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Strategic research planning: increase the impact of public research by integrating user-perspectives in planning and evaluation

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1. Introduction

The European Union has the ambition to develop Europe into one of the most knowledge intensive regions in the world with high-level investments in knowledge development, and with a fast and effective translation into economic and societal innovation. While the level of scientific production (publications) and quality in Europe is fairly high, the concern still is that the research is not being converted into successful wealth-generating innovations, new businesses and societal impact. Policy makers have been addressing this so-called 'European Paradox' recurrently in the discussion about effective science commercialization policies to increase the social and economic impact of research. Social legitimatization of publicly financed research organizations, programmes and institutes has become of great importance. This increased policy attention for the societal and economic impact of research is however not exclusively a European trend. Also emerging countries such as Brazil and Mexico are putting this topic higher on their agendas, often as part of an increased attention towards innovation and innovation policy. And, although the competitive position and quality of the Latin American scientific and productive systems still differ from the European systems, these countries are catching up rapidly and acknowledge the need to capitalize their public investments in science in order to secure the countries' further growth and development.

This paper aims to contribute to the exchange of experiences about science, technology and innovation policies in Latin America and European countries and is to be presented at the Europe-Latin America Conference on Science and Innovation Policy Conference (PRIME) in Mexico City on the 24th to 26th of September, 2008. Although the contents are mainly based on European experiences, the issues discussed can be of importance for Latin American countries that want to increase the relevance, use and impact of their publicly funded research. More specifically, the paper provides strategies to plan public research programmes together with potential users and other stakeholders in such a way that relevance, use and impacts already play an important role from the start, and are therefore more likely to be realized. Second, we offer practical guidelines to monitor and evaluate the valorization and impact of public research, in order to legitimize the investments that have been done and improve the impacts and relevance of research in the future. Our main assumptions are that publicly funded research can be more successful in terms of relevance and impact if it:

1) Is based on clearly defined objectives (in terms of activities and outcomes) and is being supported by sufficient resources to carry out the planned activities effectively
2) Is being monitored and evaluated in the light of these objectives, with not only a focus on economic benefits but also societal benefits
3) Is planned, executed and evaluated with the involvement of users and other stakeholders.

We will further elaborate on the first element in section 2. Here we will provide guidelines for the (user-driven) planning and programming of publicly funded research, describe the relationships between mission, objectives, actions, monitoring and evaluation and introduce a model we have designed for strategic research

programming based on literature and practical experiences in the Dutch and Flemish research policy context. In section 3, particular attention will be paid to the role of monitoring and evaluation of research programmes and several suggestions will be given on how to monitor and evaluate the societal impact of research. In section 4 we will discuss the crucial role of users and other stakeholders in both the programming and evaluation processes in order to increase the relevance and impact of the publicly funded research. In section 5 we draw some general conclusions deriving from the previous sections.

The contents of the paper are based on literature and experiences from various evaluations, impact assessments and consultancy projects conducted by the authors in the past years for public research organizations, governmental bodies and competence centers in the Netherlands and Belgium (Flanders)[1].

2. User-driven Strategic Research Programming

To decrease the distance between producers and users of knowledge and to be able to produce relevant research and develop successful innovations, interaction with users is indispensable. This also has been argued since years by various authors such as Rothwell (1986) and Von Hippel, (1976, 1986 and 2005). Six inter-related motives for user-driven research programming and evaluation can be found in the literature on user involvement in science and technology development:

- Improvement of networks
- Improvement of the strategic process
- Guarantee that a relevant problem will be investigated
- Increasing support for the research and its results
- Increasing (economic) success of the research results
- Articulation of demand

First, user-driven programming improves networks between researchers, knowledge appliers and other stakeholders (Allen, 2002). However, cooperation and networking is not an objective in itself, but a means to increase the potential success of knowledge production and use (Mowery, 1998). Second, user-driven programming and planning helps to define mission, vision and values together with the stakeholders who eventually will need to use its outcomes. This directly relates to the third motive, which is that the interaction with stakeholders guarantees that a relevant problem will be investigated, since owners of the problem have suggested it (Allen, 2002 and Gijsbers et al, 2000). Fourth, decisions taken on research programmes will find more support if they are taken based on the stakeholders' inputs. A better understanding of the needs of users and other stakeholders, both during the definition and execution of the programme, has positive effects on the understanding of the research results and willingness to use them (Kothari et al, 2005). A fifth motive, and logically following from the above, is that the economic success of research and its results increases when supported by the users and other stakeholders. This is for example stressed by Seth & Parvatiyar (1995), who claim that the success of marketing is related to the interaction

[1] E.g. the Flanders Institute for Biotechnology (VIB), the Netherlands Genomics Initiative (NGI), the Strategic Basic Research Programme of the Flemish Government (SBO), 11 Flemish Competence Poles and Strategic Research Centers, and the Leiden University Medical Center (LUMC) in the Netherlands.

