPI team is presented in Annex 2.

¹ The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n°230330.

² See Annex 2 for the SIAMPI team.

2. The SIAMPI approach in its original format

The SIAMPI project had three objectives:

- Identification of productive interactions between researchers and society in four research fields: nanotechnology, health, ICT and social sciences and humanities.
- Improvement of our understanding of the necessity of productive interactions as a condition for research to have a social impact.
- Development of approaches and tools for the evaluation of social impacts that are applicable in a range of fields and evaluation contexts, with a strong emphasis on the feasibility and sustainability of the suggested mechanisms.

SIAMPI started from the assumption that productive interactions between science and society are a vital element in generating social impact. Interactions are determined to be 'productive' when they lead towards changes in behaviour on either side - that is with researchers (changes in research agenda) or with stakeholders (changes in behaviour). Changes in the latter group, we refer to as social impact.

Social impact is thus seen as the consequence of an iterative practice in which researchers and stakeholders influence each other with respect to a shared interest/objective. Therefore, patterns of interaction and the roles played by the different participants in this interaction have been central in our investigations. Analytically, we distinguished three main tracks through which interactions may occur:

- Direct, in the sense of "personal" interactions that evolve around face-to-face encounters, or through phone, email or videoconferencing.
- Indirect interactions are established through some kind of material "carrier" of the interaction. These include the publication of texts or other written means of communication, but also exhibitions, models, films. Potential users of research results may become aware of such results after reading a journal article, a newspaper article or seeing a news item in the media.

Next to these two interaction channels, we distinguished a third one. This interaction differs from the previous two in the sense that it is not primarily geared towards the exchange of knowledge or expertise, but rather resulting from previous interactions between a stakeholder and a researcher. Nevertheless, it might inform us about expected and unexpected impacts:

- "Financial" interactions occur when potential stakeholders engage in an economic exchange with researchers. A research contract, a financial contribution, or a contribution "in kind" to a research programme are traditional forms of financial interaction. Intellectual property rights are becoming more and more important in some fields. We include also any correspondence related to the actual contract.

With regard to assessing social impact of research, the SIAMPI approach would need the following steps:

1. Identify the major interactions channels in the three main tracks (direct, indirect, financial)
2. Establish the major instances of social impact by interviewing researchers and stakeholders
3. Find evidence to connect the findings of 1. and 2.

On the basis of this model, we have developed a questionnaire that we used in the various case studies as a heuristic to find evidence for the variegated patterns of interaction, and instances of social impact that could be traced back to these interaction patterns. We focus on variation in interaction channels, on researcher and stakeholder behaviour and on differences between fields and countries. The case studies were of an exploratory nature.

3. SIAMPI case studies

SIAMPI thus regards in its case studies two central concepts, social impact and PI, and the relationship between the two. While we started from the basic premise that in order to have impact, you need to have interaction, the case studies we conducted show that things are never that simple.

We call an interaction productive when it leads to efforts by stakeholders to apply research results to achieve social goals. In other words, we have to see a change in behaviour, either by individuals or by organisations. But the interactions we found are often complex and may involve many different actors and diverse ways of contact and exchange; and they occurred either simultaneously or longitudinally through time. Also, individuals appeared to play different roles intermittently. For instance, an academic can act as a paid consultant to a government office (financial), write reports that are read by officials (indirect) and hold meetings with her clients (direct); the three forms of interaction occur simultaneously and individuals operate in various social spheres both on the research side and the stakeholder side.

As a consequence, the distinction between impact and interaction might become fuzzy. What is characteristic for the one concept or for the other is often not clear, particularly when patterns are diverse and intricate with various stakeholders playing different roles and the interests and expectations involved perhaps switching during the process of transformation of research results to applications.

Impact, we realize is not a one-way street concept, and it is often not the consequence of one actor. For example, government measures may have an impact on the research agenda which may lead to new kinds of interactions. Also, actions by researchers do not always lead to reciprocal actions from a stakeholder. Nonetheless, the action still might lead towards an impact. Last but not least, in many fields actors take on different roles, sometimes researcher and sometimes practitioner, which can be the case in such different fields as architecture, law, medical research or biology. The implications of this kaleidoscopic picture for the assessment of impact of research are a prime concern for the SIAMPI project.

What we have been looking for in the cases is whether we can identify contributions to social impacts by connecting productive interactions to outcomes and impacts. Compared to other methods for evaluating social impacts,

- the prime focus is thus on identifying processes that enhance the chance of social impact,
- the second focus is on the social impacts proper.

SIAMPI uses instances of social impact and then traces these back to researchers through the productive interactions between researchers and stakeholders. We do that on the basis of

interviews and documents, and in one case (Health) we have introduced a bibliometric tool to review social impact through tracking down the so-called grey literature.

We have conducted case studies in four fields to explore these ideas: Nanotechnology and – science (in France and the Netherlands), ICT (UK, Netherlands, and EU), Health and Healthcare research (Netherlands), Social Sciences and Humanities (UK, Spain). In this document we review the main results of the case studies by focusing on productive interactions, social impact, and the relation between the two, and present applications of the idea of using productive interactions. We also make some references to differences between national contexts.

For a summary of the four case studies, see Annex 1.

4. Conclusions

In the summaries of our case studies, we have tried to highlight some of the results, with a focus on the two central concepts of the SIAMPI approach, productive interactions and social impact. In line with our three main tasks, (i) the identification of productive interactions, (ii) the improvement of our understanding of the necessity of productive interactions for social impact; and (iii) the development of approaches and tools for assessment, we will now elaborate the major conclusions with regard to our initial approach. We will do so by asking two simple questions: what have we learned and what are the consequences of this for our initial model, in other words what do we propose now as the SIAMPI method?

Productive interactions

The three forms of interaction we distinguished in our initial model (direct, indirect and financial) we encountered in all the cases. However, we were not able to look into these three forms more systematically according to the subdivision in interaction channels that we used (f.e. various communication forms, various financial or supportive arrangements) because of a lack of systematic data. In general researchers keep track of the more traditional output data only. These are the kind of data used in most evaluations, that is, this is what researchers have to account for. However we did see a growing consensus that it is useful and necessary to collect data on other kinds of output, on outcome, and on the ways research is communicated with wider audiences as well. This is last point is important, because we found that publications that reach wider audiences can lead towards productive interactions, simply because this is one way how people learn about particular research that might be relevant for them.

