

Evaluation and design of R&D tax incentives

**OMC Crest Working Group report submitted to meeting in
CREST 17th March 2006**

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1 Preface

The work on this report was conducted as a part of the process of open method of co-ordination (OMC) where the aim is to achieve greater convergence towards EU goals by helping Member States progressively improve their own policies in areas where policy competence lies primarily at national level. The goals in this context were set through the Lisbon strategy that was adopted in March 2000, and through the 3% R&D target that was agreed in the Barcelona action plan in April 2002. The outputs from the OMC process are seen to be relevant for both development of national policies and for the further follow up of the action plan for R&D and innovation. The OMC Working Group on fiscal measures was one of five OMC groups that were initiated in 2004/ 2005 by CREST.

In line with this, the report from the Working Group has very much a practical aim: to provide information and advice that can be of use for those involved in developing, using and evaluating tax incentives for R&D. The report refers to standard material now available and, through the process, the OMC group has also commissioned new work in this field. The results can be read in the annexes to the report.

The following experts from EU/ CREST countries were members of the Working Group:

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| Pierre Moortgat, Belgium | Rikard Wærø and Hedda Huseby, Norway |
| Lauri Tammiste, Estonia | Dariusz Drewniak, Zygmunt Wons, Krzystof Gulda and Jacek Gierlinski, Poland |
| Christian Orfila and Claude Chicoix, France | Cesar Luca, Romania |
| Ellen McCafferty, Marie Bourke and Karen Cullen, Ireland | Peter Duben and Diana Demkova, Slovakia |
| Maria Teresa Monteduro and Vittorio Ancarani, Italy | Tristan Slinger, Richard Hopwood and Paul Lanser, United Kingdom |
| Paul Baldacchino, Malta | |
| Ilona van de Velde, Netherlands | |

The chair of the Working Group was Christian Hambro from Norway, while the rapporteur was Erik Strom.

EU Directorate General for Research and EU Directorate for taxation and customs gave valuable contributions to the work through Arie van der Zwan, and Peder Christensen from EU DG RTD and Katri Kosonen from EU DG Taxud. Jan Christoph Nill from the Institute for Prospective Technological Studies, Joint Research Centre of the EU Commission (IPTS) and Erik Arnold and John Clark from Technopolis not only produced papers that are annexes to the report, but also made useful contributions to the discussions of the Working Group.

There were 8 meetings of the Working Group. In addition, there was one workshop that addressed evaluation methods, and which also included experts from outside the Working Group. An interim report from the Working Group was presented at the CREST meeting on 19th October. As a result it also was decided to give an additional task to the Working Group of making a handbook for evaluations.

2 Executive summary and conclusions

2.1 The mandate and the report

CREST decided at its meeting on 18th March 2005 to establish a Working Group on the “Design and evaluation of tax incentives to promote business research, development and innovation”. The Working Group was given the task of producing a report that should include the following:

- Guidelines for the design and use of fiscal measures
- Guidelines for the evaluation of fiscal measures, and if necessary, also propose further initiatives that could develop expertise in this field;

There is wide agreement that government support for business R&D is beneficial for society. The question is therefore not whether government should give support, but how and to what extent. Conditions vary considerably between member states. The economic and industrial structures are different, the level of R&D as percentage of GDP and the distribution of R&D between the public and private sectors and between industries varies, as do the tax systems and R&D and industrial policy frameworks. Due to these differences, there is not one single answer to whether a country should use tax incentives to increase R&D, how such a system should be designed or how it should be evaluated.

This being the situation, the Working Group is not in a position to give firm advice to member countries as to which solutions they should choose. Through its discussions, however, the Working Group has concluded what in general seem to be sensible solutions regarding tax incentives to promote business R&D and the evaluation of these. The Working Group therefore suggests that member states consider these general conclusions when discussing whether they should have tax incentives and which designs might be most appropriate under prevailing circumstances in each member state.

The Working Group suggests that member states make themselves acquainted with the report itself when dealing with matters related to tax incentives, and not least of all the annexes. By doing this they will hopefully, and more rapidly than otherwise, get a grasp of the “state of the art” in the field of R&D tax incentives and their evaluations, and thereby be able to speed up national policy processes and more easily be in a position to capitalize on the experiences of others.

The Working Group is aware of a forthcoming Communication from the European Commission later this year which will deal with territoriality and the new State aid regime among other issues. The Working Group recognizes that these issues might influence the design of tax incentives in member countries, and look forward to a clarification by the Commission on these issues.

Chapter 3 in the report describes the mandate of the Working Group and the scope of the report and prior reports.

Chapter 4 shows the reasons for state support to R&D, the different roles of direct measures and tax incentives, and describes the various designs of tax incentives and evaluation methods. The main conclusions in Chapter 4 concern knowledge gaps that exist. These might be reduced through further research, and perhaps through countries that now operate tax incentives sharing their experiences and knowledge of evaluations in this area.

Chapter 5 discusses different forms that tax incentives may have and provides some general conclusions that could be useful for member states to consider in designing and evaluating their tax incentives.

In addition to the report itself, the Working Group has produced a paper, annex 1, with an overview of evaluation methods with general planning advice for countries performing evaluations. The Working Group has also commissioned background papers that hopefully can be of direct, practical benefit for countries wishing to study different issues in more depth than can be done in this short report.

2.2 Design of tax incentives

Tax incentives are used by many countries to increase business R&D. Evaluations, cited in the report and annexes, indicate that well-designed tax incentives actually do increase business R&D. The amount of this increase has however proved rather difficult to estimate. The evaluations suggest that the amount of additional R&D stimulated corresponds roughly to the tax revenue foregone. Because R&D investments have also been shown to have important benefits for others than the firms themselves, these additional R&D investments may be highly profitable for society. Countries with the ambition of increasing business R&D should seriously contemplate the introduction of tax incentives as an important policy instrument. Even countries with an overall high level of R&D intensity in the business sector could use tax incentives to meet supplementary goals – especially concerning the strengthening of the innovation and R&D capacity in SMEs.

Member states considering the introduction of tax incentives are advised to take due account of the policy mix of different tools for increasing business R&D, ensuring a coherent and transparent system that is understandable for all stakeholders. Tax incentives and direct measures are complementary policy tools that are suitable for different purposes. The Working Group therefore believes that member states should balance the use of these tools to reflect their individual objectives and circumstances.

The Working Group has reached some general conclusions that member states should take account of according to their individual needs and circumstances when deciding on the most appropriate tax incentive for them:

- Countries with the ambition of increasing business R&D in general or for SMEs in particular are advised to analyse carefully the possible use of tax incentives as an important policy instrument.
- When introducing tax incentives, countries should assess the economic rationale and costs for state intervention and weigh up the most appropriate policy response, including how effectively tax incentives may meet the goals and objectives identified for R&D and innovation policies.
- Tax incentives should be easy to understand, stable in their design over time and transparent in order to reduce transaction costs as much as possible.
- When designing tax incentives, countries are advised to have a broadly based approach to which companies, R&D topics and types and costs should be covered, thus stimulating the breadth of R&D within and across firms and not unduly differentiating between different types of firms.
- If the objective of the tax-incentive is to increase the level of R&D substantially, and the associated loss of tax-revenue is acceptable, a volume-based tax-incentive seems to be the appropriate tool.

- If the objective of the tax-incentive is narrower, the choice between volume-based and incremental tax incentives should be based on a number of factors. Empirical studies and research suggest that both incremental and volume-based incentives can be effective in stimulating additional R&D, with no clear evidence that one approach is more or less effective than the other. Therefore, the decision needs to consider the specific aims and objectives of the policy in each member state.
- Volume-based tax incentives might be considered where the objective is to promote R&D or R&D firms generally, as they are easier to administer, lead to less distortions and are more predictable and stable over time. In the case that countries want to limit taxes foregone, they could consider the use of caps or thresholds.
- Incremental schemes might be considered where the objective is to support R&D start-ups or firms with high R&D growth, particularly where governments want to limit tax foregone due to budgetary limits.
- A combination of volume and incremental based incentives might be considered where the objective is to support both all R&D firms as well as targeting R&D start-ups, although the additional complexity involved should be examined.
- Instead of a low percentage level of support through tax incentives, governments could use caps or thresholds to ensure that the tax incentive has a substantial effect up to a defined limit, a system that in practice would be SME friendly.
- Certainty, simplicity and consistency should be the guiding principles for the administration of tax incentives. The effectiveness of a tax incentive depends on it being delivered and administered efficiently.

2.3 Evaluation methods

Tax incentives on R&D have effects on public budgets, and the revenue foregone in the short run must be viewed in relation to other purposes. In a longer perspective, tax incentives will most probably lead to increased tax revenue due to higher income. Evaluations are a vital tool to assert accountability, to analyse the effects of the schemes and in order to establish a better knowledge base for improvements to policies.

A main task for evaluations is to ascertain whether the tax incentives result in a higher level of R&D investment where the marginal return to society of the investment more than equals the costs involved. This would imply a comparison of the return on the public support to R&D and the costs involved including the opportunity cost of the public support (to other purposes). The report and annexes refer to findings that conclude that it is very difficult to estimate the return on public support to R&D exactly. There are two reasons for this: It is difficult to isolate the effects of state support from other factors, and the effects of state support can be multidimensional. For instance, state support to R&D may change firms' strategies and interaction with other R&D actors, which may have positive effects that can only be measured in the long term. Moreover, in the case of evaluating fiscal schemes because of their generic nature, it is difficult to measure what would have happened without the tax incentive – the counterfactual situation. These problems are not specific for tax-incentives but are also present when evaluating direct measures.

Evaluations can have two slightly different perspectives:

- Estimating the size of three kinds of effects: on the increase of R&D within firms, on the improved economic performance of firms and on the benefits for society at large.
- Describing how state support influences firms: directly through increased R&D, indirectly through increased capability that causes increases in R&D and through change in attention and behaviour that in turn causes increases in R&D.

There is little doubt that an increase in R&D has important benefits for society as a whole, and that an increase in R&D for firms overall will lead to increases in innovation and productivity. However, these so-called third order effects are hard to determine through evaluations of a particular measure in isolation, because so many other factors contribute to changes in productivity. Policy makers are also advised to be aware of this limitation, and early on establish a focus on first (additionality) and second (firm economic performance) order effects when evaluating tax incentives. Policy makers should also be aware that evaluations should cover a substantial time frame, in order for them to capture the various effects from tax incentives. When it comes to evaluating how state support influences firms, this report calls for the use of multiple methods that taken together can inform policy makers how tax incentives are working, and how they should be changed in order to be best suited to increase R&D.

It usually takes several years before a tax incentive's full potential of additionality is reached, and even more years before this transforms into improved economic performance, such as increased profits. In highly competitive industries, R&D might not lead to higher profits, but is necessary in order for firms to stay in business.

An evaluation must always consider the specific objectives of a R&D tax incentive. In many cases, the objective will be to increase R&D spending and thus firm performance, innovation and productivity. However, there may be other objectives as well, such as supporting particular R&D companies (such as SMEs) or particular types of R&D activities or costs (such as collaboration). The evaluation should also consider whether the policy has met these objectives as well as achieving the general effects discussed in this section. The evaluation should also assess how well or efficiently the tax incentive has been delivered.

The general conclusions that the Working Group has reached regarding evaluations are the following:

- The quality of the evaluation depends on the policy measure having clear aims and objectives, so that questions for the evaluation to tackle can also be clearly defined.
- Evaluations of tax incentives should focus on ascertaining to which degree they induce more R&D (over and above what would have taken place otherwise) and if this causes improved economic performance of beneficiary firms.
- Evaluations should cover changes in firms' strategic behaviour and internal decision-making (behavioural additionality).
- Evaluations should not only cover additionality and behavioural effects but also, where relevant, test whether the tax incentive has met its specific objectives and whether the delivery/administration has been efficient.
- Other societal effects of tax incentives should be evaluated in the broader context of the total government R&D policy, including effects on the level of learning, the quality of R&D and the innovations resulting from the public support scheme.

- Evaluations of tax incentives should have an integrated approach using a variety of different methods to understand not only the effects of the measure but also how it actually functions.
- In the design of the tax incentive scheme, policy makers should have in mind the types of data needed and the possible ways of gathering data for evaluations.
- In estimating direct and indirect additionality the main challenge is to establish datasets that make it possible to do counterfactual analysis. This can be done in three separate ways or through combinations of these three: through the use of historical data, through the use of discontinuities in the operation of the tax incentives and/ or through the use of data from other countries.
- Careful attention should be given to the independence of evaluators and evaluations.
- The evaluation results should be published and should be used to inform policy improvements.
- Because there is not much EU/CREST experience in this specific field of evaluation, EU member states and CREST countries might like to consider establishing an international network to share experiences and examples of good practice in methods for the evaluation of R&D tax incentives.