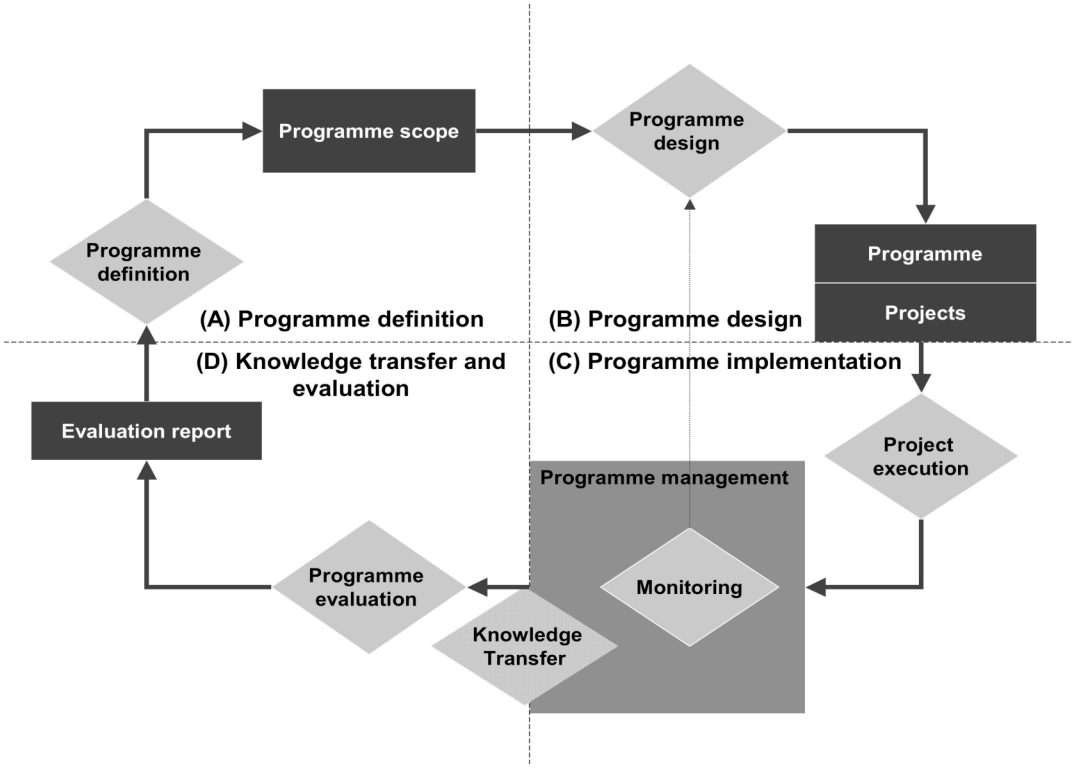
with users during the knowledge creation and product development process, and not to the amount of attention paid to results and distribution only. Moreover, research carried out by Gruner and Homburg (2000) shows that the interaction with users of knowledge and technologies in the first phases of the R&D process is strongly correlated to the product success. Finally, the involvement of users in knowledge creation and product development can lead to the better articulation of demands. In case a programmer defines a project or research in which several parties can participate by expressing their interests, this can lead to a 'demanding market' (Lauglaug 1993).

The guidelines in this paper may help organizations and policy makers to develop and implement user-driven research programmes and projects effectively. Although R&D is considered to be an important activity for a country's development, individual investors do not always have sufficient incentives for doing R&D, even though the innovations may be of societal value. R&D involves huge expenditures and runs the risk of high failure rates or low profits, because of the leaking of knowledge, spillovers and the problem of free riding (Kabiraj, 2007). Doing collective research, in which several parties cooperate in a research programme, could be a solution and stimulus for R&D performance and innovation and is often supported by governments and large research organizations.

Even though there are several ways and methods to develop such a collective research programme, we've found from the literature[2] and our experience that the process at least includes the following phases: programme *definition*; programme *design*; programme *implementation*; and programme *evaluation.* Evidently, the process is not linear with a clear beginning and end; phases feed into each other and the programmers of research often have to step back or jump over a phase to develop the most advantageous research programme. In other words, the programming process is a cyclic process, and we have tried to visualize this process in Figure 1. Ideally, the programmer goes through all four phases when developing a research programme. We can illustrate these phases as following: The programme will be defined by describing the scope of the programme (A). The programmer or programming organization then will be able to design the programme and the individual research projects (B). In the programme implementation phase, the programmer monitors the different projects that are being executed (either within the programming organization or by others), and on occasion he manages valorization of knowledge that results from the research (C). In this 'ideal' cycle, the programme will be evaluated and suggestions for improvement and feedback will feed into the follow-up programme, or in other programmes (D) (Technopolis Group 2007a).

