Ministry of Economics and Communication

AN ANALYSIS OF TAX INCENTIVES TO PROMOTE RESEARCH AND DEVELOPMENT IN ESTONIA

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Outline of the report

Research and development (R&D) and innovation are considered to be the key factors of economic productivity and growth performance. R&D tax incentives are one of the possible policy tools for governments to promote such activities.

First the current report motivates the analysis of R&D tax measures to promote research and development activities in Estonia. The main drivers for introducing R&D tax incentives is that Estonia is still lagging behind the European forerunners in terms of business sector R&D investment per GDP as well as in the number of R&D workers employed in businesses. In addition, development strategy "Sustainable Estonia 21" as well as the Lisbon Strategy emphasise redirecting the expenditures towards growth-enhancing activities.

Second, the report gives an overview of the theoretical background for justifying state intervention in promotion of (R&D) activities. The main argument for state intervention is that under pure market conditions R&D activities are underinvested because of high level of risk of such investments and large spillover effects to society. Therefore, in order to correct for the under-provision of R&D activities, governments interfere by directly subsidizing or providing tax incentives to enterprises engaged in R&D.

Third, international experience on R&D tax incentives is discussed. An overview of the effectiveness of R&D tax measures as a policy tool for attracting R&D intensive foreign direct investment is given. In addition, an overview is provided on the international experience of different R&D tax incentives used and the effectiveness of such tax incentives based on empirical international literature giving input for chapter five.

Fourth, the current Estonian level of R&D expenditure per GDP and the number of R&D employees is compared to the other EU countries. These results give an input to chapter five where the R&D tax incentives suitable for the Estonian corporate income tax purposes are chosen and discussed. Chapter five also provides a cost-benefit analysis for the selected incentives by comparing the effects on state budget, administrative costs, compliance costs, increase in R&D activity, growth in R&D/GDP ratio and employment growth.

Summary of the report

Well-designed tax and expenditure systems that promote an efficient allocation of resources are a necessity for the public sector to make a full contribution towards growth and employment, without jeopardizing the goals of economic stability and sustainability. This may be achieved by redirecting expenditure towards growth-enhancing measures such as research and development (R&D) in accordance with the Lisbon Strategy. A key priority for the EU and the Estonia is to ensure that tax structures and their interaction with benefit systems promote higher growth and employment. The Estonian Research and Development and Innovation (R&D&I) Strategy 2007–2013 "Knowledge-based Estonia" also focuses on sustainable development of society by means of stimulating R&D&I.

Government support for R&D

As other types of investments, investment in R&D is undertaken by firms in the expectation that the investment brings future benefits in the form of lower production costs and/or higher revenues. In absence of any government intervention in the economy, private investment in R&D may, however, be below the optimal level as seen from society's viewpoint for two main reasons. First, the knowledge derived from R&D may spill over to other firms and bring benefits to those. These spillovers or externality effects are usually not taken into account by the individual firm. Second, the return to R&D investments is inherently very uncertain and this may make it difficult for firms to obtain external financing, as possible lenders will have even less information about the future return to the R&D investment than the firm undertaking it.

The possibility of underinvestment in R&D suggests that government intervention can be welfare enhancing. A major problem in this context is that the socially optimal level of R&D investment is extremely difficult to estimate. R&D spillovers typically manifest themselves over a long period of time and may play an important role for the long-term growth of an economy. The spillover effects likely vary across different economies, dependent for instance on their size, openness and economic development level.

The governments can employ a number of policy instruments in order to stimulate private R&D, most widely used of which are direct subsidies and tax incentives. The main economic difference between direct and tax subsidies emerges when the recipient business entity has no tax liabilities from which the tax subsidy can be rebated. For instance, a corporate income tax incentive is useless if the company does not have any profit. The absence of a suitable tax liability could be the result of a business entity being tax-exempt (e.g. a research institution owned by a philanthropic foundation) or of a private firm having no appropriate tax liability.

Direct subsidies may also be most effective if the private firms cannot obtain external financing (e.g. a bank loan) for their R&D investments; direct subsidies can be paid out at an early stage of the R&D project and thus improve the cash flow in the recipient firms.