Having said that, we learned in the case studies that there is indeed a large variety of forms of interaction, which can be characterized in terms of potential constraints for achieving social impact.

- The first regards the mode of undertaking of research. We found that researchers working in basic research, in emerging fields, and in highly individualized fields, typically are engaged in direct, personal interactions with relevant stakeholders. In some fields (nano) these 'stakeholders' are researchers in neighbouring fields (and social impact is far away), in other fields (humanities) stakeholders are long time allies outside science (and social impact is almost part of the research process).
- Second, temporality understood as the length of the trajectory from basic research towards applications, is arguably influencing the possibilities to establish productive

interactions that lead to identifiable social impact. The longer the trajectory (as in our nano cases) the more difficult it is to trace a given social impact back to a particular research group.

- Third, we have learnt that the quality of the interactions can vary from very incidental and informal relations to highly organized and professionalized networks. In some fields, productive interactions are highly professionalized (Health care, ICT). In such cases it is arguably easier to trace back the social impact, if only because the partners on both side agreed to work on a common goal. However, since in these professionalized networks power differences between the participants play a role in the elaboration of the research agenda, the kinds of social impacts that occur are also partly a consequence of these power differences (a governmental department that pays for the research vs a patient organisation). Our findings can be seen as an addition to what was concluded in the Ricci report (2005), that “productive interactions are patterned and show that social objectives are materialized through institutionalisation, professional knowledge valuation and collective strategies”.
- Fourth, we found some major cultural differences between countries. In nano in France we found that the cultural environment to some extent operates as a psychological and organizational threshold for scientists to develop social interactions. If this cultural obstacle were to disappear – the interviewees insist - it might become more conceivable to converge fundamental research with a social objective. This is arguably the case in nano research in the Netherlands.
- Fifth, the productivity of interactions also depends on the motivation of the individual researcher to have social impact and deal with societal partners. This is to some extent independent of culture or field.
- Sixth, the sense of urgency with the stakeholder influences the productivity of interactions. This point is connected to the third point above because obviously the authority to influence the research agenda largely depends on the power position a stakeholder has in the network.

Social impact

On social impact we learned or got confirmed the following:

- It is hard to find systematic data on social impact. There is indeed a lack of a consensus about the definition of social impact, and this translates in problems with the collection of robust data on social impact. In our proposal to this study, we mentioned the fact that it is often difficult to identify social impact and trace it back to specific RTD actions or thematic research areas. This is also acknowledged in the Ricci report. That report advises, when it comes to assessing EU projects in particular, to focus on the one hand on success stories and on the other on support for policy formulation. We did this in our case studies, and found other focal points too. For example, looking at the EU level assessments in ICT, the focus has been on recording formal outputs and new products, spin-off companies and jobs created or destroyed.
- Social impact can be distinguished from other kinds of impacts, but there is not always a sharp distinction. There is more overlap with economic and cultural impact than with environmental and technical. We have not attempted to make a sharp distinction and include social-economic and socio-cultural effects in our investigations.³ The decisive

³ The Ricci report (2005) distinguishes as domains for social impact: Human rights, Social cohesion, Economic cohesion, Employment, Human capital formation, Public health and safety, Social protection and social services, Liveable communities, Culture, Consumer interests, Security, Governance, International co-operation, and the Role of SMEs.

criterion is behavioural change. These changes often depend on a broad range of research inputs coming from a variety of fields. For example, improvement in the 'quality of life' may depend on a mix of social and cultural studies, environmental research, studies on food safety, health care research etc.

- By saying that social impact refers to the effects in a relevant social domain, we primarily refer to the non-academic context of the work of a researcher, a research group, -organisation, -programme or -project. The term may evoke a linear image of the relationship between research and society: researchers transfer the knowledge they generate to society. SIAMPI, however, does not follow such an approach. We found in our case studies that social impact is the consequence of iterative processes among researchers and research stakeholders; the latter extending potentially to the whole society, including industry, public sector and government, NGO's, civic society groups, and individuals
- It makes sense to include in the assessment of social impact the possible likelihood of unintended/unexpected impacts rather than to evaluate outcomes against a statement of expected impacts. As we know, results of research that are relevant for society can be the consequence of accidents or chance – i.e. serendipity (with penicillin as the prime example). A newly emerging element in assessment of impact are 'intermediary endpoints', in particular in health research, environmental studies and other policy oriented fields. These refer to intermediary goals of research that form an indication of the expected impacted later in time. For example, you want a reduction in death from a particular kind of cancer, and you work at developing a specific diagnostic that can discover the disease at an early stage. The actual effect of less death is much later in time, but the diagnostic might become available in a few years.
- Discussing the issue of social impact might raise the awareness among researchers and stakeholders. It appeared in a number of cases that there are instances of (potential) impact not known to the management and other researchers that were discovered through the interviews we conducted. In one case, with a clear example of change in behaviour, the stakeholder was unaware of this impact. Through the interview the awareness was raised and the influence became clear to the stakeholder.

Research affects society and the environment in many different ways, and vice versa, some are diffuse and intangible, others more concrete. Social impacts are often not wholesale behavioural changes but more a matter of piecemeal engineering. While we are interested in all possible impacts, we focus on those that are somehow visible as behavioural change. According to the Ricci report, such changes may also result from: (i) revised or new policies in the public sector (e.g. on regulations, standards, etc.); (ii) decision-making in the private sector (e.g. on technologies, innovation, etc.); and (iii) citizens' behavioural changes. That is, next to research, these factors also steer and induce changes in the behaviour of economic players and citizens at large. When assessing research impact, one has to take into account changes that occur in the various societal spheres, and see what the relationship is with particular research programs. It is almost never one factor that leads to a particular social change, research like other social endeavours contributes to change (impact), it does not cause it by itself.

Clearly, this illustrates the overlap between social and other types of societal impacts, and underlines our preference not to define 'social' too narrowly.