[2] 'Ideal' processes of research programming were described by several authors, such as: (Thiry, 2004; Gijsbers, 2000; SenterNovem (2005); de Wit (2005); Allen et al (2002); DTI (2004); Arnold et al (2004); Strata (2004) and others.

Figure 1 Cyclic model of research programming



Source: Technopolis Group (2007a)

Before we elaborate on some of the elements of the model, a few concepts need some further definition. By the term *research programmes* we imply in this paper those programmes that are organized by governmental bodies or research organizations aiming to have economic or societal impact in the short or middle-long term. Ideally, these programmes consist of a number of projects that constitute a whole and contribute to the programme objectives, and often are executed by different parties or collectively. Research programmes can be generic or specific, where a specific programme has clear programme objective, usually already translated to projects. Generic programmes consist of open projects, to be defined within the general objective of the programme. In generic programmes a rather open call is launched for researchers to submit a proposal that will be assessed by experts. A generic programme requires deep knowledge of the project applicant, time, and a good understanding of its needs (Strata, 2004).

When we use the term *demand,* we refer to the needs and demands of users of knowledge and technologies deriving from research programmes, such as public and industrial (professional) customers, intermediary organizations, suppliers, or the general public. Research and innovation is demand-driven when it is, according to its users, 'needed'. Or, when the user is involved in the problem solving process; when he contributes to the development of a guideline, prototype, or process; uses it in another application or further distributes the knowledge to third parties. Furthermore, the term demand refers to the choices of stakeholders, their participation in and expression of interest for the research planning and evaluation process. Using the term demand in research policy and planning is not about privileging the economic grounds for research over non-economic ones, or privileging short-term wishes over long-term wishes (such as blue sky research where demand hardly exists), but it is

about expressing wishes and participating to increase the societal *and* economic benefits of science and innovation (OECD, 2006).

The notion of *collective* research planning is understood in a rather sociological sense and refers to how demand can be articulated based on the specific interests of groups of users, such as companies, suppliers or end-users, rather than on individual interests. After all, many research organizations receive some support of the government to serve the needs of more than one actor in society.

Valorization, finally, is a term mainly used in European countries in the discussion about the need to turn knowledge into value in the knowledge-based economy. According to Andriessen (2005):

> *"its origins can be traced back to the discussions within the bureaucracy of the European Commission about the Lisbon Agenda and the debate about policy measures to turn the European economy into the most dynamic knowledge-based economy in the world". (..) "Valorization is a French word which means 'to make useful, to use, to exploit'. Knowledge valorization can therefore be understood as the process of making use of knowledge.*

Other terms used to describe this process are exploitation, commercialization, and value extraction. Important aspects of valorization are business development, business generation, activities in the area of translational research, but also societal valorization such as dissemination through education, networking platforms, communication to the broader public, et cetera. Thus, valorization could refer to economic value creation, but also to societal value creation.

In our introduction we claimed that publicly funded research can be more successful in terms of relevance and impact when it is based on clearly defined objectives; when it is being monitored and evaluated in the light of the objectives; and finally, when it is planned, executed and evaluated with the involvement of users and other stakeholders. In order to warrant these elements, we argue that a few key questions need to be taken into account during the strategic research planning process:

1) What *themes* can be addressed?
2) How can the general *objective* be translated into concrete programme objectives and how to translate these objectives into coherent activities?
3) What *resources* can be allocated to which activities?
4) *Who* will be *using the results* of the different activities, and what are the characteristics of these users?
5) *Who* will be *executing the research* and the projects in the programme?
6) How can the *success* of the programme be measured and with what indicators?

The objectives and preconditions of the programme should be in line with the mission statement of the organization, and they ought to be SMART (specific, measurable, accepted, realistic and time-dependent). The programme objectives could range from a purely economic objective (to commercialize the research results) to objectives to improve society at large. An important factor in defining the objective of the research programme is defining the level of ambition: what impact does it want to have? Examples of economic and societal objectives could be the increase in productivity, the increase of competitiveness and the increase of employment (Technopolis Group, 2007b). To develop a coherent set of hierarchical objectives, the programmer might distinguish between general objectives, specific objectives and operational objectives.

The general objectives are the overall goals of the programme, and should be expressed in terms of the outcome or ultimate impact. The specific objectives are the immediate objectives of the programme, expressed in terms of the direct and short-term effects. The operational objectives finally, should be expressed in terms of output that directly can be measured by the research programme manager (EC, 2005). When the objective is well defined, it is easier to involve the right users and define research projects that will lead to useful outcomes. It will also ease the monitoring and evaluation of the programme.

The translation of programme objectives into projects can be done in various steps, ranging from theme definition, idea generation, idea selection, project proposal and project selection. *Ideas* signify the description of projects or ideas for projects, but with little detail in terms of objectives and content. *Project proposals* on the other hand are more detailed, containing a concrete description of activities, planning and budget. Idea generation provides the programmer with many different options for projects, well-developed ones or those still very elementary. When selecting ideas, these first need to be analysed: what is their contribution to programme objectives? Is there an overlap in ideas? How realistic are they? How many parties are or can be involved in executing these ideas, and how committed are these parties?