Overall, tax incentives are most suitable if the government's objective is broad support to R&D activities within a relatively stable framework. Specific government objectives (e.g. specific or changing areas of R&D activities) may more readily be met via direct subsidies. Often tax incentives and direct subsidies are applied simultaneously.

R&D tax incentives

Despite the ambiguity surrounding R&D tax incentives most developed countries use tax incentives to promote R&D activities. Most of the R&D tax incentives used by different countries aim at reducing corporate income tax liability of the company incurring R&D expenses.

The main corporate tax incentives used by countries to promote R&D activities are enhanced R&D expenditure deduction from taxable income (also named as tax concession or tax allowance), R&D expenditure tax credit and tax holidays. These tax incentives are aimed at increasing R&D expenditure by private firms.

In addition to corporate income tax incentives, the R&D tax measures can also be aimed at reducing the overall tax costs of the company by reducing the taxes on labour. Countries often use labour tax incentives in order to ease the tax burden on R&D labour, because R&D activities are perceived to be rather labour intensive making up around half of the R&D expenditure. In addition, labour tax incentives are generally expected to bring about an increase in the number of R&D workers.

In addition to corporate income and labour tax incentives, the incentives aimed at increasing the patenting activity of companies and reducing the tax burden on income from such activity (royalty income) are gaining popularity as well.

Country studies on the effects of R&D tax incentives

There is great diversity in terms of methodology, data, timing and scope of studies analyzing different R&D tax policies. This diversity makes the comparison of studies on the effects of R&D tax incentives difficult and general conclusions on the effectiveness of such measures are hard to make. In addition, the preconditions (economic situation, level of education etc) as well as the existence of other policy measures (e.g. direct subsidies) that may influence the outcome are very different across studies. Hence, there is a lack of comparative estimations of the effects of R&D tax instruments.

Still, some of the evaluations carried out in different countries generally suggest that the R&D tax incentives can be regarded as effective as they entail some additionality, i.e. the incentives lead to *added* or increased R&D activity by the firms benefiting from the incentives

The Netherlands employs a system of reduced taxation of salary of R&D employees' (WBSO). A study showed that for every Euro lost by the state in tax revenue, a firm invests 0.72 euro in addition in R&D from its own resources, leading to an additionality of 0.72 euro with total R&D investment amounting to 1.72 euro.

A Norwegian study on the effects of their R&D tax credit system (SkatteFUNN) estimated that for every Norwegian kroner lost in tax revenue the R&D spending of firms doubled. In that sense, the Norwegian scheme seems to be successful as an input additionality factor of around two is high compared with estimates of the additionality of tax schemes commonly found in the international literature.

The overall administrative burden of the WBSO incentive was around 9% of the subsidy. A user survey of SkatteFUNN system showed that the total administrative cost of the system made up around 7% of the total tax deduction. On the other hand, the evaluation study of the Belgian R&D tax incentive identified that many firms did not use the measures because the associated administrative cost was too high compared to the potential benefit.

A study on the Canadian tax credit system supporting R&D showed that the positive economic benefits associated with the tax credit were derived from the spillovers of the system to other firms and sectors of the economy. These spillovers are estimated to about 0.46 dollars per dollar of tax expenditure and more than offset the costs of the tax credit system. In total, the Canadian tax credit creates a gross economic gain of 1.11 dollars and a net gain of 0.11 dollars per dollar spent on it.

By benefiting from a cut in the wage costs, the user WBSO scheme were able to reduce quickly, significantly and automatically the cost of research, they dared to tackle R&D projects with a higher risk profile and perform R&D projects faster, plan R&D activities better. A survey studying the UK tax incentive identified that R&D tax credits had enabled the participants' to take on more risky R&D projects and projects that needed a longer time to pay off. The Australian R&D tax concession showed one of the strongest impacts on the speed of the R&D projects which is important, because speed-to-market is a critical competency for successful new product development.

A study on the Norwegian tax credit system identified that the system has in practice proven to resemble more closely a subsidy scheme than a tax deduction scheme which raises the issue whether a subsidy scheme outside the tax system would be more appropriate. In addition, changing the scheme to a subsidy scheme could make it more attractive because it provides a better liquidity effect for small firms with financing problems than the tax scheme.