On the assessment of social impact

Overall conclusions are that

- Social impact results from productive interactions between research and context, but are not a sine qua non. We found examples of (non-reciprocal) action from the side of researchers resulting into social impact.
- Research organisations have to make serious efforts to gather more robust data on social impact and on research output and outcome to wider audiences.
- In assessment procedures, there are differences that have to be accounted for such as the mode of undertaking of research, temporality, power differences in the context of research.
- Productive interactions can vary from very incidental, personal and informal relations to highly organized and professionalized networks. In these, institutionalisation, professional knowledge valuation and collective strategies are indications for the strive towards social impact. Attention has to be paid to the influence of power differences in the network.
- Social impact can also be shown through instances of success and of changes in behaviour in the socio-cultural domains of society. Funding organisations should put more effort in disseminating these examples as best practices.
- Assessment of social impact includes the likelihood for unintended impacts.
- Social impact can be distinguished from other impacts such as economic, environmental, technical, but there are no clear borders between the concepts, so in assessment it will be difficult to maintain such distinction (For example, improvement in the 'quality of life' may depend on a mix of social and cultural studies, environmental research, studies on food safety, health care research etc. Furthermore, changes in social behaviour can lead towards economic impacts.).

Implications for assessment of FP7 proposals

Finally, we conclude the following with regard to evaluation of social impact at the EU level. While there are three main assessment criteria for FP7 programs: scientific quality, implementation, and impact, we see that for the impact criterion two sub criteria are distinguished:

- a. Contribution to expected impacts, at the national and European level
- b. Appropriateness of measures for dissemination and/or exploitation of results

The conclusion here is that

- with regard to a. when assessing (social) impact, one has not only to look at what researchers promise, but also find evidence of contributing activities to this promise, be it in terms of network activities or output and outcome.
- with regard to b. use the productive interactions as a proxy for dissemination, and also include the strategies of researchers / institutes to achieve social impact.

Annex 1A: Social Sciences and Humanities

Case description

This case examined the applicability of the SIAMPI framework across different institutional contexts in related research fields. The objective was to analyze the social impact of a research initiative funded by the UK Economic Social and Research Council (ESRC) and of the research groups in Social Sciences and Humanities of the Spanish Council for Scientific Research (CSIC). The UK and Spain have different approaches to evaluation and different funding structures. Impact assessment and the focus on research impact have long been an element in the definition and implementation of UK research policies and this is reflected in the funding policies and evaluation expertise of the ESRC. In contrast, there is no formalized approach to impact assessment in Spain and research activities in the Social Sciences and Humanities have often been defined without a formal research project underpinning them. While the ESRC is a funding organization supporting activities in a context where project funding is a key element in defining research activities, CSIC is a performing organization supported to a large extent by core government funding (60% of total CSIC expenditure). In these different contexts impact assessment needs to be conducted in a different way: while the natural subject of an ESRC assessment will be one of its investments and will therefore be clearly time-bounded, for the CSIC, the focus is on research performing units developing their activity over a long period of time, without an end date.

We have analysed the social impact of a large research initiative funded by the UK Economic Social and Research Council (ESRC) and of a number of research groups in the Social Sciences and in the Humanities of the Spanish Council for Scientific Research (CSIC). For the ESRC we analysed the social impact of a “Research Centre”: the Centre for Business Relationships, Accountability, Sustainability and Society (BRASS). At CSIC, we focused on 15 research groups that our previous research had identified as having relevant extra-academic activities and which provided a broad coverage of the wide variety of research fields covered by CSIC in the Social Sciences and Humanities.

Productive interactions

In both cases, BRASS and CSIC, we found that every project or group displayed its own dynamics, building contacts from the bottom up and without apparent central lead. We identified a wide variety of “productive interactions” both in the UK and Spanish cases, with no dominant mode being apparent. There were, however, some distinguishing traits.

- At CSIC direct informal interactions were very important and they were almost always long-term: many CSIC interviewees had known the same stakeholders for more than 20 years. Small research groups had established long-term links with small stakeholder groups (often individual-to-individual) with whom they frequently collaborated without the intermediation of any contractual tool (mainly because the links were not associated with financial arrangements).
- At BRASS many of the of the interactions we encountered had been initiated and developed within the life of the Centre; they did not predate its creation.
- In both cases, however, indirect interactions established through publications were often the initial step that led, eventually to other types of interactions. In several occasions we found that non-academic stakeholders had initially learnt about a researcher or research group by reading their work; this indirect interaction had stimulated the stakeholder to take further steps to establish a direct interaction with the academics.

Personal networks appeared to be important in several of the cases analysed, particularly in UK projects. These were situations in which the direct link between the individual researchers and stakeholders interviewed were not enough to explain the evolving set of relevant productive interactions. A network of common friends and relatives, for instance, enabled the initial interactions between researchers and stakeholders in the Argentinean mining case. The origins of BRASS work with the South Wales Fire Department also lie in professional networks; in this case, a consulting that had worked with the researchers brokered their link with the Fire Department.

Social impacts

As far as the social impacts are concerned, in some cases we found an attributable impact. In other cases, we found an attributable outcome of the interaction whose final impact could not however be identified (see third bullet here under). Further, in other situations the research had been one among other contributions to a complex policy processes. The variety of contributions is illustrated in the following three examples:

- The application of social marketing techniques developed by the BRASS team for the fire services in Wales led to a reduction in grass fires; this effect could be clearly identified and attributed to the application of the social marketing techniques. In this case, the researchers argued, impact could be measured using the same tools that marketing analysts use to assess the outcomes of commercial marketing campaigns.
- The discovery, “translation” and publication of Spanish XVIth Century music was arguably a valuable contribution to the preservation of Spain’s cultural heritage; but the audiences for this kind of music remain small. However, the impact on cultural heritage may arguably be assessed, rather than by the size of individual audiences, by the way in which the specific contributions of the research link with others to help rescue past cultural contributions and to understand them in their original context.
- One of the BRASS projects had helped bring together different communities with divergent interests over mining operations in Argentina. The BRASS researchers had set up the grounds for unprecedented talks across communities with opposing interests and views on mining activities. This can be considered a relevant outcome of the productive interactions of BRASS researchers. Yet, it was too early to determine the final social impacts, in terms for instance of changes in specific mining practices, of the changing social relationships.