Potential users of the research results can be asked to select ideas in one or in several rounds in an iterative process. The steps that can be taken to translate programme objectives into projects do not have a standard order, but vary depending on the wishes of the programmer. For instance, ideas can lead to themes, which lead to more ideas, and finally to project proposals. The programmer can also build a programme by translating project ideas that are brought up by potential users, to project proposals while testing their commitment and filling the gaps in creative sessions. This way, the programme will be coherent and attractive for as many users as possible. The more the users are involved in this stage, the better they will become embedded in a network of users and stakeholders, which in the end lead to a better application of the results of the research in their respective practices and a higher chance on a smooth valorization process (Technopolis Group, 2007a).

In general we can say that the selection of projects will be more successful if:

- The users (or their representatives) for whom the programme is developed, are involved in the selection process
- Commitment of the users in the programme is expressed through financial or other contributions to the research
- Criteria for the selection have been developed in line of the programme objectives
- Experts have been involved to assess the value of the projects, their contribution to the objectives and their chance of success.

To be able to involve potential users, these actors should be first identified. Are they companies or suppliers in a given sector or region? Are they members of an industrial association or research organization? Are they intermediary organizations, NGO's, patients, consumers? The number of users, their diversity, their absorption capacity and their culture are all crucial factors to take into account while defining the programme (Geroski, 2000; SenterNovem, 2005). We will also come back to these characteristics in section 4. Furthermore, other stakeholders will be involved in the research process and their needs and characteristics need to be taken into account as

well. For example, the executers of the research are not always the users or the programming organization itself, but they will play an important role in the executing and valorization of the research.

The key questions as described above can feed into a so-called Logical Framework, which ideally is used as tool for developing the research programme. The benefit of such a framework is that the programmer easily can relate the activities within the programme to its objectives (W.K. Kellog, 2004). A Logical Framework furthermore allows the programmer to:

- Discuss early in the process whether the planned programme has all the conditions to contribute to the objectives of the programmer
- Prevent activities from being added to the programme when they do not contribute to its objectives
- Involve all stakeholders early in the process and ensure that they have a clear understanding of the objectives of the programme and their role in reaching it
- Continuously monitor the progress of the programme in reaching its objectives

By placing a research programme into a logical framework the intervention logic will become clear. This logic is also known as "theory of action", "programme logic", or "programme theory". Defining this upfront, eases the monitoring and evaluation of the programme before, during and after the execution of the programme.

3. Evaluation and monitoring of strategic research programmes

Many research managers struggle with 'proving' the success of the research programme to their funders. Success cannot be measured in quantitative terms alone and therefore needs to be described in qualitative terms as well. To be able to measure economic and societal success in the course of the programme, it is important to develop (performance) indicators at the beginning of the programming process, ideally when designing the logical framework. These indicators can then be monitored during the programme. Monitoring gives insight in the progress of the research, and can serve as an indicator whether the programme needs to be adjusted. During the monitoring, useful information can be collected for the evaluation of the programme.

The objective of a programme evaluation is to determine whether the resources have been used efficiently and effectively to reach the objectives. There is however a difference between the direct output stemming from the execution of a programme, the effects these outputs have on the economy and the society, and the impacts the outputs generate on the economy or society at large. By evaluating the programme, liability can be shown to the funder or client and provides him with information about the quality of research. This knowledge can be used to legitimize the public spending on research and can demonstrate the relevance of the research. Moreover, it shows when the objectives have been achieved and programme is no longer necessary (Mostert, 2008). Important questions to ask while evaluating the programme are:

- Who was the target group, and did the programme reach this group?
- What was the problem or need addressed by the programme, did the programme reach solutions for this problem or need?

- What were the results, effects and impacts of the programme, and is this in line with its objectives?
- Was the programme efficient and effective?
- How can the programme be improved?

Governments increasingly support research that is defined in programmes rather than individual research projects, which consequently requires more advanced methods to evaluate the effects of the research programme as a whole. Likewise, for some years now we have seen a shift towards the need for measuring not only the scientific quality of research, but also its socio-economic quality in terms of impacts[3]. For example, in the 1980s many European countries attempted to render research more efficiently and relevantly by the introduction of a system of 'conditional financing' which enabled governments to take other criteria into account besides the traditional Mertonian quality indicators and systems of peer review, prestige and scientific prizes. The inclusion of non-scientists in the assessment committees of scientific fields linked to societal aspects, such as health care and technology, showed to be an important step in this respect. Unfortunately, there is still a lack of clear instructions on how to incorporate socio-economic impact in the review process, so most of the evaluation committees ignore it or do not know how to deal with the information they gather (Spaapen et al, 2007; Mostert, 2008). Consequently, in many countries the evaluation of research is still based on the assumption that merely scientific peers can judge the quality of scientific work, and that only quantitative measurements can help this peer review process (Rathenau Institute, 2007; García, 2001).