Although a trend analysis of the Australian tax incentive suggested a strong correlation between the availability of the R&D tax concession in Australia and the steady increase in business enterprise R&D, the growth in private R&D may have been also driven by the internationalisation of the Australian economy in the 1980s and the resulting need for trade exposed companies to innovate in order to be competitive, as opposed to the effects of the tax measure.

R&D location drivers

The reviewed studies showed that the most relevant R&D location considerations are market size, quality of R&D personnel and labour market flexibility, quality of scientific institutions, legal framework and other non-tax conditions.

There was very little evidence that R&D tax incentives play a significant role on the R&D location of multinational enterprises. Equally, pinpointing the most relevant tax considerations that drive the R&D location would be very ambiguous. There is no reliable evidence that the R&D tax incentives have attracted R&D activities in high R&D performing countries or impact the R&D location decisions of multinational enterprise substantially. However, some studies suggest that the overall corporate tax burden (even the tax burden on the group level) may play a role in the R&D location decision-making of a multinational enterprise.

Applicability of the R&D tax incentives in Estonia

The Estonian corporate income tax system implies that only distributed profits are taxed and aims to favouring reinvestment as opposed to the standard corporate income tax system that are not aimed at favouring such activity. Under the current income tax system the companies have an option to just accumulate profits or to reinvest these, but there is no incentive to reinvest the profits in R&D as opposed to any other investment opportunity that may provide faster profits for the firm.

Despite recent rapid growth in R&D investment Estonia is still lagging considerably behind the EU forerunners in terms of private sector R&D expenditure per unit of GDP and the number of R&D employees employed in the businesses. In order to improve the situation we have selected and evaluated seven potential R&D tax measures that could be applied in Estonia.

Based on the international experience, we have selected R&D tax incentives that are aimed, firstly, at increasing the private sector R&D expenditure in order to reach the target of 2% target of GDP, and, secondly at increasing the number of R&D workers to reach the goal of 8 R&D workers per 1,000 employed persons. The idea objective is that increasing R&D activities lead to increased knowledge, experience and cooperation, which increases productivity and competitiveness.

The selected tax incentives for that Estonia are divided into two subcategories: corporate income tax incentives and wage tax incentives.

1. *Corporate income tax incentives*

For the purpose of this report corporate income tax is calculated on dividends distributed to shareholders and the R&D corporate income tax (CIT) incentives are designed to reduce the tax burden on distributed dividends. CIT incentives should encourage companies to invest in R&D as opposed to investment in any other investment object. These incentives do not target the start-up companies and non-profit sector. We have evaluated three corporate income tax incentives based on three R&D criteria: the number of R&D employees; the volume of R&D expenditure; the income from royalties.

Currently, the private R&D intensity is greater in computer related activities, manufacturing of electrical and optical equipment; and transport, storage and communication, financial intermediation and manufacturing of chemical products. It is therefore expected that these will be the sectors that benefit the most from the proposed CIT R&D incentives in the short run.

1A A deduction of EEK 300,000 per supplementary R&D employee from the corporate income tax base is provided

The main target of the incentive is R&D employment growth in growing and labour-intensive firms. This incentive applies to firms who pay corporate income tax (i.e. distribute dividends), thus profitable firms. The non-profit sector and companies not making a profit (e.g. start-ups) will not be affected by this measure.

This incentive favours the labour intensive sector rather than other sectors. However, as R&D is perceived to be a rather labour intensive activity we estimate that the labour costs make up about half of the R&D expenditure in business sector and the scheme should therefore be well targeted. The behavioural effect of this incentive shows that short-run R&D employment growth can be expected. However, this incentive has only small-scale effects as less than 100 firms are affected. The estimates have relatively low reliability and both underestimation and overestimation are possible since this tax subsidy is relatively small, the behavioural effects are important and profit distribution in Estonia is very random.

In Belgium, a similar measure was abolished after 2008, because it was perceived to be administratively too burdensome. This, however, might not be the case in Estonia, since R&D employee is defined differently in Belgium than the proposed definition for Estonia, but the risk has to be considered.