3 Introduction

3.1 Prior work

In 2003 the European Commission adopted the Communication “Investing in research: an action plan for Europe”. The Action Plan’s objective is to increase investment in European R&D so that it approaches 3% of GDP by 2010. The Plan identifies ongoing initiatives relevant to the 3 % objective, and new actions to be undertaken at national and/or European level.

One of the instruments of implementation is the open method of co-ordination (OMC). The Open Method of Coordination (OMC) is an experimental approach to EU – governance based on benchmarking national progress towards common European objectives and mutual learning. The OMC has been applied across a growing range of policy areas, including employment, social inclusion/combating poverty, and pension reform. It commits EU Member States to work together towards shared goals without seeking to homogenize their inherited policy regimes and institutional arrangements. It encourages Member States to pool information, compare themselves to one another, and reassess current policies against their relative performance, thus promoting experimental learning and deliberative problem-solving across the EU.

Public support of private R&D efforts is generally deemed legitimate, because of the positive externalities attached to these efforts. In this context, the Action Plan states that tax incentives are increasingly used to encourage business research as they can support a wide population of firms, including SMEs, while leaving enterprises a maximum of independence. To be effective, tax incentives for research should be designed with care and co-ordinated with other research support instruments. The Action Plan states that, although optimal design depends on the country-specific context, there is scope for mutual learning.

More specifically, the Action Plan addresses the following actions regarding tax incentives for research:

- a) Encourage the creation and early growth of research-intensive firms;
- b) Facilitate fund raising by new or existing foundations supporting R&D activities in Europe;
- c) Raise the attractiveness of research careers;
- d) Improve tax incentives for research on the basis of formal evaluations whose results should be disclosed, mutual learning, the application of principles of good design such as simplicity, low administrative cost and stability;
- e) Disclose data on the budgetary cost of tax incentives.

The work that has been carried out in this OMC group builds on work that was done in the first cycle of OMC which was published in 2004. Earlier, an independent Expert group on public support mechanisms for private sector R&D delivered a report in 2003 (Raising EU R&D intensity, 2003). According to this expert group, the design of tax incentives is crucial to the effectiveness of these schemes. The expert group also stressed the need for more formal evaluations of tax incentive schemes, and the need for clear principles for the design of tax incentives.

In June 2004, an OMC Expert group delivered a report that mapped tax incentives and evaluations that had been done in EU countries (Expert Group on Fiscal Measures for Research, Report submitted to CREST in the context of OMC, 2004). The group stated that

their mapping of tax incentives in EU countries provided information that could be of use for the further development of tax incentives. Among their findings were a severe lack of evaluations of tax incentives, and therefore few sources of information concerning the efficiency and effectiveness of tax incentives. The group also suggested that issues related to fiscal design should be treated in more detail during the next cycles.

The first cycle OMC report and recommended tax incentives for R&D on the following basis:

- Through tax incentives the needs of a wide range of firms can be addressed
- The decision as to the content of the research is left to the firms own discretion

Prior expert groups based their recommendations and discussions on the limited – and mostly theoretical – knowledge that is available. The report “Raising EU R&D intensity” gave the following recommendations, mostly linked to administrative issues:

- Simplicity should be a guiding principle for the design of tax incentives for R&D
- The aim should be low administrative and compliance costs
- The schemes should be long term oriented and thereby provide reliable and stable framework conditions for firms
- Tax incentive schemes should be volume based, ensure refundability and be transparent and clearly defined

3.2 Scope of work

In line with the suggestions from the above mentioned expert groups, CREST decided at its meeting on 18th March 2005 to establish a Working Group on “Design and evaluation of tax incentives to promote business research, development and innovation”. The Working Group was given the task of producing a report that should include the following:

- Guidelines for the design and use of fiscal measures;
- Guidelines for the evaluation of fiscal measures, and if necessary, also propose further initiatives that could develop expertise in this field.

In a later CREST meeting the Working Group was asked to put a larger emphasis on evaluation methods. The Working Group decided therefore to produce a paper; the attached annex no 1 to this report, which gives an overview of issues and considerations for countries planning and performing evaluations. In order to perform this task the Working Group drew on the expertise of Head of Research from Statistics Norway, Torbjorn Haegeland and Director at the European Patent Office, Bruno van Pottelsberghe.

The Working Group has concluded that the proper mix of direct grants and tax incentives to enhance R&D in firms is outside the scope of work given in the mandate. At the same time, it is difficult to carry out discussions on the design of tax incentives without giving some attention to the different roles of direct measures and tax incentives. This is reflected in the report.

The Working Group has concluded that country-specific conditions vary considerably, and that both the design and evaluation of tax incentives must take this into consideration. The Working Group’s guidelines must therefore be regarded as general conclusions that countries are advised to examine when making their own choices - and not in a prescriptive way as what is the best solution for every country.

The Working Group has limited its discussions to specific tax incentives for R&D activities in enterprises, although some of the existing schemes in Member States cover public research

institutions as well. The tax treatment of R&D within the general tax systems of countries has been regarded as falling outside the mandate for the Working Group¹.

Several papers have been commissioned by the Working Group. The papers have been very useful for the group, and should be read as independent contributions meant for those who wish to study the issues at hand in more depth than is reflected in the report. The papers are therefore annexed to the report:

- Annex 2: Institute for Prospective Technological Studies, Joint Research Centre for the EU Commission (IPTS) on the description of tax incentive schemes in EU/CREST countries;
- Annex 3: Technopolis on the methods for evaluations;
- Annex 4: Statistics Norway on methodological aspects concerning the evaluation of the Norwegian tax incentive scheme, SkatteFunn; and
- Annex 5: Jacek Warda on the B-index

3.3 Meetings

The first meeting of the Working group was held in Warsaw on 22nd April 2005. It was decided to build on the work that had been done already, and that the work on evaluations should be given high priority although the group also should discuss and develop guidelines for the design of tax incentives. It was further decided to draw upon external expertise at IPTS, Technopolis and Statistics Norway in order to create a knowledge base for advice from the group.

In the following two meetings, the group had discussions on the basis of papers and presentations from the IPTS and Technopolis and from members of the group that described various tax incentive schemes and evaluation designs. The group was also presented with a paper from Statistics Norway about challenges concerning the establishment of databases for the evaluation of the Norwegian tax incentive scheme. Jacek Warda, who works for the OECD as a consultant, presented the B-index for the group – which is a method for analyzing the net effect of state support to R&D through the tax system. At the same meetings, the group was presented with discussion papers from the rapporteur and chair in order to facilitate discussions on the design and evaluation of R&D tax incentives.

Prior to the meeting on 7th September, the Working Group had a workshop on the evaluation of tax incentives. The report from Technopolis was discussed and a presentation of the Norwegian evaluation of SkatteFunn, the Norwegian tax incentive scheme for R&D, formed the basis for the discussions. There were also pre-prepared comments from a panel of experts, Erik Brouwer from Price Waterhouse Coopers, Bruno van Pottelsberghe from Solvay Business School and Luke Georgiou from PREST/ University of Manchester.

At its meeting on 7th September, the group discussed the conclusions in the draft report. This was followed by discussions at the 29th September and 16th December meetings on the draft report and its conclusions. It was also decided to make an annex to the report that should be an outline of a handbook on evaluations. Through discussions in CREST this was given more emphasis, and in line with suggestions from CREST and the Commission the Working Group decided to prolong its work in order to complete a handbook on evaluations. Thorbjorn Haegeland from Statistics Norway was asked to lead this work, and made a presentation of a draft outline at the meeting of the Working Group on 16th December in Oslo.

¹ See for instance IBDF report on tax treatment of R&D expenses (2004)

The ambition of the Working Group is that the report will be of use to CREST countries by giving guidance and information on methodologies for the evaluation of tax incentives and the general design of tax incentives. The Working Group also hopes that the report may be of use in the further work of CREST and EU/ DG Research and their efforts to promote mutual learning and exchange of information between policy makers in the member countries. The report and its conclusions may also be used as input to the policy making in the member countries and in the EU – especially concerning the Annual Progress Report as a follow-up to the Lisbon declaration and the forthcoming Communication of fiscal incentives for R&D.

4 Description of the current situation

4.1 Gains for society and government support

4.1.1 Reasons for government support

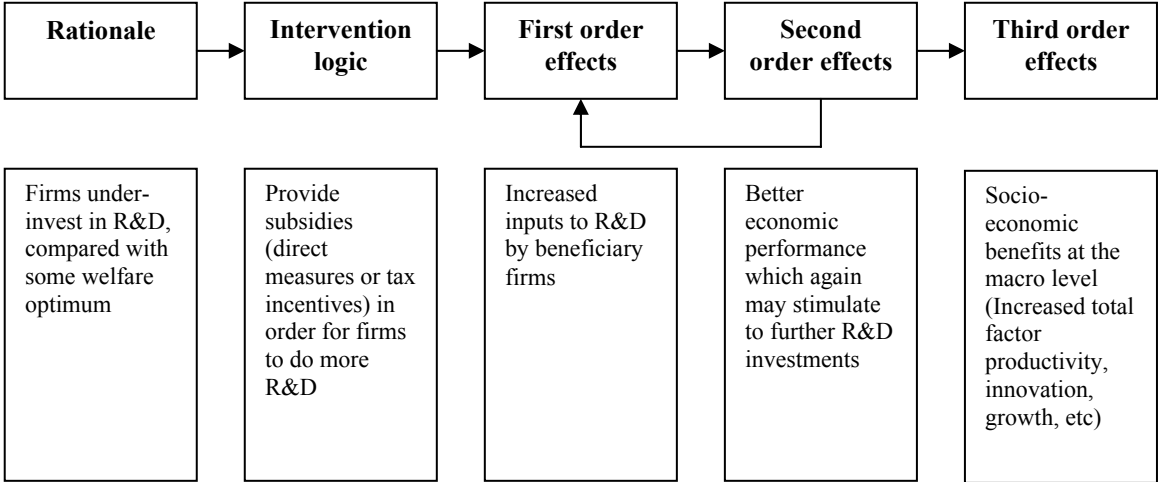
R&D is as a whole extremely beneficial for society and business at a macro level. But it can sometimes have negative effects at a micro level. New knowledge and technology can lead to the dismantling of existing businesses. R&D can also cause waste through unnecessary product differentiation, and can create barriers to market entry that reduces competition.

Industry can not be expected to finance much basic research, however valuable such research might be for society. From a business point of view basic research has such a long term perspective and is so risky, that firms will not finance it. For society as a whole, it is of importance that the results of basic research are open and can be used by all.

Even when looking at R&D that primarily would be beneficial to the individual company, there are market-failures at play, in the sense that companies finance less R&D than would be economically optimal for society. There is a divergence between what companies regard as profitable, and what is profitable for society at large. There are several reasons for this. One is that the individual company will not reap all the profits of the R&D. The results will to larger or lesser degree spill over into the rest of the economy in ways that are not protected by the IPR system. The company will only take results into account that it can use itself when making its cost-benefit analyses. R&D is also a risky business. Although the average rate of return is high, many companies can't afford to invest in a sufficient number of projects to attain the average profitability. Information asymmetry between the R&D-performing company and possible investors, and the risks related to the ability to execute a project, is also a limiting factor. For these and other reasons, most countries acknowledge that there are market failures that call for government support of BRD.

The rationale for state intervention through grants and tax incentives for R&D is rarely expressed in a very explicit way, but tends to be as shown in Figure 1. The figure has as its primary focus the rationale for state subsidies to R&D performed in or by firms.

Figure 1: Generic Intervention Logic for Fiscal R&D Incentives



Source: Annexed paper by Technopolis

4.1.2 The role of direct measures and tax incentives

The question of a proper policy mix is the mandate of another OMC group. This report does therefore not include a general overview of how government cost for supporting business R&D is or should be distributed between tax incentives and direct grants. The Working Group is, however, aware that the planning and implementing of tax incentives must be seen in a broader policy context. Direct measures – grants to firms as well as research institutions, laws and regulations together with tax incentives influence the quality of the innovation systems. Estimating the total governmental contributions to R&D may also be difficult to measure because the total amount of indirect support is unknown in some Member States.

Tax incentives and direct measures have different roles within a policy mix for business R&D. Direct measures are best suited to encourage high risk projects and to meet specific policy goals, and are usually allocated based on a competition between firms. This ensures that resources from the state budget are invested in the best projects within the topics defined by the political authorities – and not according to what firms or market conditions would give grounds for. Such allocation mechanisms might be relatively costly to administer, but make it possible to target financing according to what society at large has decided are vital goals for R&D.