Concluding remarks

The application of the SIAMPI approach to the Social Sciences and Humanities has allowed us to identify the broad variety of ways in which productive interactions emerge in different institutional and research contexts. Sometimes, interactions are based on informal, long-term, relations between researchers and stakeholders. In other cases, these interactions come about through indirect contacts, for example through stakeholders reading the work of researchers and seeking them to establish a direct relationship. Sometimes the interactions were brokered by common friends, and therefore rested on social networks in the traditional sense. In other situations, the “broker” was a professional (another researcher or stakeholder). These differences, however, did not appear randomly. In the UK case, interactions were typically brokered by other professionals, whereas in the Spanish (humanities) case most interactions were direct: a simple long-term link between individual researchers and stakeholders. These differences were not evident beforehand; the SIAMPI approach identified them but cannot explain, by itself, why the differences emerge. We found that it was at the early stages of a relationship new links were

brokered by other individuals acting as intermediaries; but we could not beforehand determine whether the PI in a specific research context were to be dominated by long-term relationships or by new links.

The SIAMPI approach, including the interview questionnaire, has been very well received in the case study fields, because:

- It has helped both researchers and their stakeholders to understand the ways in which research and its results can be applied. It has also shed light on the variety of forms of application and of social impact
- it has identified sets of interactions and social contributions that were not yet visible to research managers (not on the research managers radar and as such underutilised/wasted in terms of demonstrating accountability to stakeholders)
- It can be easily introduced in formative evaluation processes aimed at assessment and improvement of practices and it does this, in part, directly through the interviews themselves (interviews as both means of collecting data and raising awareness)

Annex 1B: Health and Healthcare research

Case description

Cases for the health domain were located at two institutes, one at the University of Leiden, the other an independent research institute in Health and Health Services.

- The first one, the Leiden University Medical Centre (LUMC) is a university medical centre that combines patient care, education and research, with an annual turnover of about M€ 580 and about 6.500 employees. With regard to research, LUMC harbours a broad variety of fields, departments and themes. The mission of LUMC is to maintain and expand its long standing tradition of pioneering medical and bio-medical research at the international top in this field, performing top level patient care, and to relate its research to its top clinical patient care. Three departments of LUMC were selected as examples of the varied research practices at the medical centre: Gynaecology, Anatomy (including a cardiology program related to one of the research lines of Anatomy) and Public Health & General Practice.
- The second case, NIVEL (Netherlands Institute for Health Services Research) is a non-profit independent research organization. NIVEL carries out research activities on national and international levels in various related subjects such as health care needs (health status, life style, social environment, norms and attitudes), health care provision (volume, capacity, organizational structure, quality and efficacy) and health care policy (legislation, regulations, financing and insurance). Clearly, the prime goal of NIVEL is to perform applied scientific research that has impact in policy making and among professionals in health care and health care services.

For the various LUMC departments and for NIVEL, several research projects have been studied. In the case of two of the three LUMC departments (gynaecology and anatomy) interviews could only be held with these researchers as the requested information of stakeholders was lacking, Researchers from these departments found the questions during the interview difficult to comprehend in relation to the purpose of the investigation. Earlier attempts of LUMC to establish indicators for societal relevance of research might have raised different expectations among these researchers. For the LUMC department of General Practice and Public Health however 6 stakeholders have been interviewed. For NIVEL, interviews have been held with all programme coordinators and management (15). As NIVEL carries out a large number of projects a sample of 21 projects were investigated in more detail, and interviews were held with 20 stakeholders that were mentioned in relation to these projects.

Productive interactions

Both for NIVEL and LUMC, productive interactions take place in all consecutive phases of projects. In the phase of agenda setting and execution of research direct interactions prevail. In the phase of dissemination and implementation, indirect interactions (publications, reports) occur more. productive interactions display various organizational forms and degrees of intensity. Three characteristics influence the form of productive interactions: a. the mission of the research organization, b. organizational degree and intensity of interactions in the network of stakeholders, c. the variety among stakeholders and the dominance of some of them in the network.

1. The two research organizations studied have different missions: a mission to provide policy relevant work on the basis of scientific research (NIVEL) and mainly science oriented research (LUMC). As a policy oriented institute that depends largely on externally funded projects, NIVEL sees its mission to be a network organization.

Interactions at NIVEL are more frequent and more organized than in science oriented departments at LUMC, in particular in the phase of agenda setting and execution of research. By contrast, the department of Anatomy sees its mission to deliver stem cell research that stands out in the international community of stem cell researchers. As this is basic research, clinically relevant research is only expected in the long run, and researchers are hesitant to interact with public audiences, patient groups and other stakeholders. This reluctance is also caused by the public and political sensitivity surrounding this topic.

2. The organizational degree and intensity of interactions in the network of stakeholders varies, also in relation to the mission of the research institution. At NIVEL, interactions in the phase of agenda setting and research display characteristics of formal organization, both at the level of the organization as a whole and in individual research projects. NIVEL holds formal consultation rounds with various stakeholders (both among funding agents and non-funding stakeholders), and organizes user groups for research projects. Also, during projects, research on political sensitive issues is monitored at the institutional level by the management team. Similar patterns to organize stakeholder interaction occur in science oriented departments at LUMC. Though less intense, interactions are noticeable at the departments of Public Health and General Practice, where the agenda for projects on health care for the elderly is set in close interaction with stakeholders, including general physicians, nursing homes and local and regional health authorities. Projects too are carried out in close cooperation with these stakeholders. Although these organized forms of direct and indirect interaction are readily carried out by departments, the impetus comes from external sources. In the case of Public Health and General Practice, the interaction is required by ZonMw, the major funding agent for Health in the Netherlands. Two other departments also have interactions with stakeholders in the phase of agenda setting and research. In cardiology, interactions are institutionally sustained through a Public Private Partnership in a large consortium. In Gynaecology, the initiative for the agenda is taken by researchers rather than by stakeholders. Moreover, stakeholders are limited, as the interaction concerns mere student exchanges and patient information. Characteristic both for LUMC departments and NIVEL is a positive relation of duration and intensity of the interaction with stakeholders with its prospected social impact.
3. Diversity influences interaction in three major ways: (i) stakeholders vary in dominance. As appears from the interviews (and this is confirmed by the literature): funding agents may be dominant in the phase of setting the research agenda, in particular if these agents fund large proportions of the projects of an institute. This is not only an issue with private funding agents. Ministries can be dominant too. (ii) Secondly, researchers themselves can be dominant in the network of stakeholders. According to ZonMw, university researchers appeared to be too dominant in setting the research agenda in formulating research projects with other stakeholders. (iii) Thirdly, stakeholders may differ in insights and interests and have unequal weights in influencing interactions. This leads to a need for accommodation of diversity among stakeholders and researchers. This is the case with NIVEL, where policy oriented work often touches on politically sensitive issues, but also at LUMC, e.g. in preparing medical guidelines.