1B Tax Credit

- *Tax credit 1 – 10% of tax credit is provided for expenses on intramural business enterprise R&D and on subcontracted R&D to non-profit organizations (e.g. universities) with a maximum ceiling at 30% of corporate income tax payable (the credited amount cannot be more than 30% of the total corporate income tax payable on dividends). Expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies are excluded*
- *Tax credit 2 – R&D expenditure base includes all business enterprise R&D expenditure (including subcontracted R&D)The expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies are excluded*

The tax credit has the best targeting of the CIT tax measures and may have a large additionality as it is tied to the entire spending on R&D not only the spending on R&D workers. Both labour-intensive and capital-intensive firms can gain from this tax incentive based on their R&D spending patterns. This incentive targets R&D expenditure growth meaning that it is rather well targeted.

However, the beneficiaries of this incentive are to be found in business enterprise sector, leaving non-profit sector and non-profitable firms that may be starting their activities untouched. Because of this incentive businesses may be inclined to distributing profits in order to benefit from the measure leaving less funds for other investments.

While a tax credit in general is one of the simplest tax subsidies available, using it with R&D expenditures has its risks. One major problem is that the firms might have large compliance costs. E.g. regarding the first tax credit option all extramural R&D expenditure has to be verified in order to make sure that R&D is subcontracted only to non-profit sector. There is also a danger of efficiency loss for the tax incentive, in the case of double subsidisation when R&D subcontracted to other companies can also be included in the computation base (second tax credoit option). However, if applied to all R&D expenditure the method should encourage cooperation between R&D players. In that case cumulation of benefits will not be avoided as firms subcontracting the R&D activity as well as the firms performing the R&D can benefit from the incentive.

This incentive should have a medium size scale effect as less than 500 firms are affected. Since the behavioural effects play a great role and profit distribution in Estonia is relatively random, the estimates have a low reliability and both underestimation and overestimation are possible.

1C 80% of royalty income from patents is exempt from income tax on dividends

Since the Estonian Tax and Customs board does not differentiate between income from royalty sales and income from rent, there is no adequate assessment available for any impact analysis on this tax subsidy. There is no statistics available about how many royalty transactions are being made, and what is their value.

Similar incentives have been introduced in several countries and e.g. in Belgium the scheme is perceived to be conceptually simple, covering a broad number of transactions, and seemingly less burdensome than other incentives.

It is our understanding that this incentive could have similar effect in Estonia[1]. However, we would recommend implementing this incentive as an additional incentive to other incentives as the effects of this incentive will be relative low because of the low patenting activity in Estonia. If implemented together with a R&D tax credit this incentive may attract the attention of foreign R&D companies. Favourable results could also be achieved if this incentive is implemented together with one of the wage tax incentives. However, in these cases the joint effects of the incentives would have to be carefully analysed.

As discussed, the negative effects are marginal since the Estonian intellectual property activity is very small in scale. It is well targeted because it targets the end result (creation of intellectual property) as opposed to the means (employees, expenditure) that may or may not result in additional welfare gains.

This incentive targets intellectual property transfer in the business sector and the beneficiaries are the firms which make a profit and receive royalty income. As other CIT incentives the non-profit sector and firms not making a profit remain untouched. In addition, as patenting activity is a time-consuming and costly process, the benefits of this incentive can be enjoyed with possibly a relatively large time-lag. The patent tax incentive alone may therefore not be attractive to companies.

This incentive is rather competitive in an international context as it implies a 5.3% effective tax rate on income from royalties; the corresponding figure is 5.72% in Luxembourg,10% in the Netherlands and 6,8% in Belgium; in Singapore such foreign sourced IP income is exempt from income tax for 5 years. The competitive nature of the incentive may lead to foreign investment growth. In addition, this incentive has low administrative and implementation costs, but so is the overall impact. Thus, this instrument has to be considered as an additional instrument.

The positive effects are likely to outweigh the negative effects, but it has to be stressed, that the positive side is essentially impossible to quantify. There is no way of ensuring that this tax incentive will attract foreign companies or increase R&D activity.