Tax incentives will reduce the marginal cost of R&D. Thereby firms are stimulated to increase their R&D volume. Tax incentives are usually available for a wide range of firms. These incentives therefore encourage an increase of R&D across the whole spectrum of firms without giving them clear directions as to what kind of R&D should be given priority. The firms themselves decide what kind of R&D should be given priority. Because of this the tax incentives are generally also the least burdensome way of increasing R&D in the business sector from an administrative point of view. Firms are already obliged to deal with the tax system anyway, and this may explain why tax incentives are popular among firms.

There is a trade-off between selecting specific R&D projects to support and keeping transaction costs low. The allocation mechanism of direct measures based on competition may be efficient in order to meet specific goals and finance high quality projects – but this may also be costly. Swapping a tax incentive from which thousands of firms benefit with the processing of the same number of applications on a competitive basis would in many cases not be realistic from an administrative point of view. And the quality of such mass-processing of applications could be questioned. The objective of tax incentives is often to stimulate the breadth of the innovation system and improve the innovation climate by increasing absorptive capacity, an objective that does not go well together with the rationing of government stimulation through competition

Whatever mix of government support countries find appropriate, it makes sense to ensure that the total system of government funding for business R&D is coherent and transparent, that the different elements are understandable, and fit well together in a holistic approach. In addition there might be some questions of relevance for most countries when deciding on their policy mix:

- Is the objective to increase the R&D intensity among firms from a relative low level? If this is the case, it might be sensible to use tax incentives as a general instrument for all firms by reducing their marginal costs on R&D.
- Is the objective to increase R&D intensity among SMEs? Tax incentives might be better suited than direct measures here. Tax incentives can be restricted to or be more generous for SMEs, and a more efficient way to reach out to a large group of firms.

- Is the objective to ensure specific goals for the development of the R&D and innovation system? In that case direct measures might be an efficient tool. However, tax incentives could also be used as a tool to encourage firms to buy more of their R&D from universities and research institutes.
- Is the objective to stimulate high risk projects or to stimulate R&D in general? Direct measures might be more efficient in stimulating high risk projects, while tax incentives might be more efficient in stimulating R&D in general.
- Is the objective to enlarge the R&D capacity within certain fields or R&D milieus? In that case direct measures would be the natural choice as it is difficult to use tax incentives to target such specific fields or areas of R&D activities.

4.1.3 A wider use of tax incentives

The use of R&D tax incentives as a policy tool in the EU as well as in the OECD is clearly on the rise. Based on the most recent OECD data (2004), an increasing number of OECD countries - now numbering 20 – have introduced special tax incentives for business R&D. This compares with 12 such OECD countries in 1996. Most of the recent changes in R&D tax treatment took place in Europe.

Example 1: A new tax incentive scheme in Poland

In 2005 the Polish Parliament decided on changes in the tax systems regarding R&D through a new law which enter into force 2006. The main ingredients are:

- deduction from tax base expenditures spent on a purchase of the new technologies of the amount no greater than 50% (SMEs) or 30% (other than SMEs);
- shortening the depreciation period off the finished experimental developments from 36 months to 12 months; and
- imposing a 22% VAT rate for scientific-research services. Under the previous law these services were exempted from VAT, which created a barrier for cooperation of research units with enterprises, as VAT could not be deducted.

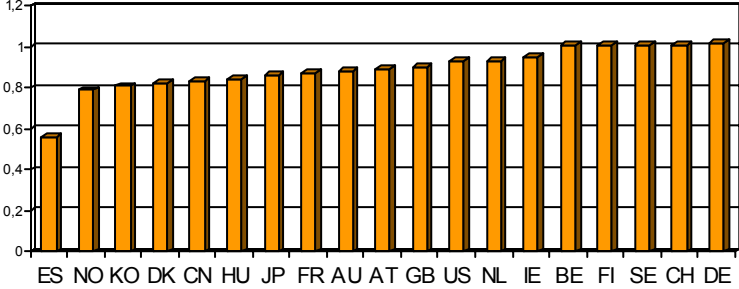
In addition, R&D intensive private enterprises were given the status of Research and Development Centre. These have the right to apply for grants from the science state budget, and can have a monthly deduction of 20% of revenues from their research and innovation funding. The R&D Centres will be exempted from tax on real estate, agriculture and forest tax when a tax subject is exploited while executing research and development works and from other payments. A mechanism of technological credit was also introduced. This is a new instrument for entrepreneurs that are purchasing or implementing new technology. At least 25% of the value of the purchase or implementation of a new technology must be provided by the entrepreneur, and the government contribution has a limit of 2 million Euros.

Robust comparisons of national tax incentive schemes are problematic, as it is not possible to take account of the all the detailed differences in designs. However, the B-index is a useful tool to provide a general indication of how different R&D tax incentives compare at a very broad level. Figure 2 shows the score of OECD countries on the B-index. The B-index measures the relative attractiveness of a corporate income tax system in terms of its R&D tax treatment. The B-index is based on as the present value of before-tax income that a firm needs

to generate in order to cover the cost of an initial R&D investment and to pay the applicable corporate income taxes: The lower the index, the greater the incentive for a firm to invest in R&D. More briefly it can be explained by how much own effort that is needed in the firm for financing 1 Euro of R&D. In Spain, business enterprises need about 0,55 Euro to finance 1 Euro of R&D due to the generosity of the tax system, while in Germany, Sweden, Finland and some other countries the firm has to generate all the resources needed themselves or through other means than the tax system.

The B-index therefore provides a very general indication of the value of tax incentives for R&D as it does not take account of some key features, such as caps. The Norwegian SkatteFunn for example, is attractive but only up to approximately 500.000 Euros pr. enterprise. The B-index does further more not express the total government generosity related to R&D when looking at the tax treatment and direct measures in combination. Nor does it take into account caps or other limitations in tax-deductibility of R&D costs, or tell how much firms actually use the tax incentives. Transaction costs might discourage industry from using a tax incentive, or the industrial structure and availability of researchers might be such that a tax incentive is not much used in practice.

Figure 2: International comparison of B-Indexes – 2004



Source: JPW Innovation Associates Inc and OECD, Italy not included

4.1.4 Impact of tax incentives on R&D expenditure

A good deal of evidence is now available on the impact of tax incentives on R&D expenditure – there are at least 11 studies of the US ‘Research and Experimentation’ system alone (see the attached Technopolis report for details).

There is a great deal of variation in the results produced by empirical studies. In 19 studies reviewed in 2003, for example, the price elasticity of R&D varied from insignificant to over 2 (which imply that a 10% reduction in price leads to a 20% increase in R&D). Where results are presented as a comparison between tax foregone and additional R&D, again the variation is considerable but the ratio is frequently of the order of one. And in just about every case, long-term effects considerably exceed short-term effects. Early studies (prior to 1988) tend to give lower values than later studies. The general conclusion of later studies is that the tax foregone more or less matches the increase in R&D expenditure. That is, as an overall average effect; firms increase their R&D broadly in line with the reduction in their tax liabilities. However, this effect on R&D is not instantaneous - the impact is initially lower and builds over time (see the attached Technopolis report for details).

It is important to take into account that the additionality effect is not the same as the wider benefits of the increased R&D to society. Based on a wide range of studies the benefits to society can be 2-3 times higher than the cost of R&D. Even if the increased R&D is not higher than the taxes forgone by government, the tax incentive can still be an excellent investment for society.

4.2 Design options and their use – a cross-country overview

4.2.1 Introduction

Tax incentives for business R&D were introduced in several of the EU/ CREST countries in the beginning of the 1980s. Among countries with a long experience with tax incentives are Belgium, France and the Netherlands and, outside Europe, Australia, Canada, Japan and the United States. In recent years, however, a number of European Countries have introduced or reinforced such schemes. Currently 17 of 33 CREST Countries and 15 of 25 EU Member States have tax incentives for business research and development in place: Austria, Belgium, Denmark, France, Hungary, Ireland, Italy, Malta, the Netherlands, Norway, Poland (2006), Czech Republic (2006), Portugal, Slovenia, Spain, Turkey and the United Kingdom.

The OMC first cycle report on tax incentives made a map of these, and found some striking features:

- There is a great variety in the design of tax incentives
- There are a number of combinations of design traits that countries are choosing – in other words, there seems to be no clear link between the different dimensions of designing tax incentive schemes
- Most countries have tax incentives for R&D where all firms are eligible
- Most countries have definitions for eligible R&D spending that include all forms of R&D and R&D activity

The following descriptive overview covers a total of 23 national tax incentives for business R&D in 15 EU/ CREST countries in 2005, and is based on the attached paper by IPTS. The number of incentives is significantly lower than the 63 measures covered within the much broader scope of the questionnaire of the CREST OMC first cycle expert group on tax incentives. The reason for this discrepancy is that the Working Group has focused on tax incentives related to corporate taxes and, in addition, excluded the treatment of R&D under the general tax law provisions.

Among the countries which do not use tax incentives for business R&D in the strict sense, there are some which use tax incentives only for fostering the market introduction and uptake of new products and processes, e.g. Israel and Romania, and some countries such as Greece, Latvia and Malta which include R&D as one of many possible items for a general investment incentive scheme. Among the countries which do not use tax incentives for R&D at all are countries with high R&D intensity such as Germany, Sweden, Finland and Switzerland as well as countries with low R&D intensity such as Cyprus and Slovakia.

Example 2: The French R&D Credit

Created in 1983, the tax credit supports the companies in their R&D efforts. All industrial, commercial or agricultural companies that are subjected to the tax (whatever their size or their branch of industry) are eligible for support. The scheme supports 9 000 companies with a tax credit that amounts to 1 billion Euro. R&D supported is according to the OECD-definition of research, applied research and experimental development. The scheme also involves depreciation of expenses for buildings and equipment and for personnel expenditures for researchers and research technicians. It is possible to depreciate 75% of personnel expenditure for technicians and 100% for expenditures on young doctors. Through depreciation of expenditures to patents this is also supported – with a ceiling of 60 000 Euro. The same goes

for standardization procedures and expenditures for monitoring of technology outside companies. The support scheme can be used for sub-contracted R&D that firms buy from experts or private companies approved by the Ministry for research and from Pros' and universities. R&D can be sub-contracted throughout EU. For the tax credit there is a ceiling for support at 8 million Euros. Support is given as a blend of R&D volume and R&D increments. The firms are, in 2006, given a 10 % credit based on their volume and in addition 40 % of their increased R&D-effort. A tax credit that is not used can be carried forward for the coming three years.

4.2.2 Level of generosity

The generosity of tax incentives vary considerably across countries. It is no easy task to measure the generosity of tax incentives in a form suitable for cross-country comparisons. The B-index shown in chapter 3.1 is one approach that indicates the level of generosity, although it has a number of limitations. Another approach is the percentage rates of tax relief chosen by governments, either as a tax credit (a reduction in payable tax) or as an allowance (the deduction of expenses from taxable income) as indicated e.g. in the OECD report Tax incentives for R&D, trends and issues, 2002, which is presented in table 1. However the rates of relief may not be directly comparable due to differences in scope and design of the tax incentives and qualifying expenditure.

Table 1: Rates of tax incentives for R&D in CREST countries 2005 (caps not included)

| | Based on level of R&D | Based on Increment of R&D |
|----------------------------|---|---|
| R&D tax credits | France (10%) Ireland (0-20%) Netherlands (14-42%) Norway (18-20%) Portugal (20%) Slovenia (10-20%) Spain (30%) Turkey (40%) | France (40%) Ireland (20%) - - Portugal (50%) - Spain (50%) |
| R&D allowances | Austria (125%) Belgium (113,5-120,5%) Denmark (100-150%) Hungary (200-300%) Italy (110%) Malta (200%) United Kingdom (125-150%) | Austria (135%) - - - Italy (130%) |

Source: Annexed paper by IPTS

The amount of tax relief and the generosity of the tax incentives vary considerably. It should be noted that the size of the tax relief available is not the same as the total size of government support through the tax system, since this also relies on:

- the corporation tax rates, which have in particular an impact on the net value of R&D allowances
- the general corporate tax treatment of R&D
- the detailed design options chosen which often restrict the tax incentive scheme to certain target groups or types of R&D
- the way measures are implemented in administrative practice
- the awareness and take-up of the tax incentives amongst firms

For a comprehensive picture of the cross-country generosity of schemes, the whole range of design options which are presented in the following sections should be taken into account. A more detailed description is given in the annex by IPTS and in attached tables.