Despite this, several attempts have been made to develop an explicit methodology for the evaluation of research in its socio-economic context, such as the *sci_Quest* method in the Netherlands (sci_Quest, 2007) and the *Payback framework* in the UK (Hanney et al., 2004; Wooding et al., 2005) but they are either very complex and time consuming to carry out, or specifically developed for a single research area. Therefore we suggest an evaluation method that takes the two sides (scientific and socio-economic quality) into account; that can be applied in various areas; and is rather easy to carry out. Moreover, it focuses on involving users and other stakeholders, besides scientific peers, in the evaluation process. Reviewing research by scientific peers in peer review processes is still indispensable, but no longer sufficient. Evaluating the valorization and socio-economic impacts of the research programme requires other methods and other 'peers' as well. In this section we therefore further focus on the evaluation of the valorization process and the socio-economic impacts and we do not elaborate on the more 'traditional' methods used for scientific peer review. We would like to stress however that this methodology is not to replace the traditional system of scientific peer review, but it could be added to the standard protocols and methods already applied by research funders and research managers.

The start for an evaluation of the valorization process and socio-economic impacts should be the analysis of the mission and (socio-economic) objectives of the research programme. In the light of these objectives the evaluator can review the valorization process and socio-economic 'quality' based on the interaction with key users and

[3] This shift fits within the modern theories of knowledge production such as the so-called 'mode-2' of knowledge production introduced by Gibbons in 1994 and the notion of 'triple helix' of government, academia and industry introduced by Etzkowitz & Leydesdorff in 2000 to explain innovation, the development of new technology and knowledge transfer.

other stakeholders in various stages of the research and valorization process: during the production of knowledge (inputs), during the exchange of information and knowledge with society (outputs), during the use of the knowledge by society (effects) and while institutionalized and appreciated in common practices and society at large (impacts) (Van Ark & Klasen, 2007; Technopolis & Qanu, 2008). We describe here five steps to be taken to assess the socio-economic quality of the research.

Step 1:
A prerequisite for this exercise is that the potential users and other stakeholders have been identified. In this method we have chosen to divide them in three broad domains: the private professional sector (including private peers, business community, suppliers); the public professional sector (including professionals (the 'learned profession'), policymakers, public peers and students); and the general public. The second condition is that a clear mission and objectives are defined at the start of the programme and reconfirmed at the initiation of the evaluation process.

Step 2:
The evaluator will have to review the ways the programme and its participants try to realize their objectives. Information should be collected on the type of activities that have been executed to realize the socio-economic objectives, and the way the participants in the research programme interacted with the societal stakeholders.

Step 3:
To measure and value the valorization process and socio-economic quality of research, indicators should be developed. In theory, this already was part of the strategic programming process (as described in section 2), but in practice specific indicators often are only defined while reviewing the research programme or organization. Notwithstanding, useful indicators can only be identified in concurrence with the logic of the research programme or organization. They are furthermore highly depend on the *degree of specificity* of the research to be evaluated; the *level of aggregation* of the evaluation (is the entire research programme being evaluated, or just parts of it); the *purpose of use* of the evaluation results (internal or external for example); and the *type* of evaluation (ex ante, ex post) (Mostert, 2008). To choose useful indicators for the assessment of the research programme, four rather simple criteria can be used (Van Giessel & Deuten, 2008).:

1) Is the indicator relevant for the research programme?
2) Is the indicator measurable?
3) Is the source reliable?
4) Is the assessment of this indicator repeatable?

The interaction with key users and stakeholders should be 'quantified' or at least qualitatively described to be able to evaluate them. Below we provide a long-list of indicators to give an idea on what indicators could be developed in order to assess the valorization process and the socio-economic impact of research.

Step 4:
When a set of indicators has been defined, data collection can start. This can be done for example by sending out a (online) survey, executing in-depth interviews with a

selected group of stakeholders, doing desktop research and/or in (focused) group sessions. In any case the evaluator will look for the involvement of the (group of) users and stakeholders before and during the research process; the relevance of the research; the use of the research results; and the (future) impacts of the research and contribution to socio-economic questions. The data collection should be complemented with a more qualitative assessment of the various activities since not all of the valorization processes and impacts can be quantified. The role and impact of user committees in research programmes for example can vary strongly and can only be assessed in qualitative terms during focused sessions, interviews or by observing their activities in practice (Technopolis Group, 2007c).