Social impact

Social impacts in Health are often not wholesale changes in behaviour of stakeholders but confirmative impacts with piecemeal or incremental alterations of policies or professional practices. Examples are reports on manpower planning, or the monitoring of social participation

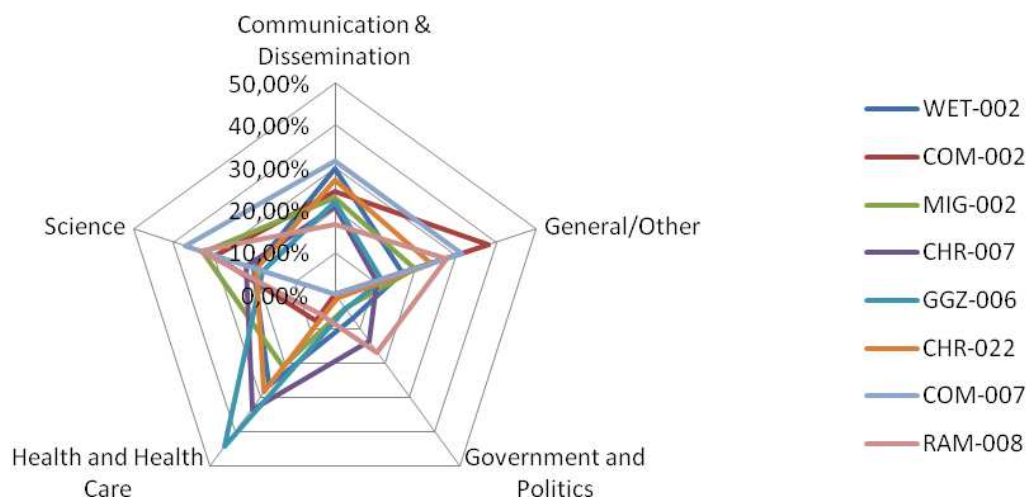
of chronically ill and disabled that largely confirm current policies regarding educational capacities at universities, or the adjustments in current policies regarding reimbursements for the chronically ill. Such incremental alterations often involve attuning of resources or maintenance of (policy) practices among stakeholders. Occasionally, behavioural changes in Health are presented as wholesale changes, such as the (political) decision to postpone the establishment of a local health centre for the elderly. This decision was taken in the face of research indicating that such centers raise spurious rises in health care. The example makes also clear that changes might involve political decision-making in a field of stakeholders with varying interests. Interactions often involve broader ranges of impacts: firstly, many expectations about impact involve developments in the longer term. This is in particular the case with basic medical research in clinical applications for stem cell interventions, but other impacts (new guidelines for GP's or the monitoring of needs for care among (ex-)cancer patients) too are to be expected in the longer run. These are sometimes measurable, e.g. as compliance of GP's with the guidelines in diagnosis, but otherwise difficult to attribute as changes in behavior depend on a variety of factors. Secondly, broader impacts involve a multitude of stakeholders. This is the case with medical guidelines, involving several professional organizations, the involvement of universities, ministries and professional organizations in the aforementioned manpower planning, the investigations of environmental health care effects of a large steel mill, involving GP's and the people in the neighbourhood. Lastly, impacts may involve unintended outcomes that may also bring new actors into view, such as the organizations responsible for the placement and location of measuring stations for environmental hazards that got involved in the aftermath of the environmental investigations in the case of health concerns near a steel mill.

Social impacts can often only be identified some time after the research results have been publicized. We can however use a proxy-indicator of social impact by analysing the social response to reports, papers and other output through a bibliometric method based on databases that include a broader output than just the scientific publications. We have conducted such an analysis in the case of NIVEL and it shows a wide variety of interested stakeholders in various domains.

We have explored one particular form of social impact (social response) in a systematic way. Impacts of research results among stakeholders can be traced (measured) on the internet by using the so-called Contextual Response Analysis (CRA). This method records internet usage of publications, press releases and other online or written material using one or more search engines, and classifies the URL that refers to the publication or other sorts of output according to the domain or sub domain in which the user/URL operates. The results of the method allow an analysis of the response of specific documents and other products in terms of the intensity of use and of the origin of the users according to social domains or the subdivision thereof.

A contextual response analysis was performed of some of the NIVEL publications that have been produced in relation to the projects investigated in this case study. The graphic above displays the origin of users in five main social domains of NIVEL. WET-002 through RAM-008 are NIVEL codes for various research projects each having different stakeholders and domains of interaction. As is apparent from this figure, usage is not restricted to academic stakeholders. Users are also found among hospitals, local health authorities, general practices, for-profit and non-profit advisory agents, professional organizations or health insurance companies (Health and Health Care). They are also found among the many websites and institutes that translate and transmit knowledge and information for wider audiences and among newspapers and news

websites (Communication and Dissemination). In the category of General or Other, various users can be found, such as (personal) blogs, and organizations and businesses in other domains than health.



Internet responses such as shown here are not arbitrary or superficial. In total, almost 30% to 50% of all references were found in the form of documents or PDF's, which indicates that many of the references are made in documents produced or listed by organizations.

Concluding remarks

1. Even though social impacts are not expected to be immediately realized or attributable to outcomes of research, stakeholders and researchers often seek productive interactions in order to achieve impact. In the examples from health, these interactions appear mostly to be organized by internal or external institutional frameworks for stakeholder involvement. Institutional frameworks for interaction seem crucial to stimulate interaction particularly in the phase of agenda setting for research projects. Successful frameworks for interaction pay attention to checks and balances in order to maintain leverage among stakeholders and researchers. Parties may be dominant in the interaction, due to prominent positions in funding, such as industries and governments. However, researchers appear dominant too, in formulating projects, to the detriment of stakeholders with little experience in research. Productiveness of interaction is also promoted by the density of interaction: if researchers and stakeholders combine various kinds of interaction, the possibility of realizing social impacts increases.
2. Stakeholders in the field of health have differences in interests and insights, as is also apparent here. In view of the possibility of unequal (dominant vs weak) stakeholders, it is of interest that examples were found in which interactions with a diversity of stakeholders was sought after. Involvement of a diversity of stakeholders in phases of agenda setting and research, in particular in relation to possible differences in insights and interests might stimulate leverage and balance. Also, transparency over funding relations and systems of checks and balances to curb unwanted contextual effects
3. Impact analysis at the level of projects (instead of institute or program), for example by a contextual response analysis is useful to identify impacts but also to identify stakeholders and stakeholder domains outside of the interactive network.