4.2.3 Eligible R&D

A tax incentive can be more or less generous depending on what type of R&D is covered and whether outsourcing of R&D falls under the scheme.

Most countries have used the OECD (Frascati-manual) definition of R&D in their schemes for tax incentives. Usually all types of R&D according to this definition are eligible for the tax incentives: Basic and applied research as well as development. Concerning development a usual condition is that there is some element of novelty and resolution of some sort of scientific or technological uncertainty in the project.

Some countries have excluded certain types of R&D from tax relief. Examples are the exclusion of R&D related to design or to services or to the development of computer software.

An important design issue is whether only in-house R&D is eligible or also R&D subcontracted to other businesses and organisations is included, and whether the commissioner or the subcontractor is the one who benefits. In some countries there are also restrictions as to which types of organisations are acceptable as subcontractors.

In Belgium and Denmark there are specific measures that give incentives for stronger linkages between the business and the public research sector. This might promote the goal of better interaction across research sectors but probably also leads to higher administrative costs. In Norway the cap on eligible costs is doubled in the case of co-operation between business and a research-institution.

Example 3: Defining R&D and innovation

The definition of R&D used in this report is consistent with the OECD recommendations contained in the Frascati Manual. R&D performed by enterprises is generally investigative work which is of actual or potential use in the development of new or enhanced materials, products, devices, processes or services. Innovation can be defined as the application of ideas that are new, regardless of whether the new ideas are embodied in products, processes or services, or in work organisation, management or marketing systems.

4.2.4 Eligible R&D costs

A design choice with a variety of options is the type of R&D costs covered. Basically, three general types of costs can be distinguished:

- Wages and social charges
- other current expenses and
- capital expenditures

The tax incentive can be designed in a way that includes all types of costs, or exclude some of the costs, i.e. capital cost, market surveys and administrative overhead costs. As part of the general tax treatment of R&D, most of the CREST countries allow for a 100 percent deduction of current expenses. Also, in all 23 incentive schemes for business R&D in use current expenses are eligible. Three schemes in Belgium and the Netherlands, however, restrict the eligible costs to the most important subcategory, the salaries of the researchers.

The treatment of capital expenditures for R&D, which constitutes typically only about 10% of all R&D expenditures, is less homogenous. About half of the tax incentives covered allow for certain types of capital expenditures, usually machinery and sometimes also buildings. A number of countries accept accelerated depreciation of R&D related capital expenditures, of which the formula and restrictions vary considerably in detail. Some countries, e.g. Ireland, Spain and the United Kingdom, allow even 100% depreciation of the capital expenditures in the first year (OECD 2002a). Finally, schemes differ to what extent categories such as software, patent purchase and licenses are eligible.

Theoretical arguments suggest that all R&D outlays should be treated as (intangible) assets instead of current expenses (on this topic see the report of the independent EU expert group chaired by Bruno van Pottelsberghe, European Commission 2003), and be depreciated according to appropriate principles. However, due to a number of reasons, all EU countries seem to accept the treatment of R&D as current expenses.

4.2.5 Target groups

A further important design issue is the definition of target group:

- Are all R&D performing companies covered by the scheme?
- Are SMEs given a more generous treatment than other firms
- Are there provisions that give relief to companies that are not in tax-position?
- Are firms in a start-up phase given preferred treatment?

About three quarters of the tax incentive schemes are open to all types of firms. In about half of the schemes this general openness is somewhat limited by an upper ceiling of eligible R&D expense – a cap. This makes the tax incentive schemes less interesting for large firms because of lack of a marginal incentive for R&D expenses above the cap.

About one third of the tax schemes provide specific incentives for SMEs, and two schemes in France (the young innovative company) and the United Kingdom only target SMEs (although in the latter case formally the SME scheme has been extended to other firms). A growing number of schemes try to provide for young innovative or less profitable firms. In France there are even specific conditions and schemes for these target groups. Incremental tax incentive schemes might, in general, favour SMEs and young companies who are about to increase their R&D expenses from a fairly low level. There might be reasons for arguing that “mature” firms in general will have more stable R&D investment patterns.

R&D tax incentives need to be compatible with the internal market and with state aid rules. This will be treated in a forthcoming communication describing and analysing relevant Treaty provisions and ECJ case law regarding fundamental freedoms and non-discrimination principles as well as setting out the legal constraints arising from State aid control.

4.2.6 Tax regime chosen

The choice of the tax element that the incentive is related to is sometimes a neglected design option. Theoretically, a range of options exist, e.g. corporate income tax, personal income tax (including the treatment of capital gains), wage taxes, social security contributions, sub-national taxes or even the value-added tax or customs.

Usually, discussion focuses on corporation tax, which is the basis for the vast majority (20 of 23) of the incentives in use covered here. At the same time, nearly half of the incentives are also an integrated part of the personal income tax system. This is important for SMEs because

a number of these are not organized as corporations, or have no profit that makes room for the use of tax incentives that are part of the corporate tax system.

Four of the 23 schemes are not based only on corporation tax. In Belgium, there are tax exemptions for additional researchers under the wage tax. In the Netherlands, the WBSO scheme reduces the employers' wage taxes of firms which invest in R&D. The tax credits result in lower wage taxes to be paid which affects the taxable income of the corporation thus increasing it and higher taxes must be paid. The effect is net between the value of tax credits and the value of induced additional corporate income taxes that must be paid. The young innovative company scheme in France combines exemptions from corporate taxes with lower social security contributions and local taxes. These tax regimes have the advantage that firms receive the cash advantage directly because the amount of relief does not depend of the current profitability of the firm.

There are other traits in the corporate tax system that also may be of importance for the R&D activities within firms. Rules for activating and depreciating costs may influence whether firms finds it economically viable to invest in R&D. In the full discussion of framework conditions for R&D spending in firms, policy makers should be aware of how these other characteristics of a tax system influence firm behaviour.

Example 4: Giving incentives for hiring knowledge workers in Belgium

One of the political goals of the Belgian Federal Government is to reduce the cost of knowledge workers. Since the end of 2003, a series of different measures have been taken to achieve this objective. It was decided to reduce the advance levy on researcher's wages in universities, high schools, official and private non profit research institutes by 50%. This implies a reduction of 10% of the overall cost of a researcher.

In 2006, this measure will be extended to:

- research staff and technical staff in small enterprises younger than 10 years with research expenses that come to 15% of their total expenses
- researchers in all enterprises with PhDs in exact or applied sciences, medicine, veterinary sciences and civil engineers

The extra income that these measures generate for private firms has to be booked as revenue, which means that they will be taxed by 34% (the Belgian corporate tax level for large enterprises) or 25% (for SME's). An exception from taxation is made when this income is reinvested in the firm. This gives the firms an incentive to reinvest the extra-income.

4.2.7 Type of fiscal relief

An important choice for R&D tax incentives is whether all R&D expenditures are eligible (so-called volume-based schemes) or if only additional research is supported (incremental schemes). A rather large literature argues that this choice is one of the most important issues in designing tax incentives. Among the measures in use the first option is increasingly favoured. One repeatedly reported reason for this is that business strongly argues in favour of this design option. 13 measures in 10 countries can be considered as strictly volume-based. Another four measures base the incentive on the approval of specified R&D projects, which means that they are effectively volume based. Six measures combine a volume-based and an incremental approach, either by leaving a choice to the firms or by giving higher incentives for increments. Taken together, eight countries follow a non-incremental design approach, of which five limit themselves to a volume-based approach in the strict sense (Hungary, Malta, Turkey, Slovenia, and UK).

One comparison between tax incentives in USA and Canada that is cited in the attached IPTS report suggests that the additional research reported per unit of government expenditure tend to be somewhat higher for incremental tax incentives than for volume-based measures. However, the evidence at hand is so limited that no firm conclusion can be drawn from the IPTS report on this point.

A volume-based scheme might seem to be more generous to business, in particular towards research-intensive (and hence often large) firms. This depends however on the tax rates involved, how much R&D the company is doing, how many companies qualify for the tax incentive and the trend in R&D spending and whether any caps or thresholds are set in place. Governments can therefore to a large degree control the taxes foregone both under volume-based and incremental tax-incentives.

The decisive issue is whether the price-elasticity of R&D costs is greater for firms increasing their R&D than for the rest of industry. There is no conclusive evidence on this issue and it may well be the case that the opposite of the intuitive position is true: some firms might be in a technology and in a phase where they would increase their R&D even without a tax incentive. Also the business cycle might have a negative impact on incremental schemes, because the R&D investments by firms are strongly linked to profitability within firms. If this is true then incremental systems would boost R&D investments levels in growth periods, but would make no contributions in upholding R&D investment levels when the business cycle turns downwards. According to standard theory the R&D intensity of an individual firm has an S-shaped form (Gompertz curve) with an upper limit during its life time. As a result larger firms, with stable R&D intensities do not profit from incremental schemes – and get no incentives for upholding their R&D investments. It is a well established fact that under-investment in R&D is an inherent market failure, which also applies to firms which are in a position where they have to choose whether they should reduce or uphold their R&D investments. Incremental schemes will in general only support companies that want to increase their R&D investments. After a certain point the incentive would be withdrawn – due to the fact that that firm is not increasing its investments. However, the market failure aspect remains the same and might cause the firm to reduce its R&D investments.

Figure 3 compares incremental and volume based incentives by showing the advantages concerning the two. In brief, the figure shows that volume based incentives are the most advantageous seen from the business perspective, while seen from the government perspective this can be a more expensive system. Incremental designs are, however more complicated and costly to operate and may discriminate between firms – because only firms that increases their R&D efforts are beneficiaries. There is no guarantee that this promotes the most profitable projects or that an incremental tax incentive has a higher additionality effect than a volume-based system.

Figure 3: Advantages of volume and incremental designs

| | Business perspective | Government perspective |
|--------------------|---|---------------------------------|
| Volume | Easy to comprehend Low application costs Provides no incentives for distortions in or between firms Apply to a wide range of firms | Low administrative costs |
| Incremental | Target R&D start-ups and firms with fast growing R&D | Limited costs Target new R&D |

Source: Based on presentation from Bruno van Pottelsberghe to the Working Group 6th September 2005

The three basic types of fiscal relief are tax deferral, tax allowance and tax credit. A tax deferral is a delay in the payment of taxes, typically in form of an allowance for accelerated depreciation. In principle, certain forms of tax deferral exist in the tax treatment of R&D in nearly every country. Most of them accept the full deduction of current R&D expenses, which can be regarded as accelerated depreciation. However, such depreciation is a weak incentive.

The alternative to full deduction immediately is the depreciation (and costing) over subsequent years. If the cost in terms of money is disregarded, the amount of taxes is the same. However, for many companies cash constraints are a serious problem and, for them, it may be much better to move the tax bill into the future.

A tax allowance allows for the deduction of expenses from the taxable income. The typical form is that more than the usual 100% of expenses are deductible. The value of the resulting relief depends on the applicable tax rate. This form is used in half of the schemes.

The other half of the schemes is based on tax credits. This provides a reduction in payable tax, which is applied on the base of the tax to be paid and reduces this by a certain amount.

Two schemes are used for companies not in a tax-paying position. One is a cash refund from government. The other allows companies to carry forward unused tax credits. The carry forward of unused tax credits is technically more difficult, because it requires the creation of a specific pool for tracking.

Example 5: The R&D tax incentives in Italy

The fiscal incentives now in place in Italy vary widely in their form and other features of their design (e.g. target group), taking one of two forms:

- i. *tax credits* or amounts deducted from tax liability.
- ii. *tax allowances* or extra amounts over current business expenses deducted from gross income to arrive at taxable income.

There are three tax credits that all are decided in law. One is geared towards venture capital and aimed at SME's, the other supports the purchasing and know-how and the third supports the recruitment of researchers by companies. Two of the measures are optional for implementation in regions. The first measure is only implemented in 5 of 20 regions.

With regard to tax allowances, in 2003 the Techno-Tremonti act introduced for one year a fiscal incentive to R&D based on a combination of level and increment. The firms were given a 10% tax deduction based on their R&D investments in 2004, and a 30% deduction on additional R&D spending in coming years.

The qualifying costs were salaries and costs for materials and services, expenditures on interests for loans signed in order to perform R&D and for costs regarding patents and use of licenses. In addition, Italian Researchers that worked abroad and came back to Italy were given a 90% tax exemption for three tax periods when they return to Italy.

4.2.8 The administration of tax incentive schemes

There are variations in firms' use of tax incentives across countries that cannot be explained by the generosity of the different schemes or whether the systems have some specific target groups. Other factors than the tax incentive evidently play a role in take up. These can be

related to the industrial structure in the country, the availability of researchers and how liberal the general tax system is.