Step 5:
Finally, the data need to be analyzed and a score needs to be given to the indicators in the different domains. It will be a qualitative decision, again based on the mission and objectives of the research programme or organization, how the different indicators should be weighed. Do the scores correspond with the objectives formulated during the programming process? An often-used method, but more time-consuming, is to weigh the scores of the programme against comparator programmes in for example other countries, other sectors or other knowledge clusters by performing a benchmark study. When identifying impact, the links between cause (the action) and the effects and impacts should become clear (EC, 2005) and based on this analysis, mission, objectives and strategies of the research programme or organization can be adjusted if necessary.

Figure 2 Overview of possible indicators for the assessment of socio-economic impacts of research

Interaction with / During	Private professional sector	Public professional sector	General public
Inputs (to produce knowledge)	$ participation in research from this sector (national and international)	$ participation in research from this sector	$ participation in research from this sector
	# participants in research from this sector (national and international)	# participants in research from this sector	# participants in research from this sector
	# of graduates/ doctorates working (part-time) in this sector	# of graduates/ doctorates working (part-time) in this sector	
	# of representatives of the sector in user groups or other role	# of representatives of the sector in user groups or other role	# of representatives of the sector in user groups or other role
	Existence of plans to valorize results to this sector	Existence of plans to valorize results to this sector	Existence of plans to valorize results to this sector
Results (transfer of knowledge)	# interviews and articles in business media	# interviews and articles in professional media	# interviews and articles in popular media
	# patents, # patent filings # licenses	# publications	# popular publications
	# performances in private sector conferences, forums et cetera	# performances in scientific and public sector conferences, forums et cetera	# performances to popular forums, such as national tv, radio
	# (part-time jobs) of participating researchers in this sector	# (part-time jobs) of participating researchers in this sector	
	# training and courses to this sector	# training and courses to this sector	# contributions to educational material

	# training and courses from this sector (entrepreneurship, IP, scouting)	# training and courses from this sector	
	# contributions to private professional websites	# contributions to public professional websites	# contributions to popular websites
	# products and services developed for the commercial market	# products and services deeloped for the public professional market	# products and services developed for the public market
	# spin-offs # start-ups		# of people reached directly and/or indirectly by developed products and services
Effects (use of results)	$ products and services used by commercial market	$ products and services used by the public professional market	$ products and services used by the public market
	# consultations by this sector	# consultations by this sector	# consultations by this sector
	$ revenue from patents		
	$ revenue from licenses		
	$ revenues from spin-offs and start-ups		
	$ revenues from other services to this sector	$ revenues from other services to this sector	$ revenues from other services to this sector
	# citations in commercial publications	# citations in professional journals and publications	# citations in popular media
	# new job openings because of the programme	# new job openings because of the programme	
Impacts (relevance and appreciation of the effects)	# prizes awarded by this sector	# prizes awarded by this sector	# prizes awarded by this sector
	# job changes in this sector	# job changes in this sector	increase in jobs and impact on functioning of labor market
	$ additional investments for this type of research from sector	$ additional funding or grants for research from sector	increased choice for consumers
	# new standards, protocols and guidelines in this sector	# new standards, protocols and guidelines in this sector	higher quality products
	increased productivity because of new products/services/standards	increased life expectation/environmental condition/safety etc because of new products/services/standards	better information to and protection of consumers
	a faster distribution of technology	affection on foreign (trade) policy	lower consumer prices
	increased competition	affection on developing countries	affection on gender equality
	lower costs of operation and administration		affection on privacy

4. User involvement in planning and evaluation

In the previous sections we have provided some practical guidelines for the strategic planning and evaluation of a research programme or organization with the involvement of the (potential) users and other stakeholders. In this fourth section we will elaborate on the role of the user in these processes and possible interaction mechanisms. The main challenges in involving users and other stakeholders in the planning and evaluation process are to target the right actors and motivate them to participate in the process with the most effective methods. Depending on whether the expected users will be the industry (e.g. production companies, R&D intensive SMEs), actors from the public professional sector (e.g. health practitioners;

environmental organizations; et cetera) or the general public (e.g. consumers, consumer organizations or patient organizations) interaction strategies can be developed. In developing countries for example, the most important potential partner and user of research based knowledge is the public sector, and not the private. The science and technology sectors in developing countries tend to stay more isolated from the user side than in developed countries where you can speak more of integrated 'innovation systems'. Although it is very important that the productive sector comes closer to the research sector in these countries, the principal partners for scientific research here are the public sector institutes (Schwartzman, 1995; 2002).

In terms of interaction, there are several models available. An article on citizen's participation in biotechnology (Rask, 2003) highlights three different paradigms that lead all to different ideas about the way users may participate in S&T development. The "enlightenment" paradigm assumes that the root cause of the problem is a lack of the users' knowledge about new technology. Scientists need to fill the gap by providing information, so that the users will have a better understanding about new technology, which will lead to improved acceptance. The second "economic" paradigm sees the role of users as instrumental to create favorable conditions for innovation. Interaction between scientists and users is mainly important to speed up innovation and accelerate growth. Finally, the third paradigm is called the "critical" paradigm, and suggests that new knowledge and technologies are developed through the process of interaction between producers and users of technology. The second and certainly the third model are from our viewpoint most defensible. They suggest that new knowledge and technologies are most successful when developed through the process of interaction between producers and users of technology. Here bargaining, negotiation and strategies of mediation are used to change the ideas, attitudes and behaviors of the users and the producers. In this way each actor is able to influence the other in the quest for the definition of common needs and interests (Van Ruler, 2004).