Annex 1C: Nanoscience and technology

Case description

Nano-science and technology is a broad denominator rather than a particular field. It ranges from “from basic research (such as single-molecule devices and new materials) through to applications (in, for example, nanomedicine and data storage)”. We selected more specific fields of research activities at the nano-scale. We studied cases in France and the Netherlands.

- The Institute des Nanosciences de Paris (INSP) which is simultaneously a national and local body, consisting principally of Centre National de Recherche CNRS personnel, yet also engaging many others employed at the University of Paris VI-Marie Curie (part of the Sorbonne).
- The research group ‘Molecular Nanoscience’ at the Laboratoire de Photophysique Moléculaire LPPM (University Paris XI-Orsay) and their sister group at the Laboratoire de Physique et de Spectroscopie Electronique in Mulhouse. The Molecular Nanoscience group focuses on molecular machines, consisting of a single molecule. The Mulhouse group is specialized in simulation.
- Research being conducted in the national consortium on nanotechnology (“NanoNed”) especially on miniaturization in semiconductors, linked to broader denominations such as nano-electronics and nano-materials. Groups from the University of Twente were studied.
- Faculty of Electrical Engineering Eindhoven, which includes research on devices and systems, some components of which (such as transistors) are realized in existing CMOS processes at dimensions below 100nm. This can be considered ‘nano’ in the sense of scaled technologies though it is not bottom-up nano.

One of the reasons to include Nanoscience and technology in the areas to study was the amplitude of promises and expectations in this field about possible social impacts, and also because it is a rather new field. We expected to find emerging stakeholder contacts and productive interactions around specific impacts. However, we found this was rarely the case. What we did find was overall a large distance between actual research interests and social impacts in terms of end-user products. Because of this long temporality it appears to be difficult to connect any (potential) social impact to the productivity of interactions in this emerging field of nano-scale research and engineering. That is, if social impact is understood as product use by end-users. However, if we understand social impact as uptake in industry, we found some examples of such uptake.

Productive interactions

The interaction between researchers and stakeholders in this area is characterized by a very broad network and a long temporality. Stakeholders in this domain are a combination of actual and potential audiences of interaction and uptake, the boundaries of which are dependent on the kind of research a group is doing. For a group working on more fundamental issues of nano electronics, actual audiences are primarily other nano research groups; potential audiences are in the first place the ‘more applied’ groups that could act as potential intermediaries between research and industry. These more applied groups have actual audiences both among other nano research groups, as well as industry. But large parts of industry are better conceived as potential audiences, e.g. those customer firms of firms that are actual audience.

At TNO, an applied research institute in the Netherlands, researchers relate both to immediate contract partners but sometimes also to their suppliers. In the Dutch sample, TNO is the one

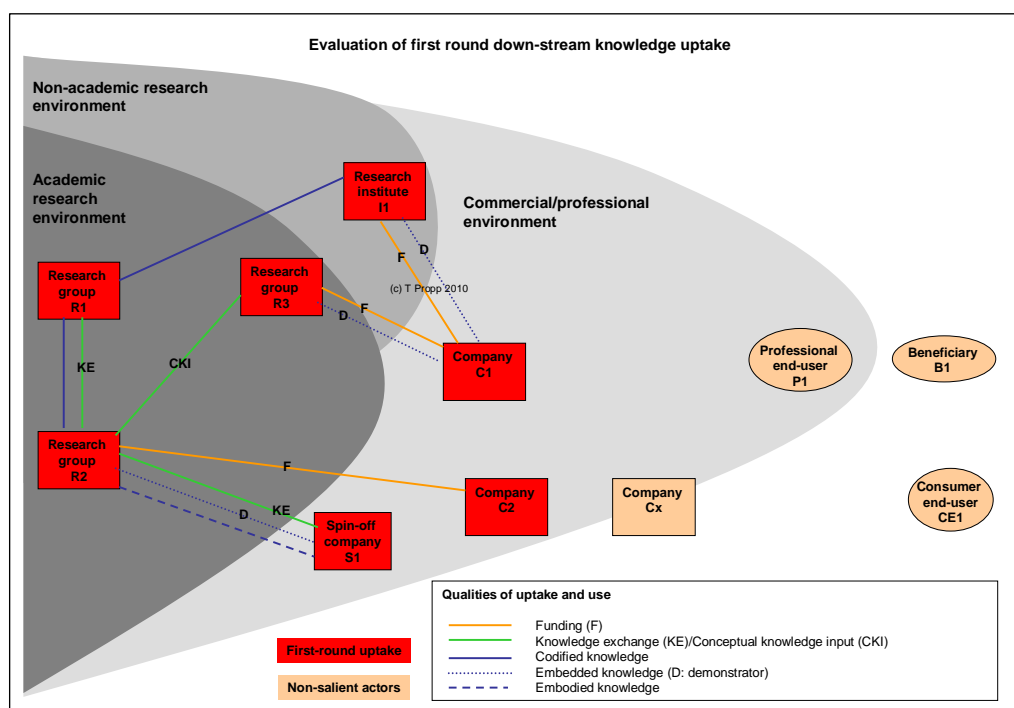
example that – depending on the case at hand - penetrates most deeply into existing innovation chains.

The productivity of interactions in this area of research is hard to connect to social impact unless this is understood in terms of communication with other, more applied research groups, or as uptake in industry. Social impact is perceived in this field as referring to the long pathway from basic research to applied research to commercial engineering and further to product development and market introduction (be it the business-to-business or business-to-end-user market). Researchers in basic research as a rule do not have direct productive interactions with end users. Their interactions are focused on earlier sections of the pathway.