However, it is reasonable to believe that the administration of the tax incentive is an important factor in itself. The Working Group has not had in depth studies of these issues, and evaluations usually do not look into the administration of the scheme. However, evaluations should consider this issue as it is crucial to the overall success of the policy.

The core question related to the administration of tax incentive schemes is the transaction cost (costs for examples in gathering of information, administration and reporting to authorities) as perceived from the companies' point of view. If they are considerable, companies will stay away and the policy objectives will not be met. On the other hand, for the long term legitimacy of the scheme, control systems must be in place to avoid the risk of the system being misused.

Information

How wide-spread a tax incentive will become depends initially on the information provided to companies on the scheme itself and alternative financing of R&D. This information can be provided by Government, or by professional business advisers/accountants who may have better routes into company board rooms. If information is widely published in the media and easily accessible on the web, and if public authorities target information to industry that a new and interesting scheme is in place, rapid take-up can be expected if other factors are in place. One of these other factors would be assistance in taking the necessary steps to benefit from the tax incentive. This can be anything from good information services to advice related to the filling out of forms and the physical availability of qualified personnel who can answer questions. HMRC in the UK and Norwegian authorities have, for instance, in consultation with industry put quite an effort into establishing a high quality service related to their tax incentives.

Information is also a key aspect in reducing the firms' compliance costs. These are costs that firms and public administration entail in the follow up of the use tax incentives and the control of how resources are used. If firms are well acquainted with the conditions concerning the use of tax incentives, they will find it easier to administer the transactions with government agencies involved, and the resources from public bodies on control might also be more efficiently used when firms are aware of what to expect concerning control measures.

The processing of claims

The processing of claims is an important factor for companies. This issue has a number of facets: approval of applications for tax incentives, approval of the costs related to the project, provisions related to accounting and documentation, the frequency and burdens related to tax-inspections and the time involved.

There are a number of different solutions to how claims are processed. The main difference is between self-assessment schemes and schemes where projects have to be approved ahead of firms making use of the tax incentive. In self-assessment schemes the firms themselves declare how large a claim they are filing for, and they are themselves responsible for making sure that the money involved is dedicated to the purpose defined by the tax incentive scheme. Government authorities have the responsibility to check afterwards if the money involved is used according to purpose or not. In schemes where firms need pre-approval of projects they are responsible for making sure that resources are used according to what they have stated to government authorities, but they are not themselves responsible for making sure that the project is a R&D project. This is taken care of through the pre-approval process and by government authorities.

There seems to be considerable differences between countries related to the processing of claims. In one country eligible projects are approved in advance with a normal time for processing of 2-3 weeks, while in another country it can take up to 1 ½ years until this issue is resolved. Anecdotes indicate that in some countries the visit of a tax inspector is regarded as so disagreeable that no tax incentive is worth the risk. Although such anecdotes are probably exaggerated, they do illustrate a point. In some countries there is a division of tasks between different authorities. In Norway the Research Council gives forward approval for which projects fall under the scheme. Tax authorities on the other hand approve which costs are eligible and are responsible for documentation and inspection

The time it takes before the tax relief is a reality is naturally of great importance, particularly for start-ups and other companies with a weak cash position. The motivating effect of a tax incentive which gives immediate relief, such as in the Dutch system, is usually stronger than an incentive which does not affect the cash position for several years. A number of studies indicate that one of the important effects of tax incentives is that they speed up the R&D processes of companies. Based on this, time from project to when the relief is realized is probably a very important factor.

For a number of companies ongoing R&D is regarded as very confidential information. If the processing of claims involves unmasking these secrets, and if there is not 100% trust in how the authorities involved handle this confidential information, companies will stay away from the tax incentive. It is therefore necessary that authorities give careful attention to how much confidential information really is warranted, and how it should be treated.

Appeals

If an application is rejected there is usually a possibility for appeals from the individual firm. These appeal processes may be strictly judicial processes or also have a first round of appeal through Government authorities. This last solution might be preferable because, through this kind of a “softer” appeal process, items might be clarified that could resolve problems before they enter into the judicial system. There might be different grounds for appeal, and it may be defined ahead as to what aspects of the claim can give grounds for appeal through government authorities. The possibility of “soft” systems for appeals that have low costs for firms may cause a larger amount of appeals, but might also raise the attractiveness of the tax incentive scheme because it is perceived to have high legitimacy – especially among firms that cannot afford judicial appeal processes.

Culture

One aspect that governments should have in mind when designing the administrative systems for tax incentives is which public bodies should be in charge of what. Traditionally tax authorities have an expertise and culture fine-tuned for handling economic and legal issues within the tax system. The task of encouraging industry to initiate R&D projects is a different one and might call for a different culture. This might make it sensible to establish a separate unit in the revenue services for handling the tax incentive, or possibly have a division of tasks between research councils, regional development agencies or local government. However, it is important to ensure that the division of tasks does not complicate the situation for industry by creating new problems of co-ordination or uncertainty as to who is responsible for the smooth running of the scheme as a whole.

Consultation

The legitimacy and attractiveness of the tax incentive scheme can be influenced by the way firms are engaged in the making, adjustment and reporting of results from the tax incentive systems. Ongoing consultations with firms might be an efficient way of finding problems and

solving them, thereby increasing administrative efficiency. In some countries, there is also a tradition for involving interested parties in making important new policies, for instance by hearing processes in making laws or white papers.

The firms themselves of course report results from the tax incentive scheme. In addition, they might be used as partners in the evaluation of the administration of the tax incentive system. The inclusion of firms in these processes might have impact on the use of the tax incentive system, and might therefore contribute to the success of the scheme. However, in order for this to have a positive impact the choice of which firms or representatives of firms' interests to invite as partners in these processes should be given consideration.

Example 6: The consultation process in the UK

An interesting approach looking at both qualifying R&D activities, and the eligible costs of those activities was taken in the United Kingdom. A wide ranging consultation took place with business on these issues in 2003, three years after the introduction of the first R&D incentive scheme.

The consultation had two key features. Firstly it looked at the definition of R&D to check with business whether it was fit for the purpose – in particular whether it was perceived by those involved in less R&D intensive sectors such as engineering or services as applying to their industries. Secondly whether the costs eligible for relief were a fair reflection of the direct costs incurred in conducting R&D.

The outcome of the consultation was that substantial improvements were made on both fronts. The boundaries of R&D activity were not changed, but the wording of the definition was substantially revised to make its principles more easily applied across different sectors and technologies. Businesses welcome this more neutral statement of the definition of R&D as a major simplification. On eligible costs, the Government rejected calls for 'all direct costs' to qualify as it was feared this would increase complexity by being too imprecise. Instead a change to extend qualifying costs to certain further specific direct costs was implemented. A recent survey of 1,000 UK R&D companies indicated that around two thirds felt they had a good understanding of the scheme.

Data gathering

Evaluations depend heavily on the data gathered from the firms involved in the tax incentive scheme. These data are also of vital importance in establishing accountability for the tax incentive scheme in relation to policy processes, and will have great value for the general factual basis for the R&D and innovation policy.

At the same time the gathering of data might be costly for firms involved. The strategies for data collection should therefore be considered carefully, and might be an item for discussions between companies and government agencies. Other information sources could also be used to gather information on the use of tax incentives – for instance through the regular R&D and innovation surveys.

4.3 Evaluation methods

4.3.1 Methods for evaluation

Evaluations have different roles in different stages of the policy process:

- Evaluations can provide a knowledge base for introducing or modifying tax incentives for R&D;
- Information based on data that are used in evaluations can be used in the ongoing monitoring and reporting; and
- Evaluations can be used to assess the effects of policies or tools for policies, and thus increase accountability.

According to the first cycle OMC report on tax incentives, only 8 of the 17 countries that use tax incentives have evaluated those measures. Countries that have or are in the process of carrying out evaluations are summarized in table 2.

Table 2: Evaluation of tax incentives

| | Are measures evaluated? | Are results available? |
|-------------|-------------------------|---|
| Austria | Y | Not published |
| Belgium | Y | On a ad hoc/recent basis |
| Hungary | Y | Y |
| Latvia | Y | Y |
| Netherlands | Y (new is initiated) | Y |
| Norway | Y | Not yet (preliminary results in March 2006) |
| Portugal | Y | Not yet |
| UK | Y | Early results are available |

Evaluations aim to assess how well policies meet their objectives, to learn how to improve how they operate in practice and if they still are necessary. Hence, evaluations are vital tools for the development of policies. The challenge involved in carrying out evaluations is because the objectives of tax incentives often are multidimensional: for example to increase R&D investments, R&D personnel, and collaboration across R&D sectors. This, as well as the inherent limitations of available evaluation tools, requires the use of multiple methods. Evaluations also need to consider any specific policy objectives and the delivery or administration of the policy. Useful methods include the following.

Case studies

Case studies can be used as a tool for exploratory studies in order to improve the design of the evaluation itself, or as part of the evaluation. In some circumstances, it may be necessary to get additional information to develop the evaluation design. Case studies could explore some of the questions in the evaluation that need clarification.

Case studies could also be an important part of the evaluation itself. Critical tests could, for example, consist of comparing firms operating under different framework conditions to see how they respond to tax incentives. In-depth studies could provide extensive information, and take into consideration the different contexts that firms operate within. A small number of firms could also be used for interviews to cover extensively certain aspects of the tax incentive. In this manner case studies would enrich the contextual information for evaluating tax incentives and their objectives.

Survey-based evaluations

Most evaluations of state grants for R&D have involved surveys. Several state agencies for research and innovation have also developed on-going systems for monitoring and analysis through the use of surveys. Surveys could be used for covering different objectives that are set for tax incentives, and could be used in a more limited way as part of an exploratory study.

These may also be important for analyzing outcomes of tax incentives like their administration, the awareness and understanding of the scheme amongst R&D firms, the ease/difficulty of claiming (i.e. transaction costs), and companies' perspectives regarding the effects of the tax incentive – their R&D spending, types of R&D they do, and R&D processes. Also the making and operationalising of R&D strategies within firms can be included to measure behavioural additionality. One key advantage of surveys is that the results can be produced much more quickly as one does not need to wait for sufficient data to build up, although such early surveys of course do not pick up the long term effects.

Econometric studies

Econometric methods rely on quantitative procedures to estimate relationships for models specified on the basis of theory, prior studies, and/ or knowledge of the subject. Given good prior knowledge about relationships and good data, econometric methods provide a way to incorporate expert judgment and quantitative information.

Evaluations of tax incentives are overwhelmingly based on econometric analysis, unlike evaluations of direct measures. The main reason for the difference is presumably the universality of tax-based schemes, where the effect on firms can be estimated at a distance, so to speak, without collecting evaluation specific data. With targeted subsidies, there is a need to know the extent of public assistance (firm-by-firm) over time, which is not easily available information.

The success of a tax incentive scheme critically depends on the effect it has on R&D activity. Econometric evaluations quantify extra R&D generated by the tax incentive keeping the influence of other factors constant. The coefficient of the R&D cost variable in the business R&D expenditure equation indicates how much additional R&D is generated through the fiscal incentive. In addition to this "direct additionality" effect, "indirect additionality" effects can also be evaluated through econometric methods. "Indirect additionality" means that increased levels of R&D investments increase firms' R&D competence, thereby increasing the profitability of future R&D projects.

Counterfactual analyses

Counterfactual analysis should be an integrated part of econometric studies, but can also be used in other types of evaluations. To answer fundamental questions about the additionality of tax incentive schemes it would be desirable to carry out counterfactual analysis, where the actual level of R&D investments would be compared with the level of investment that would have been realized if the tax incentive scheme had not been implemented.

Ideally, such a question should be answered by carrying out a controlled experiment, randomly dividing the population of firms into two groups, and giving one group access to the tax incentive scheme. In most circumstances this would be neither practical nor legal. In Canada however, where regional incentives are in place, it should be possible to compare between regions. The challenge in a non-experimental setting, without a formal control group, is to deduce from historical data what the situation would have been if the tax incentive scheme had not been launched.

In order to do this several different approaches can be used. The conceptually simplest approach is to carry out a "before-and-after-study", i.e. to look at changes in total R&D investments under the assumption that the changes can be attributed to the implementation of the scheme. This approach can be refined, and the estimates improved, by estimating a model that predicts R&D investments from firm-specific variables, business cycle indicators etc, thereby controlling for other factors than the tax incentive that are relevant for the level of R&D investments.