[1] Presumably it will not have a large-scale effect in Estonia.

2. Wage tax incentives

The current Estonian tax system relies heavily on labour taxes. Considering the fact that labour costs make up around half of the total R&D costs, the Estonian system is rather unfavourable in terms of labour-intensive R&D. Thus, wage tax measures may have some potential in the R&D incentive context in Estonia.

Wage tax incentives do not require taxable profit and therefore these measures are relevant for new innovative companies as those may not be profitable during the start up period and non-profit sector as well as companies that have decided not to distribute profits. Wage tax incentives tend to favour internal R&D as opposed to contracting the R&D activities out, which stimulates the investment in human capital. These incentives generally increase the number of R&D employees and the R&D expenditure in terms of wage costs.

In addition, labour tax incentives have a positive effect on companies' cash flows as benefits of the incentive can be enjoyed on a monthly basis which is especially beneficial to small companies and start-ups.

Wage tax incentives may have favourable effects in terms of the breakdown of the R&D by the type of R&D activity undertaken, e.g. most of the basic research is done in universities, thus the balance of R&D activity may not be distorted as universities may benefit as well.

Wage tax incentives are not targeted specifically at business sector R&D performance, but since business enterprise R&D employees have higher wages, wage tax subsidies effectively target this sector. Although labour incentives target the R&D labour costs as the most prominent input to R&D activity they do not target other R&D inputs, like investment to machinery.

We have selected four wage tax incentives to be evaluated in this report: an income tax reduction for R&D employees, a social tax reduction for R&D employees, a social tax ceiling for R&D employees, and a ceiling on social security tax for imported R&D (and innovation) employees.

2A Income tax for R&D employees reduced to 10% (11% decrease from 21%)

This tax incentive does not have a negative impact on contribution-based social benefits. However, the reduced personal income tax rate will have an impact also on the local government budgets as 11.4% of the personal income tax collected by the tax authorities is transferred to the local governments based on the registered domicile of the individual taxpayers. Thus, depending on the location of the R&D employees' activity, some local governments will be more effected than others.

This incentive targets R&D labour costs in all sectors having a large scale effect by whith up to 10,000 employees beign affected. The behavioural effect is estimated to lead to increased R&D employment as R&D labour costs are reduced.

2B Social tax reduced to 15% for all R&D employees

Contribution-based social benefits are affected with this incentive. These might have to be compensated to R&D employees. So an additional negative impact on the state budget has to be considered. This complicates the implementation of this measure.

This incentive targets R&D labour costs in all sectors having a large scale effect by which up to 10,000 employees are affected. The behavioural effect is estimated to lead to increased R&D employment as R&D labour costs are reduced.

2C Social security tax ceiling for all R&D employees. Three different monthly ceilings are assessed: € 500, € 400 and € 300 (EEK 7,800, EEK 6,300, EEK 4,700 accordingly)

This tax incentive has many positive additional effects; mainly it is an incentive for creation of jobs requiring high qualifications. It may make the Estonian job market attractive for old EU member country residents, who are accustomed to considerably higher wages. Also high-qualification employees have higher additionality to the economy. Since business enterprise R&D employees have higher wages than non-commercial entities, this tax subsidy targets business R&D more efficiently.

As with the previous tax subsidy, contribution-based social benefits are affected. These might have to be compensated to R&D employees having a possible negative impact on the state budget.

This tax incentive has a medium to large effect (depending on the ceiling value), affecting 1,000-4,000 employees. It is expected that it may lead to high-income R&D employment growth.

2D Ceiling on social security tax for imported workers

- *Ceiling 1 – "Imported" R&D employees, up to 3 years in Estonia, working on R&D (based on occupational classification), social tax capped at € 1,000 absolute value (meaning EUR 3000 salary with 33% social tax rate). After 3 years social tax will be 33%*
- *Ceiling 2 – "Imported" R&D and innovation employees, up to 3 years in Estonia, working on R&D or innovation (based on occupational classification), social tax capped at € 1,000 absolute value. After 3 years social tax will be 33%*

These tax subsidies target high-income R&D and innovation employees from abroad. These are employees with the largest additionality to the economy, so these tax incentives have an excellent target. Since business enterprise R&D employees have higher wages, theses tax subsidies target business R&D to a larger extent than non-commercial R&D.