Social impact

In this area of research, in order to understand the generation of long term impact from research, a network perspective is of crucial importance. ‘Network’ means not only a network at a particular moment in time but also the uptake, transformation and exchange of research results in innovation chains over time. These chains are networks that are often only connected by one node; for example, one of the research groups produces in joint projects with firm X demonstrators for analog-digital converter (ADC) integrated circuits. Firm X then, after upscaling, sells these as ‘discretes’ (components) to their customers. The research group rarely interacts with these customers.

For the group at TNO the case is different in that the organization has to stay close to industry, which can include the supply chains of paying project partners.



Annex 1D: ICT

Case description

ICT research represents a huge investment for Europe. Since the start of the Framework programmes it has been seen as an absolutely critical technology for economic growth and development, in the context of around 30 years of anxiety about Europe's technological and business performance in ICT. ICT public research programmes have been key both at national level (for the more technologically advanced countries of the EU) and at EU level, and thus provide us with a case study area where we will look at multiple levels of productive interactions and their contexts. We have explored productive interactions in ICT research in two national settings (UK and the Netherlands) and at EU level.

- In the UK we have focused on applied ICT research from two successive national programmes: the UK e-science programme and the Digital Economies programme. In particular we looked at a 14M€ million research hub 'Social Inclusion through the Digital Economy' which aims to tackle social exclusion by making it easier for people to access the life-changing benefits offered by digital technologies. This Hub is based at Newcastle University, in collaboration with the University of Dundee. It addresses four fields where the application of digital technologies could deliver major social benefits: connected home and the community, accessibility, inclusive transport services and the creative industries.
- In the Netherlands the focus has been on research projects within the Department of Informatics of the Free University of Amsterdam. The Department consists of around 230 people, including support staff. The Dutch case covers a range of computer science and ICT research from highly theoretical to applied (high performance distributed computing, theoretical computer science, knowledge representation and reasoning).
- Our work at the EU level has focused on the ways in which the social impacts of Framework Programme projects have been evaluated and a meta-evaluation of stakeholders and productive interactions from previously conducted impact case studies of ICT projects within the IST programme. The actors and their roles within the project were identified and attempts made to determine the productive interactions between the actors and the identified and expected social impacts.

In all, we conducted 37 interviews, of which 17 were with stakeholders and 20 with researchers.

- The UK case study team started with a scoping exercise to identify a suitable research programme and to understand the national policy context in which researchers and funders operate. We visited key stakeholders in ICT research in the UK: the Engineering and Physical Science Research Council evaluation unit and ICT unit, and evaluation units in the Medical Research Council and the Department of Business, Innovation and Skills (the parent funding ministry). Further scoping meetings were held with senior ICT academics at Manchester University to discuss the issue of stakeholder engagement and measurement of impact. The main case study work was carried out at Manchester, Newcastle and Dundee universities.
- For the EU case, 3 officers from the European Commission, DG Information Society and Media were interviewed. In the first interview, we explored the role of ICT research, development and roll-out in the Vision 2020 and in the second we consulted members of DG InfSo's impact assessment team about relevant studies and practice. Following this, we examined secondary data from detailed impact assessment case studies of large EU

ICT projects in the area of applied ICT (the IST programme) and in particular two previous projects (AVANTI and IMAGINE).

- The Dutch case study was conducted at the Department of Informatics, which is part of the Faculty of Sciences of the Free University, Amsterdam. The choice of case was made from a possible 12 computer science departments in Dutch Universities. After careful consideration the department selected was chosen because it is large and has a good scientific reputation based on research assessment, it also covers a broad range of computer science from theoretical through to more applied. There was evidence of interdisciplinary collaboration by the computer science staff with economists and social science researchers. For the Dutch case study 3 interviews were conducted with research professors and four interviews with stakeholders: the scientific programme director of a multinational electronics company, a representative of a not-for-profit ICT service provider, a former employer of a small software developer and researcher in a university medical centre.

Productive interactions

We have found that productive interactions are highly present in ICT research. We have found a variety of stakeholders actively engaging with research, during its conception and execution and in bringing about impacts and effects. The UK ICT projects had stakeholders in the form of professional groups (healthcare planners) and third sector organisations (charities and organisations representing social groups such as older adults and dementia sufferers and their families), small and large firms and regional economic development bodies. Similarly, the Dutch case study showed multinational and small companies in ICT, communications hardware and software, Ministries, railway and shipbuilding companies and a not-for-profit organisation. Both the Dutch and the UK cases showed that other academic communities can be considered as stakeholders, as the ICT research is translated into tools and grids (e-science). At EU level we see again a range of different sizes of company, some within ICT and others applying it, and many local authorities and third sector organisations.

A feature of our ICT case study (particularly the applied research) is the structuring of productive interactions into the research projects from the outset. These interactions will include interactions with officials from University/EC or user groups and expert advisory groups. Strong engagement with stakeholders during a research project can be essential to the success of that particular piece of research and result in a final product or deliverable that changes the way the stakeholders do their work. Without the interaction of the stakeholders the research cannot be undertaken to produce a successful output of use to the user community. The productive interactions built into projects help the researchers to demonstrate a path to impact, and allow testing of emerging results. Our Dutch case showed, however, that the stakeholders do not frame the research projects – their input allows for modification of the researchers' questions, and researchers will walk away if stakeholders impose conditions which they cannot accept. An example of this is a company forbidding a Dutch research team to involve researchers from certain national backgrounds due to security concerns.

Although productive interactions are commonly built in to applied ICT projects, we have seen that interactions with other stakeholders may take place during or after the end of the project which then become important for achieving social impact, for example another company taking forward results for commercialisation.

An example of direct productive interactions structured from the outset into the UK Digital Economies Hub project includes regular demonstrations by researchers of the technologies developed from The Ambient Kitchen work being undertaken. The Ambient Kitchen is a lab-based project through which the research team is exploring the use of pervasive computing for assisted living. The project team are particularly interested in supporting the elderly and those with dementia. Researchers hold regular planned and unplanned opportunistic demonstrations for a variety of groups such as university students, representatives from other universities, members of the public, city council members, company visitors and the media. The concept of delivering demonstrations to a variety of groups was planned but the type of audience is subject to opportunities emerging during the timescale of the project.