Another approach is to utilize discontinuities built into the schemes to generate “quasi-experiments” that can be analysed by so-called difference-in-difference methodologies. Some tax incentives have been set in place gradually, and prior restrictions can be used to develop different datasets that can be used for comparisons. This would be based on the assumption that firms around the border of the, for instance, size restrictions are comparable, and that it is in a sense random whether they were eligible for tax subsidies or not. The weakness of this approach is that it cannot tell us much about the effect for firms that are far away from the former restrictions or thresholds.

A third possibility would be to use data from other countries in order to construct datasets that make it feasible to carry out counter-factual analysis. This may be necessary in situations where it is not possible to construct panel data based on historical firm data and, where it is not possible to utilize discontinuities in the tax incentive scheme, to draw a sample of firms and thereby construct panel-data to perform counter-factual analysis. A weakness of this approach is that specific national traits may cause a situation where the dataset for the contrasting situation may be of limited value. Nonetheless, using data from other countries is a tool that has been used in order to test robustness of national findings.

4.3.2 The making of databases

Evaluations require an extensive information base. It is often necessary to combine data from existing databases together with surveys carried out to obtain data on specific aspects of the tax incentive schemes not covered by existing data sources.

The “core” databases in evaluations are micro data from national statistical agencies and databases assembled by the operating agency for the tax incentive. To study the effects of a tax incentive scheme for R&D, one needs a fairly long time horizon because the total economic effects of R&D cannot be expected to be visible in the short run. The data should cover a sufficiently long period both prior to and after the launching of the schemes. What should be regarded as “sufficiently long” can in principle not be established *ex ante*. In practice, one has to make a compromise based on the availability of historical data, the cost of gathering new data and the time horizon for the evaluation project.

The databases from the operating agencies will contain all relevant information from firms’ claims. In some countries, there will also be information from processing of applications and from the firms’ reports after the completion of the supported R&D project. The users or beneficiaries of tax incentives also often report annually how the money saved through tax incentives are spent.

Not all aspects of a tax incentive scheme can be evaluated by using existing data sources. It is therefore necessary to have specific surveys covering behavioural additionality and administrative aspects of the scheme.

Perhaps the major data problem in many evaluations is that relatively small firms, firms with less than five or ten employees, carry out a disproportionately large number of the R&D projects supported. In most countries these firms are not covered by the general R&D surveys; hence there is not any direct and independent information about the R&D activity prior to the launching of the tax incentive scheme. It is therefore necessary to rely on other sources to try to indirectly identify changes in R&D activity among these firms. The need for data should also be balanced against the burden this imposes upon especially smaller companies.

Example 7: The making of a database for the evaluation of the Norwegian tax incentive scheme

The most important data-input to the evaluation of the Norwegian tax incentive scheme, SkatteFunn, is the micro information behind various statistics produced by Statistics Norway (SN), as well as databases assembled by the Research Council of Norway (RCN) (most importantly the SkatteFunn database). The panel database for the evaluation of SkatteFunn consists for the time being of data from about 18000 establishments with data back to 1993. This will be continuously updated throughout the project. All establishments which are found in SN's R&D statistics and/or which have submitted applications to SkatteFunn during this period are represented in the database. This database contains detailed information on R&D activity, inputs and outputs, employees (including education) as well as information from accounts from business enterprises. It has been taken into consideration that these may undergo structural changes, therefore only enterprises defined as comparable are included. A change in R&D activity for an enterprise will be based upon real change and not structural change in the enterprise (i.e. mergers and acquisitions). SN and RCN have a constant dialogue where errors, misunderstandings and inaccuracies found in the data are discussed. The SkatteFunn database has been under continuous development, which means that the oldest projects are of poorest data quality. In addition to statistics mentioned above the panel database also includes data of real tax exemptions from SkatteFunn collected from Skatteetaten (tax authorities). This is important in order to see how many of the projects which are completed.

4.3.3 Experiences from econometric studies

There have been many econometric studies of tax incentives, carried out mainly at the level of the individual firm, but there have also been some industry-level and cross-country studies. Most of the work is related to the US, although there have been several studies of schemes in other countries.

In general, input additionality is the least difficult to identify. Results on profits in companies and for society at large are harder to identify. These can also involve substantial time lags. The Institute of Fiscal Studies in the UK has for instance suggested that the full effects of the UK R&D tax credits will take around 10 years to emerge.

The question of overall macroeconomic effects of increased R&D on GDP is rarely carried out as part of an evaluation of the impact of tax credits, but in principle the effects of tax incentive schemes come in three stages. First, the scheme must lead to more R&D in firms (first order effect). Second, this increased R&D must lead to an increased pace of innovation (second order effect). Third, this increased pace of innovation must lead to increased profitability, etc. (third order effect). A successful scheme therefore requires more than a large input additionality. Generally, it will take more than 10-15 years before all effects can be measured.

Costs to the state include the tax foregone and administration costs incurred by the tax authority and by firms. The situation is complicated by the fact that exploitation of tax credits may have other effects on the overall net tax liability of the firm - for example, the credit itself may be taxable. Taxes foregone by government obviously depend on the extent of R&D carried out under, or induced by, the scheme - the extent of take-up of the benefits. In principle at least, the benefits at national level, in terms of increases in productivity or

national income, can be compared to the costs. Eventually government income will increase because of higher profits in industry but this will take time.

4.4 Knowledge gaps

It seems evident that the national economy gets back many times its investment in R&D, as referred to above. The evidence also seems very strong that there is a real and large gap between social costs and social returns to R&D. There are in other words significant and positive spillovers from private R&D investments to the rest of the economy. This gives a justification for state intervention.

There does also seem to be good evidence that R&D is increased by tax incentives, although there is variation in the estimated extent of that increase. One unit of R&D stimulated per unit of tax foregone seems to be the best rule of thumb. But this needs to be treated with caution, as there is a great deal of uncertainty.

There are no studies of which the Working Group is aware that show the links between tax incentives and effects on productivity and/ or growth. However, there are theoretical grounds to believe there is such a linkage, due to the fact that firms decide to undertake R&D with the provided tax incentive. This in itself would indicate that the firms see the opportunity to make profits from R&D through the use of tax incentives.

When it comes to the influence on behaviour within firms there are few studies, nearly no evaluations and no cross country comparisons. The same goes for the design of tax incentives. There are only a few studies that compare the effects from different forms of tax incentives, effects from different incentives on different target groups, eligibility, tax regime, type of fiscal relief and support level. This does not exclude the possibility that there may be more information regarding this in the future.

Most of the knowledge gaps mentioned above can be filled through research, and perhaps by countries that now operate tax incentives sharing their experiences and knowledge of evaluations in this area. This is especially relevant for comparing the effects from various forms of tax incentives. When it comes to effects on firm behaviour, the situation may be more complicated. How state support to R&D alters firm behaviour is a somewhat new topic, and demands both theoretical studies and empirically oriented work as a platform for proper evaluations to be carried out. The Working Group is aware of the work done in OECD/TIP regarding this, and is certain that this might give some input on how to move this field forward.

5 What works?

5.1 The design of tax incentives

5.1.1 Objectives

The design of tax incentives must be seen in relation to their objectives. As described earlier the Working Group is aware that tax incentives are part of a policy mix consisting of direct measures, grants to firms as well as research institutions, and laws and regulations. Tax incentives should also be designed according to what is perceived to be the most important challenges for innovations systems in the different member states. At the same time the Working Group has come to some general conclusions that member states should have in mind when designing tax incentives.

5.1.2 Incremental and volume-based designs

One of the crucial and most discussed choices in the design of tax incentives is between a volume-based and an incremental approach. At present, as shown in Chapter 4, most member states with R&D tax incentives use either a volume-based scheme or a scheme combining volume-based and incremental incentives.

The report “Raising EU R&D Intensity” recommended volume based schemes where the main objective is to substantially stimulate business R&D. This was based on the conclusion that volume-based schemes are simpler to administer (for both firms and public authorities), provide more predictable levels of support, and are more likely to stimulate greater increases in R&D (in part because they benefit more firms).

In the context of the rather ambitious aim of increasing the level of R&D in EU to 3% of GDP within 2010 it should be noted that volume based incentives is more generous, and stimulates a larger amount of R&D. If the objective of the tax-incentive is to increase the level of BRD *substantially* and the associated loss of tax-revenue is acceptable, a volume-based tax-incentive seems to be the appropriate tool.

If the objective of the tax-incentive is narrower, the choice between volume-based and incremental tax-incentives should be based on a number of considerations. Empirical studies and research suggest that both incremental and volume-based incentives can be effective in stimulating additional R&D, with no clear evidence that one approach is more or less effective than the other. Therefore, the decision needs to consider the specific aims and objectives of the policy in each member state.

As highlighted in the earlier report, the main arguments in favour of volume-based schemes are lower administrative costs for public authorities, lower transaction costs for firms and lower complexity because no baseline has to be defined or reported by the beneficiaries. The simplicity of volume-based schemes also means that firms can be more certain of support in future years, helping them to take account of the tax incentives in future R&D plans.

The absence of a baseline in volume-based schemes means they are available to a much wider range of R&D firms (potentially all R&D firms). The general nature of volume-based incentives also leaves all R&D investment decisions to firms, so avoiding potential distortions in business planning of R&D and changes in the relative pricing of R&D across firms.

Whilst incremental-based incentives may be more complex, as firms need to calculate the increment in their R&D over a particular baseline, such an approach can be useful to target support to particular R&D firms. In particular, incremental schemes should be considered

where the objective is to support R&D start-ups (as the baseline is zero in the first year and, depending on how the increment is defined, can be reduced in other early years where the baseline includes years before the company started spending on R&D) or firms with high R&D growth.

As incremental schemes target support on a smaller group of R&D firms, they generally represent a smaller cost to government than volume-based schemes. Therefore, where the available budget for a tax incentive is relatively small, an incremental scheme might be considered in order to target support to areas of government priority (such as R&D start-ups, for example). An alternative approach, however, might be to consider a volume-based scheme that uses caps to limit the total cost of the support provided. This choice will again depend on the specific objectives of the policy.

There is now a wide range of tax incentive schemes that use combinations of incremental and volume-based support. This may be an indication that there might be also other factors at work than the ones considered so far.

5.1.3 Design features coping with innovative firms not making profit

One limitation of tax incentives based (as most are) on corporation tax is that they only work properly if the companies have sufficient taxable income to make use of them. In the design of tax incentives, special provisions could be made to ensure that companies that do not have taxable income can benefit from the tax incentive. This is particularly important for start-ups and SMEs in general because they are more likely to be financially constrained than multi-product and multi-technology large firms. Important new knowledge is often generated by “outsiders” and new firms, while well established actors are more likely to be bound to well established paths of knowledge accumulation. Hence, appropriate designs for coping with firms with little or no taxable income are important.

The simplest solution is the option to carry forward the unused incentives. For the majority of measures in use, carry forward of up to ten years is possible. The availability of this option is often linked to characteristics of the general tax system. However, the effects might be limited due to the alternative costs and value of time involved. Moreover, this would be of no help in the case of liquidity constraints. In principle, the establishment of a tax refund in cash or group relief instead of or as well as a system of carry forward should be more effective. This is in use in four countries: Austria, Norway, France and UK. The two latter countries make refunds to young companies and companies in hardship or to SMEs, respectively.

Theoretically, the tradability of tax credits might lead to the same effect but the related transaction costs might limit the effectiveness for SMEs in practice. Some US states practice tradability of tax credits e.g., Connecticut, Pennsylvania, New Jersey.

This particular problem arises only if the tax incentive is based on income. Two measures in the Netherlands and in Belgium which are based on the wage tax for researchers therefore avoid the entire problem.

5.1.4 What types of R&D are encouraged?

During the last decade a lot of attention has been given to the fact that R&D intensity in firms must be viewed in relation to the specific innovation system that firms operate within. This leads to more context-dependent approaches where tax incentive systems are used in order to stimulate R&D efforts and the absorption capacity for knowledge and R&D within firms in general, rather than to stimulate certain types of R&D.

The empirical cross-country comparison reveals a variety of R&D definitions in use as basis for the different tax incentives. Many of them take as a starting point the OECD definition of R&D. The main variation between countries are to what extent development is included in eligible R&D, how strictly the novelty criterion is interpreted and how much the R&D definition is tied to marketable results. It is also noteworthy that there are only very few examples of a targeting of tax incentives towards a specific research field. Examples are the UK scheme for vaccine research, the IT focus of an Italian scheme and the Belgian tax incentive for environmentally beneficial research. This fits well with the hypothesis that tax incentives might be less appropriate than direct measures when research areas with high expected social returns are to be promoted.