This brings us to a crucial factor for motivating users to participate in the process and deal with potential conflicts between users. When defining and designing a strategic research programme with different stakeholders, the main challenge is to analyze their common needs and interests, and use this knowledge to motivate them to participate and prevent potential conflicts beforehand. This analysis can be approached top-down, or bottom-up. A top-down approach implies that the needs of the potential users are being identified without personally consulting them. This still could lead to a 'user-driven' programme and can be done at relatively low costs, although the demand and common interests are rather 'likely' or 'expected' and there is a risk that the research results will not be in line with the actual expectations of the users. Another option is the bottom-up approach where potential users (or their representatives) are being approached directly by means of a survey, brokerage event, conference or interview. The advantage of the bottom-up approach is that the potential users feel more committed to the programme and are more likely to participate in the further planning and evaluation process. These two approaches however do not necessarily exclude each other.

The common interest can either be defined in terms of common opportunities or problems, or be based on existing projects that already match common interests. Different interests can lead to an incoherent programme, or a programme with little

support and a large risk of conflicts between stakeholders. To deal with divergent interests four strategies could be implemented.

- The first is to *homogenize* the objectives of the users by organizing interactive exercises such as a Delphi study, roadmapping, or other foresight techniques. This possibly narrows down the interest gap between the participants.
- The second strategy is to *broaden* the objective of the programme so that all interests are 'covered'. This however could lead to an incoherent programme.
- Third, the objective could be *segmented* into several 'sub' objectives or to develop several 'sub' programmes.
- The fourth strategy is to *select* a smaller group of users that share a common interest and narrow down the size of the target group.

A second challenge for motivating users to participate in the programming and evaluation process is to relate the interaction methods to the characteristics of the users. These characteristics determine the way he can best be involved in the planning and evaluation processes. Three characteristics of the users are important to consider: *size, absorptive capacity and the level of (mutual) trust.*

If the potential user group is small, it will be relatively easy to grasp their (collective) needs and verify their interest in a research programme and its possible outcomes. A large group of potential users will be more difficult to directly involve in the programming and evaluation process, because mutual interest will be more difficult to identify, and because of practical difficulties. 15-35 parties could still be easily interviewed or organized in a workshop within a few days. Larger groups can be approached by mail or through web based applications, or a sample could be taken provided that they have a thorough overview of the common needs of the users they represent.

Second, the possible degree of involvement of the potential users is also very much dependent on their absorptive capacity or learning capabilities (Geroski, 2000; Allinson, 2006). Users with a low absorptive capacity will have more difficulties in estimating what the impact of the collective research programme has or will have in their domain. The higher the absorptive capacity, the more likely the organization can be stronger involved in both the planning as the evaluation the process.

Third, especially industry users will not be very open about their strategy when their main competitors are involved in the programming process as well. Yet the quality of the research programme and its outcomes depends on the openness and participation of these users. By involving the users from the start of the programming process, mutual trust and commitment can be built. Programme managers should facilitate interaction and flows of information and technology by ensuring that there is a climate in which partners can share and where there are no hidden agendas. Therefore there should be an agreement on the rules of engagement, which concerns basic decisions on the governance of the research programme or organization, and on competition and collaboration. The distribution of costs and benefits of participation have to be acceptable for the different parties. Within the EU this is of specific relevance, since the governments are not allowed to fully subsidize research for the industry, and therefore the applicant organizations (in case they are companies) usually have to fund parts of the research themselves.

As a final challenge, there exist an enormous number of possible methodologies to involve uses. However, not all methods are suitable at every step in the planning and evaluation process. In the programme definition phase, state-of-the-art and trend studies help narrowing down the subject, and foresight studies could be initiated to have a better idea of the future technological, economic or societal needs in the area of interest. Interviews can be organized with representatives of the users. The result of the interviews could be a list of expected trends, opportunities, problems or subjects for a research programme. If resources lack to do interviews individually, the programmer could initiate a survey amongst opinion leaders or organize working groups or workshops to narrow down the subject and to further define the scope of the programme. In the programme design phase, ideas and project proposals need to be identified and selected. If the group of users is rather small, structured interviews are a useful method to collect ideas for projects. When selecting ideas and project proposals, a selection of interested users can be involved in focus groups, brokerage events or road mapping exercises. When implementing the programme, users can be involved by the formation of user commissions, steering groups, but also in brokerage meetings, partnership planning activities and contract meetings. User-commissions could be established to steer and monitor the progress within the projects while the programme is being implemented. This is particularly interesting when the users do not execute the research themselves. Some visionary users could also participate in the management of the programme, and its administration and monitoring. Finally, during the evaluation of the programme users can be involved by organizing customer satisfaction audits; interviews with users to discuss the outcomes and impacts of the programme; and expert reviews. These expert reviews may include, besides scientific peers, also representatives of other domains in the society such as the professionals (public and private) and the general public. The outcomes of the evaluation finally, can be communicated through newsletters, or during workshops or conferences.