Both Dundee and Newcastle Hub sites have professionalised the interactions with users. This was being achieved through the employment of staff to specifically recruit users and facilitate user groups and user interaction with the research. At Dundee University the computing department building facilities had been designed to facilitate interaction. This professionalisation of interactions with social groups from the local communities occurs at a level comparable to professionalisation of interactions between the universities and commercial/business world within technology transfer offices.

During the course of our study we identified particular networks that are helping to shape the course of the research activity and who helped with the design of the research activities themselves. Networks of project partners from previous European projects were engaged in the design of new projects. Successful and productive interactions with partners met on previous projects can be used to formulate a strong consortium to conduct effective and well informed future research. For the day to day activity of the research projects networks of available users are an essential part of the process. The concept of the user network may be embedded into the day to day activity of the research department making users available for a range of student and professional research projects. These users may be regular attendees at group drop-in sessions or occasional visitors. The engagement of users in research activity helps the research evolve and grow as a continuous and on-going area of investigation, beyond one specific grant. The EU context is important here, as funding is needed to involve companies and not-for-profit organisations within projects.

The Dutch team determined that all ICT fields have at least some direct linkages to societal partners. We found several examples of institutionalisation of interactions between researchers and stakeholders. From data on the case of the Free University of Amsterdam, a pattern could be inferred of developing interactions, starting with informal interactions towards formal collaborations between organisations. Often however the informal interactions are as valuable as the formal collaborations for knowledge exchange. We found this also to be operating with the UK, as the Hub has been built upon years of interactions with particular companies, third sector and social groups as well as incorporating some new ones. The Dutch case brought out some of the difficulties inherent, for example the different “cultures” of stakeholders and academics in terms of time pressures, priorities and interests in the research. These differences are already well-known, but should not be forgotten in our approach.

Social impacts

A clear result emerging from the ICT case studies concerns the time required to social impact. Timelines for the impact of a specific research project depend on the nature of the research

undertaken and are often longer than expected, 5 to 10 years not being unusual. Some researchers produce knowledge or products that can be readily applied by social partners. Others play an enabling role; their knowledge and products can be used by researchers from other fields such as, psychology, biology or medical research, for example to solve problems related to data analysis. Other researchers may work on the more theoretical end of the computing spectrum and thus play a facilitating role more applied ICT researchers.

The social impacts from ICT research are various and almost unlimited, since ICT is an enabling technology, which can be applied in numerous ways, not only products and services but in how citizens interact with government, in healthcare and the environment. In our case work we found examples in safety impacts, for example, around railways, medical practice or computer networks. Economic impacts include cost reduction, marketable products, establishment of spin off companies and the creation of new jobs. There are also social impacts which encompass social inclusion or impact on local culture. Policy impacts including decision making and provision of information for policy and also academic impact, examples here include enabling imaging in medical science, enabling model building in biology and enabling database analysis in social sciences.

Some conclusions

From the ICT case study undertaken during 2009/10 of both completed and on-going research projects we have been able to identify a range of productive interactions, give examples and present rich stories, from which we can draw a number of lessons. These lessons are detailed below.

Setting up the circumstances for productive interaction does not guarantee social impact. Some of the case study researchers demonstrated they are strongly motivated to achieve social impact but others in different projects are primarily focused on their research outputs not on the social (and economic) impacts of the research results. We saw examples of both with UK case study respondents designing their research with integrated stakeholder participation and concern for social impact. The Dutch respondents were more focused on their research outputs. At EU level, researchers were hoping to achieve impacts but needed to think about the next research project and local government priorities changed and indeed technology changed, as it does in this fast-developing area.

Social impacts are vague, desired medium to longer term outcomes. The researchers focus on the research and there is no guarantee of social impact. There needs to be the appropriate market support from commercial companies, Non-Government Organisations (NGOs) or policy actors to implement. Some interactions will require a decision, policy action, new regulation or decision by a company to commercialise a product from an organisation outside of the project and possibly quite removed from it in order to have an impact.

ICT is an enabling technology. Its impacts are diverse but usually unnoticed by the end user and so difficult to measure. At EU level, the focus has been on recording formal outputs and new products, spin-off companies and jobs created/destroyed, but without much reference to the context for achieving impacts (such as market and regulatory conditions). However, in project selection, attention is paid to the composition of the consortium, and so our understanding of productive interactions should have some potential to help in evaluating projects.

In conclusion to our case study approach we are now able to incorporate our identified productive interactions into evaluation methodologies and check lists. The case study has, for the UK/Dutch SIAMPI team, been an important development towards a process to allow the development of an evaluation method to identify non-monetary impacts. The SIAMPI approach enables a better understanding of the reception of academic knowledge by stakeholder groups in society and to start to understand how events in society enable impacts. A fuller approach might incorporate the development of scenarios for impact with stakeholders.

Annex 2: SIAMPI team

SIAMPI is a two year research project, which runs from March 2009 to March 2011. It is funded by the FP7 Science in Society program. The SIAMPI consortium is:

- Jack Spaapen, Royal Netherlands Academy of Arts and Sciences (KNAW, the Netherlands), coordinator of SIAMPI
- Kate Barker of the Manchester Institute of Innovation Research, part of University of Manchester, UK
- Peter van den Besselaar of the department of Science System Assessment of the KNAW Rathenau Institute and the Free University Amsterdam, the Netherlands
- Barend van der Meulen of the department of Science System Assessment of the KNAW Rathenau Institute, the Netherlands
- Jordi Molas-Gallart of INGENIO, a joint Institute of the Consejo Superior de Investigaciones Científicas (CSIC) and the Universidad Politécnica de Valencia (UPV), Spain
- Terry Shinn of Fondation Maison des Sciences de l'Homme (MSH), France
- Leonie van Drooge is executive secretary at l.vandrooge@rathenau.nl

The case studies have been conducted by:

- Ad Prins: health
- Tilo Propp (Rathenau Institute) and Anne Marcovich (MSH): nanosciences
- Puay Tang (SPRU), Elena Castro Martinez (CSIC): Social Sciences and Humanities
- Stefan de Jong (Rathenau Institute), Deborah Cox and Diana Pierson (MIOIR)

The SIAMPI website is www.siampi.eu