5.1.5 What costs might be included?

When the objective is to enhance industry's absorptive capacity a broad R&D definition is called for, and capital expenditure might then be accepted as costs under the scheme since new equipment often is of great importance for gaining new insight and experience. When the challenge is to strengthen links in the innovation system, costs related to subcontracting R&D might be considered – and give extra encouragement through the support scheme.

A range of countries try to explicitly enhance collaboration with other research sectors, either by increased tax subsidies or through specific schemes. There is little information about how effective these specific design features are. The evaluation of the Dutch WBSO scheme for corporations gives a hint concerning this. The scheme allows for subcontracting but does not provide specific collaboration incentives. The evaluation shows that firms rather disagree with the statement that the tax incentive encouraged R&D cooperation (see attached IPTS report). One reason might be that the transaction costs involved in setting up projects where firms cooperate with research institutions are higher than the support given through the WBSO scheme. In order for firms to undertake cooperative arrangements, the support measures might therefore be somewhat higher than for R&D undertaken by the firms themselves.

5.1.6 Administrative issues

The Working Group has not entered into discussions of administrative systems and routines in great detail, but has some views on the principles for the making of administrative systems.

In Chapter 3 a number of administrative issues are mentioned of which governments might wish to consider: The processing of claims and appeals, consultation, culture and data gathering. Governments may also want to consider the principles that underpin the delivery of R&D tax credits in the UK: the administrative system should be certain, simple and consistent.

- A certain system will contribute to a predictable framework for R&D policy and thus encourage R&D in businesses.
- A simple system will ensure that the credit's value is not eroded by excessive compliance costs.
- A consistent system will ensure thrust by avoiding distortions in the use of R&D funds and be more efficient for public agencies

5.2 Conclusions

Target Group

When designing a tax incentive, there are many options. The choice between them should be carefully fine tuned in relation to the objectives set for the tax incentive.

The Working Group suggests no limitations concerning firm size in the design of tax incentives. However, the use of a cap on the size of eligible R&D might be useful in making sure that large firms do not make use of a disproportionate amount of the tax relief involved (see also below).

Several countries have specific arrangements for SMEs that have been made through the design of tax incentives, for instance a higher percentage for state support of total R&D costs and mechanisms that ensure that firms that are not in tax position also benefit from the tax incentives. The Working Group recognizes that SMEs have special needs for support. To remedy this through tax incentives might be a solution, but ought to be balanced against the administrative costs for firms and authorities in making these specific arrangements.

Tax incentives could target certain sectors, in order to facilitate increased R&D in areas that for some reason are important for society. The Working Group does not in general support this use of tax incentives. Such specific target groups invite industry to adjust strategies in a way that might be harmful for the economy at large. Categorization of firms to branches might also be an over-simplification of the true activities within firms, and thereby not capture the goal of targeting certain types of R&D based on the needs of society.

Eligible R&D and costs

Limitations on R&D topics and types covered by the tax incentive reduce the effect of the tax incentive. In addition, limitations might induce industry to enter into other R&D projects than the most profitable. One solution would be to adopt the whole range of R&D defined by the OECD (according to the Frascati-manual or IAS 38). There may however be national circumstances that call for some more specific definitions of R&D, but the main principle that countries might consider is that a wide or general definition of R&D should be used.

The Working Group advises that costs related to the purchase of R&D services should be covered by the tax incentive. R&D – co-operation usually disseminates new insight better to the rest of society than in-house R&D. Such co-operation results in extra transactions cost for the parties involved. Member countries might therefore have a tax incentive that is slightly higher than normal for co-operative projects.

When it comes to eligible R&D costs the Working Group is of the opinion that, as a guiding principle, industry itself should be able to optimize the combination of different resources put into the project, suggesting the need for a broad range of eligible expenditure. However, cost constraints may suggest the need for a more limited range of eligible costs. If this is a consideration, it is generally considered that the single most important heading of cost, which must always qualify in any R&D incentive scheme, is the wages of research staff. Beyond that, there is perhaps a hierarchy of costs which are of descending importance to the R&D activity, starting with materials and other direct costs, then directly related overheads, and lastly capital expenditure (other than buildings). Although all the costs are incurred in order to conduct R&D, those higher up the hierarchy tend to vary more as more R&D is done and so could be seen as more appropriate for Government incentives aimed at stimulating R&D. Where overhead costs are covered they might be calculated in a practical way to avoid a high compliance cost, for example as a percentage of R&D wages.

Form of tax incentive

The Working Group has observed that both tax credits and tax allowances are in use. The discussions in the Working Group have not revealed that the one or other system is preferable.

Tax incentive ought to be designed in such a way that start-up firms not in a tax-position can make use of them. Such firms often have cash constraints. The Working Group therefore believes that the establishment of a tax refund in cash instead of a system of carry-forward of unused tax-benefits is best.

The choice between volume and incremental based incentives is far from simple. Empirical studies and research suggest that both incremental and volume-based incentives can be effective in stimulating additional R&D, with no clear evidence that one approach is more or less effective than the other. Therefore, the decision needs to consider the specific aims and objectives of the policy in each member state.

Volume-based tax incentives are generally easier to administer, lead to less distortions and are more predictable and stable over time. Therefore, they might be considered where the objective is to promote R&D or R&D firms generally. Incremental schemes might be considered where the objective is to support R&D start-ups or firms with high R&D growth. Where a relatively small budget is available for R&D tax incentives, an incremental scheme might be considered to target support to areas of government priority (such as R&D start-ups, for example), or caps could be used within a volume-based scheme. A combination of volume and incremental based incentives might be considered where the objective is to support both all R&D firms as well as targeting R&D start-ups, although the additional complexity involved should be examined.

Level of support

What the appropriate level of support should be cannot be decided scientifically. On the one hand the tax relief must be large enough to make an impression on industry. On the other hand it must not be so generous that it induces too many marginal projects, or results in industry pocketing a large proportion of the tax incentive without increasing R&D sufficiently. What percentage of support within this wide range is most sensible has no clear answer, and the level of support could be adjusted on the basis of evaluations. Because of the need of stability in the framework conditions of firms, countries might consider to inform firms in advance for how many years the tax incentive will be unchanged.

Government costs

Government financial concerns could induce a low general tax incentive and too low in order to have impact on R&D investments from firms. The use of caps could be useful tools in order to limit the total volume of the tax incentives and at the same time ensure that SMEs are given support which makes a difference. However, caps diminish the marginal incentives for firms who have R&D above the cap.

Administrative issues

The Working Group has not entered into detailed discussions concerning the administration of tax incentives. However, the Working Group advises governments to consider how they could reduce transaction costs as much as possible in establishing administrative systems and routines. The main principles in ensuring this are, as referred to as the guiding principles in the UK system mentioned in 5.1.6, to make the administrative system certain, simple and consistent.

The Working Group has reached some general conclusions that member states might consider when deciding on the most appropriate tax incentive:

- Countries with the ambition of increasing business R&D in general or for SMEs in particular are advised to analyse carefully the possible use of tax incentives as an important policy instrument.
- When introducing tax incentives, countries should assess the economic rationale and costs for state intervention and weigh up the most appropriate policy response, including how effectively tax incentives may meet the goals and objectives identified for R&D and innovation policies.
- Tax incentives should be easy to understand, stable in their design over time and transparent in order to reduce transaction costs as much as possible.
- When designing tax incentives, countries are advised to have a broadly based approach to which companies, R&D topics and types and costs should be covered, thus stimulating the breadth of R&D within and across firms and not unduly differentiating between different types of firms.
- If the objective of the tax-incentive is to increase the level of R&D substantially, and the associated loss of tax-revenue is acceptable, a volume-based tax-incentive seems to be the appropriate tool.
- If the objective of the tax-incentive is narrower, the choice between volume-based and incremental tax incentives should be based on a number of factors. Empirical studies and research suggest that both incremental and volume-based incentives can be effective in stimulating additional R&D, with no clear evidence that one approach is more or less effective than the other. Therefore, the decision needs to consider the specific aims and objectives of the policy in each member state.
- Volume-based tax incentives might be considered where the objective is to promote R&D or R&D firms generally, as they are easier to administer, lead to less distortions and are more predictable and stable over time. In the case that countries want to limit taxes foregone, they could consider the use of caps or thresholds.
- Incremental schemes might be considered where the objective is to support R&D start-ups or firms with high R&D growth, particularly where governments want to limit tax foregone due to budgetary limits.
- A combination of volume and incremental based incentives might be considered where the objective is to support both all R&D firms as well as targeting R&D start-ups, although the additional complexity involved should be examined.
- Instead of a low percentage level of support through tax incentives, governments could use caps or thresholds to ensure that the tax incentive has a substantial effect up to a defined limit, a system that in practice would be SME friendly.
- Certainty, simplicity and consistency should be the guiding principles for the administration of tax incentives. The effectiveness of a tax incentive depends on it being delivered and administered efficiently.

5.3 Evaluation methods

5.3.1 Recommendations from prior Working Groups

Additionality is seen as the key issue in previous reports regarding tax incentives for R&D. It is indicated below that an econometric approach can be supplemented by other methods to capture better the wide range of additionality effects. Based on this, evaluations can have a design that integrates different methodological approaches. Evaluations could also consider any specific objectives of tax incentives, and test the efficient delivery and administration of the tax incentive. The first cycle report on tax incentives stated that an integrated approach might contribute to more robust conclusions and recommendations from evaluations. This would call for the use of different methods and different data. Other recommendations from the first cycle of OMC related to tax incentives are:

- When implementing a new tax incentive, it is crucial to define clear policy objectives, targets and indicators to enable the evaluation process, right from the start. Schemes should be appropriate, efficient and effective. For instance, one should define precisely the term innovation and choose clear indicators to monitor the process in advance;
- Right from the beginning of implementing the tax incentive all the necessary data for monitoring and evaluating should be collected;
- The use of a single method to evaluate a tax incentive is not advised. A combination of methods like a survey, interviews, desk study and econometric analyses should be used. In the case of fiscal schemes econometric analysis is particularly appropriate because of the large population of beneficiaries compared with direct measures;
- Changes in the scheme can also be used to evaluate its effectiveness by econometric modelling.

5.3.2 Evaluations of tax incentives vs. direct measures

The few evaluations of tax incentives that have been carried out in EU/CREST-member countries do not give precise evidence of how tax incentives function, but more or less certain indications. This is however to a large degree also the case for evaluations related to direct measures, and intrinsic to the problems of giving precise descriptions of economic behaviour and linking single causes and effects with certainty. Methods and experiences related to the evaluation of direct measures are to a large degree also relevant when evaluating tax incentives. As shown below there are, however, some special challenges in evaluating tax incentives – in particular related to counter-factual analysis.

5.3.3 A wide range of aims and methods

Although most tax incentives have the increase of R&D as the main objective, many tax incentives also have other types of objectives. This underlines the need for different types of expertise and the use of different methods in evaluating tax incentives.

Statistics Norway has given a description of its approaches to the evaluation of the Norwegian tax incentive scheme. Their evaluation tries to capture a wide range of effects:

- Direct additionality (input/ output additionality): The increase of R&D in firms based on tax incentives

- Indirect additionality: The increase of R&D based on the increase of competence in firms based on enhanced volume and knowledge of R&D
- Behavioural additionality: The change in firm strategy based on tax incentives for R&D
- Benefits for firms and society: The effect on firm profits and benefits for society based on tax incentives for R&D

These can be seen as alternative approaches to evaluations or as parts of an integrated evaluation design. For an evaluator these different approaches also call for different skills and methods, and different needs concerning data. Table 3 shows that the different approaches call for two different kinds of skills: econometric methods and more sociological oriented research concerning the behaviour of actors within firms and how innovation systems react to tax incentives. While quantitative methods are important, qualitative approaches are also needed to interpret the econometric results and for understanding aspects that are not included in the econometric studies. Surveys can also be useful for understanding changes in firm behaviour and strategies. Some of the main questions that might be answered through this approach are:

- To what extent does the tax incentive induce persistent changes in firm routines?
- Does learning about benefits of R&D lead to sustained higher levels of investment?
- Does the visibility of tax credits in the financial picture influence the decision making process about R&D investment within companies?
- Do firms increase or decrease their R&D efficiency?
- Are these benefits more evident when a Research Institute is involved?

Econometric approaches cannot answer these questions. To measure this, it is necessary to use surveys and interviews, perhaps combined with case studies. This might be a better way to understand how tax incentives can have other effects than those measured through econometric studies, and also a way to understand how the effects measured in econometric studies come about. Because of the need to capture a wide range of effects there is a need to make use of a wide range of methods, which also has implications on what kinds of data that are needed. The use of different methods makes for more robust results. Through the use of a range of methods and data, evaluators can uncover uncertainties and produce a degree of robustness that otherwise would be open for discussion, due to the limitations the different methods have in explaining specific results.