5. Conclusions

The main hypothesis of this paper was that for publicly funded research to be more successful in terms of relevance and impact, it is crucial to base the research programme on clearly defined objectives related to its mission; to monitor and evaluate it in the light of these objectives with not only a focus on economic benefits but also social benefits, and to carry out these activities with the close involvement of users and other stakeholders. We have provided several guidelines and identified challenges for these processes leading to a number of conclusions summed up in this section.

- Effective science commercialization policies to increase the socio-economic impact of research and the societal legitimatization of publicly financed research organizations, programmes and institutes has become of increased importance, both in European as Latin American countries
- Doing collective research, in which several parties cooperate in a research programme, could be a solution and stimulus for R&D performance and innovation and is often supported by governments and large research organizations.
- Planning a research programme is a cyclic process, at least involving the definition of mission and objectives, the design of the programme and its

projects, the implementation of the projects and the monitoring and evaluation of the programme. In this cyclic process it should become clear what themes to address, what activities to carry out with what resources, who will be using the results, who will execute the research and how to measure the success of the programme.

- Using a logical framework facilitates the strategic planning process and helps to relate the objectives with the activities and desired outcomes and impacts. It furthermore eases the monitoring and evaluation of the programme. Agreement on objectives, tasks and responsibilities is essential in a research programme and programme managers need to promote consensus on this, taking into consideration the different interests of participants, users and other stakeholders.
- (Performance) indicators should be developed at the beginning of the planning process, when designing the logical framework. They can be used to assess the outputs, effects and impacts of the programme on the economy and society. This knowledge can be then used to legitimize the public spending on research and demonstrate its relevance.
- There is however a lack of clear instructions and indicators to incorporate socio-economic impact in the review process. For that reason we propose a methodology in which the mission and objectives of the research programme are the start for an evaluation of the valorization and socio-economic impacts. Moreover, the key focus is on the interaction with users and other stakeholders in the various stages of the research and valorization process: during the production of knowledge, during the exchange of knowledge with society, during the use of knowledge by society, and during the internalization of knowledge in society.
- Prerequisites for the assessment are that users and other stakeholders are known and that information can be collected on how objectives have been realized in interaction with the users and stakeholders. Furthermore, indicators should be identified based on the degree of specificity of the research, the level of aggregation of the evaluation, the purpose of use of the evaluation results and the type of evaluation. Indicators should be relevant, measurable, reliable and repeatable. Finally, data should be collected with involvement of the users and scores should be given to indicators to weigh the outcomes, possibly related to international standards.
- When involving users in the planning and evaluation process, the main challenges are to target the right actors and motivate them to participate in the process with the most effective methods.
- A crucial factor for motivating users to participate in the process and deal with potential conflicts between users is the analysis and/or definition of the common needs and interests of the users. New knowledge is often controversial and it is important to develop an agenda so that participants who do not always have parallel objectives, still participate in network activities and contribute to it objectives. This common interest can be analyzed top-down, or bottom-up. Four strategies can be used to deal with divergent interests: homogenization, broadening; segmentation; or selection.
- Furthermore, three user characteristics determine the way he can best be involved in the planning and evaluation process: size, absorptive capacity and (mutual) trust.

- Building trust and transparency is an important challenge and there should be an agreement on the rules of engagement, which concerns basic decisions on the governance of the research programme or organization, and on competition and collaboration.
- Finally, various methodologies can be applied in the different stages of the research programme to involve the users ranging from foresight studies, interviews, surveys, workshops, focus groups, steering groups, user commissions, satisfaction audits, expert reviews and conferences.

We would like to conclude with some considerations: We are aware that we did not provide a vast set of rules, checklists or indicators to plan and evaluate research with users, but discussed a number of available routes, characteristics and indicators based on practical experiences with planning and evaluation research programmes with users. From our viewpoint, every programme or organization needs to develop and use their own set of routes and indicators, since different types of research and different research areas will lead to different outcomes and impacts, that cannot be measured with a standardized set of guidelines. Moreover, we have not mentioned that assessing the impact of research relies on the ability to circumvent some methodological difficulties; such as the time lag between intervention and effect; attribution issues; dead weight (changes that would have come up anyway); working with control groups; paper vs. reality (what exists only on paper, and not in practice), et cetera. We leave these issues for future explorations and publications to further discuss and improve the ideas on user-driven strategic research planning and evaluation.

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