Table 3: Approaches, methods and data

| Approach | Method | Data |
|--------------------------------|--|--|
| Direct additionality | Econometric/ quantitative methods | Tax incentives data, R&D statistics, firm accounts and surveys |
| Indirect additionality | Econometric/ quantitative methods | Tax incentive data, R&D statistics, firm accounts other micro (register) data and surveys |
| Behavioural additionality | Case studies/ quantitative and qualitative methods | Surveys/ interviews |
| Benefits for firms and society | Econometric and case studies/ quantitative and qualitative methods | Tax incentive data, R&D statistics, CIS data and surveys, interviews, firm accounts, other register data and national accounts |

Source: Thorbjorn Haegeland (attached paper)

5.3.4 Challenges to data collecting

In order to capture the effects of R&D subsidies, there is a need for a solid platform of micro data concerning firms and the distribution of workers and their skills. In most EU countries, this platform is in place but the quality of the data varies. In addition, there is a need for R&D statistics that are in place in all EU countries – based on the same way of collecting data and according to standards from OECD. The same goes for innovation statistics – CIS data. The so-called Oslo manual for collecting these data is now being revised by the OECD.

While some of these data are derived from the national registers of companies, some are based on regular surveys (like the R&D survey and CIS). In addition, there might be a need to carry out additional surveys to fill gaps in the existing platform of data. These survey-based data can be used both in econometric studies and in more sociological oriented studies.

When establishing a tax incentive scheme for R&D, countries should be aware of the challenges related to data collection in order to monitor and evaluate the schemes. In addition to routine and national data collecting, it will usually be necessary to establish databases for firms that apply for the tax incentive. When establishing these databases countries might want to consider three important points:

- The technology used and design of databases must be compatible with other national databases so that matching of datasets is possible. In addition, problems concerning confidentiality regarding the matching of datasets should be sorted out.
- The right questions must be asked to the firms from the outset – and must be linked to the need for monitoring and evaluating the tax incentive scheme. Ideally this should be considered before the measure is implemented so that data on the use of the scheme are collected from the very start.
- There is a limit to how much specific and new data that should be collected due to the administrative burden, especially on smaller companies.

At the same time, countries should be aware that during the evaluation questions may arise that evaluators had not foreseen. Within acceptable limits this calls for gathering more data than initially called for, based on qualified guesses about what might be needed.

These points may seem to be detailed – but are of great importance for a successful evaluation. If the data issues are not dealt with at an early stage, this could increase the cost of monitoring and evaluating the tax incentive scheme greatly – or could make it impossible to perform a proper evaluation. Evaluators should also, from the start, be aware of the limitations of establishing databases that could exist because of laws and regulations concerning confidentiality. They should also take into consideration the administrative burden placed on companies through the collection of new data.

One major challenge in evaluations is to isolate the effects of tax incentives from other influences on firms R&D, changes in strategy and gains for firms and society. The papers from Technopolis and Statistics Norway provide in-depth discussions of this matter of crucial importance for the success of evaluations. One of the aspects here is the possibility of doing counter-factual analysis. This means that in order to assert the effects from tax incentives, one must also show what would be the situation if there were no tax incentives in place. There are some different ways of handling this:

- Establish datasets composed of firms just below or above the threshold for eligibility for tax incentive or firms in different marginal tariffs like in the Dutch WBSO – this is however only possible in situations where tax incentives are not eligible for all firms;

- Establish different datasets composed of firms before and after the introduction of a tax incentive scheme; and
- Establish datasets composed of firms from different countries, with similar framework conditions but with and without tax incentives.

In most cases, evaluation involves one of the two first routes for counter-factual analysis indicated above. This may not always be possible, due to the fact that countries may have tax incentives schemes that are available for all firms and have no proper time series data to create different panels for counter-factual analysis. In these situations, one could consider the possibility of using datasets from other countries.

5.3.5 The need for independent evaluations

A number of issues about the role and responsibility of evaluators could be vital for the quality of the evaluations:

- Interdisciplinary skills and competences (including combining econometric methods, surveys, case studies and interviews);
- Links to international networks in order to disseminate and increase learning effects from evaluations; and
- Independence from authorities responsible for the tax incentives as well as independence from those who benefit from tax incentives.

The skills needed may be broadly or more narrowly defined according to the object of the evaluation. Links to international networks may be of particular importance if an evaluation is broadly defined. If the evaluation is limited to, for example, administrative efficiency, links with international networks may be of less importance. Independence is a key issue for the choice of evaluators, as evaluations can easily result in controversial findings. The results from the evaluations may have less impact, if the evaluators have interests themselves in the tax incentive scheme or have strong formal ties to governmental bodies. Evaluation of fiscal instruments is a very specific task (a niche market). As a consequence, there might be few specialists at the national level. This is an argument for using an approach that takes into consideration possible specialists also from other countries in choosing evaluators.

5.3.6 The costs of evaluations

A sound evaluation of a tax incentive is a difficult task and an expensive one. In addition to establishing necessary data-bases, there might be the need for costly surveys, theoretical studies, quality control of data, building of models, competent interpretation of findings and quality assurance of hypotheses and conclusions. On the other hand, the revenues foregone might be substantial. Evaluations that can assure the cost-efficiency of the tax incentives are therefore well worth their cost.

To exemplify costs, it can be mentioned that the Norwegian SkatteFunn evaluation, which to a large degree builds on existing data-sets, will cost about 1 million Euro and will last 3 years. Although such a sum might seem high, it is low compared to the taxes foregone and volume of additional R&D induced by the SkatteFunn in Norway. The economic value of small improvements of a tax scheme triggered by a sound evaluation will easily dwarf the evaluation costs. Evaluation costs should be accounted for right from the beginning and be regarded as part of the administrative cost of running the tax incentive.

5.3.7 Evaluations of administrative aspects

Countries might want to cover administrative aspects of the tax incentive in their evaluations. These are costs incurred by state authorities and by firms in their handling of claims or getting approval for projects. In order to cover the effectiveness of public authorities it is necessary to link evaluations to experts with knowledge from organisational studies. In order to fully understand the administrative costs that firms will have, it might be necessary to carry out a combination of case studies and surveys. Evaluations of these aspects could give a knowledge base for improving the operation of the tax incentives, and could also make it possible to compare the administrative burden of tax incentives with direct measures.

5.3.8 Evaluations and the policy cycle

Evaluations are carried out in order to create a better knowledge base for operating agencies and political authorities. It is a tool for learning and to improve policies (or even abolish them) by assessing how well policies perform against their objectives.

In order for evaluations to have effect, the different roles of evaluations must be viewed properly. In establishing new policy tools, politicians and authorities use the information they have to create a factual base for why new tools are implemented. Information from evaluations can in this respect be relevant for two reasons:

- There may be evaluations that have been carried out regarding policy tools with similarities with the one being contemplated; and
- Evaluations carried out in other countries, may give valuable factual information for developing policy tools.

Politicians and operating agencies have a need to monitor and report regularly on the results and costs of tax incentives. This is due to the fact that politicians are increasingly accountable to the public when it comes to spending (or granting exemptions from tax rules). In addition, the operating agencies may have a need, due to outside pressure or other ad-hoc situations, to make adjustments in the tax incentives. In order for these to have positive effects, there must be some kind of factual base for the adjustments. This calls for a monitoring system, where data from the R&D projects are collected and can be compared to other R&D and innovation statistics.

In order to increase the impact of evaluations – and provide the right expectations among firms – the evaluations should be made public. Countries might also consider involving the stakeholders in the evaluation process. It would of course not be possible to involve all firms in the evaluation process, but representatives from business organisations or other representatives for firms' interest could be invited to take part in the evaluation process.

5.3.9 Conclusions

Evaluation aims and methods

The Working Group recommends that evaluations of tax incentives should have an integrated approach using a variety of different methods to understand how the incentive actually functions.

Statistics Norway has in its paper to the Working Group shown that it is possible through econometric models to establish the effect from tax incentives on the size of R&D within firms. The main challenge is to establish datasets that make it possible to do counterfactual analysis. This is hard because tax incentives usually reach out to a large number, or all, firms.

Counterfactual analysis is still possible to do in three separate ways, or through the combinations of these three:

- Through the use of historical data: The assumption that tax incentives have an effect on R&D can be tested on different datasets made up from different periods. These can show situations where the tax incentive has been introduced, and where it was not in use.
- Through the use of discontinuities in the operation of the tax incentives: Many of the tax incentives put in place have been changed through time. This can be used in order to show how firms are influenced before and after they are eligible for the tax incentive.
- Through the use of data from other countries: In many countries it is not possible to form datasets based on historical data. Neither might be it possible to make use of discontinuities in the tax incentive scheme – because it might have been unchanged. The only way of carrying out counterfactual analysis might be to use data from other comparable countries. This is not usually done, but has in some circumstances been used to test the robustness of findings from national evaluations.

Evaluations ought also to consider the way tax incentives indirectly influence R&D within firms – for instance through enhanced R&D competence within firms and hiring of more R&D personnel. In addition tax incentives might lead to a different orientation and different perspectives within firms, and thereby lead to a change in their strategies, goals and interaction with others. Alteration of the behaviour of firms should therefore be addressed through evaluations of tax incentives.

International learning networks

It is rational to learn from others. Most evaluators are already involved in international networks based on their academic or professional positions. The flow of information within these networks could, however, be made more efficient. The Working Group suggests in this respect that EU member states and CREST countries might like to consider initiating a learning network for evaluation experts, and that an internet-library based on information from evaluations is established. Investments made in these international networks would enhance the capability in evaluations – and this gives strong arguments for the EU and member countries to stimulate R&D milieus that operate in this field. The role of such a network would be to share experiences and examples of good practice.

The independence of evaluators

Legitimacy is crucial for the impact of evaluations on policy-making. For the integrity and legitimacy of an evaluation, it ought to be independent. The need for legitimacy and independence could have a bearing on the choice of evaluators. The vital issue is that the choice of evaluators is based on open and well-known criteria that capture the skills of the evaluators. Countries are therefore advised to give careful attention to the legitimacy and independence of evaluations.

Evaluating administrative aspects

In order to improve the administrative routines and to better compare tax incentives with other measures that policy makers might use, it is necessary to evaluate the administration of the tax incentives. This is both how public authorities are operating their tax incentives and how firms are handling their claims or approval processes. This might call for a different kind of expertise than is found among evaluators concentrating on additionality effects of policy tools.

Financing evaluations

Evaluations of tax incentives take several years and are a difficult task. However, they are absolutely necessary to ascertain whether the objectives have been met and for the fine-tuning of the system. Putting too little effort into an evaluation can be costly in terms of getting the right information that is needed for developing policy. Countries are therefore advised to ensure sufficient funds for evaluations of their tax incentives. Cost for evaluations could also be included as an element in the operating administrative cost of the tax incentive.

The conclusions that the Working Group has reached regarding evaluations are the following:

- The quality of the evaluation depends on the policy measure having clear aims and objectives, so that questions for the evaluation to tackle can also be clearly defined.
- Evaluations of tax incentives should focus on ascertaining to which degree they induce more R&D (over and above what would have taken place otherwise) and if this causes improved economic performance of beneficiary firms.
- Evaluations should cover changes in firms' strategic behaviour and internal decision-making (behavioural additionality).
- Evaluations should not only cover additionality and behavioural effects but also, where relevant, test whether the tax incentive has met its specific objectives and whether the delivery/administration has been efficient.
- Other societal effects of tax incentives should be evaluated in the broader context of the total government R&D policy, including effects on the level of learning, the quality of R&D and the innovations resulting from the public support scheme.
- Evaluations of tax incentives should have an integrated approach using a variety of different methods to understand not only the effects of the measure but also how it actually functions.
- In the design of the tax incentive scheme, policy makers should have in mind the types of data needed and the possible ways of gathering data for evaluations.
- In estimating direct and indirect additionality the main challenge is to establish datasets that make it possible to do counterfactual analysis. This can be done in three separate ways or through combinations of these three: through the use of historical data, through the use of discontinuities in the operation of the tax incentives and/ or through the use of data from other countries.
- Careful attention should be given to the independence of evaluators and evaluations.
- The evaluation results should be published and should be used to inform policy improvements.
- Because there is not much EU/CREST experience in this specific field of evaluation, EU member states and CREST countries might like to consider establishing an international network to share experiences and examples of good practice in methods for the evaluation of R&D tax incentives.