As with the previous two tax incentives, contribution-based social benefits are affected (see above). However, since imported employees usually stay in Estonia for only a relatively short time period, they will generally not make full use of Estonian contribution-based social benefits, so burdening them with too much of the social security tax might be de-motivating for the employee and an excessive cost for the employer.

Currently, there is no reliable assessment regarding the number of imported R&D employees or imported innovation employees, making quantitative assessment of effects more or less impossible.

However, the short-run fiscal impact of the first subsidy (for R&D employees) is deemed small, even when adding imported innovation employees, the expected short-run fiscal effect is smaller, than most other tax incentives analysed. Long-run effects depend on how well these tax subsidies will attract employers to import R&D employees.

It has been suggested, that knowledge importation is of major importance for the success of a country's innovation activity. This is because the innovation systems are opened and are crossing country borders, it is more efficient to import the knowledge and experience temporarily, than to try and create it from scratch. So, this tax subsidy might have the best targeting capabilities of all the tax subsidies analysed in this report. However, without a full analysis, no reliable policy recommendations can be given as to what the best social security tax ceiling should be (the social security ceiling should fall between € 500 and € 1000) or what are the fiscal effects.

Summary of the main positive and negative qualitative effects of selected tax incentives

Aim: Increase R&D activity in Estonia		
	Positive effects	**Negative effects**
Intermediate aim: To reduce capital cost of R&D activities by reducing corporate income tax liability	• Attractive investment climate • Increase in foreign direct investments • Increase in R&D expenditure	• Incentive does not favour start-ups and non-profit organizations
Option 1A: By the number of R&D employees	• R&D employment growth in labour intensive firms	• High administration costs • Small effects • Does not influence capital intensive firms
Option 1B: By R&D expenditure	• Well targeted • Influences both capital and labour intensive firms • Cooperation between R&D companies may increase	• High compliance costs • Risk of double subsidisation
Option 1C: By income from royalties	• Intellectual property transfer growth • Attractive for foreign companies • Low administrative costs	• May not benefit Estonian firms • Benefits will be enjoyed with a time-lag • Low overall impact
Intermediate aim: To reduce labour cost of R&D activity	• R&D employment growth • Benefits also start-ups and non-profit sector • Positive effect on companies' cash flows • Balance of R&D activity will not be distorted	• Large negative influence on the state budget • Does not influence capital intensive R&D activity
Option 2A: Reduction of income tax on R&D employees' salaries	• R&D employment growth • Large impact	• Negative impact on state and /or local government budget
Option 2B: Reduced rate of social tax on R&D employees' salaries	• R&D employment growth • Large impact	• Negative impact on social benefits
Option 2C: Ceiling on social tax on R&D employees' salaries	• Well targeted (creation of high-income jobs) • Estonian labour market may be attractive • Medium to large effect	• Negative impact on social benefits
Option 2D: Ceiling on social tax for "imported" R&D (and innovation) employees' salaries	• Excellent targeting (imported high-income employees) • Import of knowledge	• Fiscal effects are more or less impossible to assess

Summary of quantitative effects of selected tax incentives, million EEK (except employment growth and R&D/GDP ratio growth)

	CIT base reduction by the number of R&D employees (300 000 EEK)	Tax credit by intramural R&D expenditure	Tax credit by total R&D expenditure	Income tax reduction to 10%	Social tax reduction to 15%	Social tax ceiling for R&D employees (€300)	Social tax ceiling for R&D employees (€400)	Social tax ceiling for R&D employees (€500)
Negative state budget impact (*short-run*)	3.3	26	30	102	170	96	42	21
Negative state budget impact (*mid-run*)	3.3	25	29	101	170	95	42	21
Negative state budget impact (*long-run*)	6.4	53	60	230	420	211	86	41
Administration cost (*short-run*)	0.06	0.52	0.6	2	3.4	2	0.8	0.4
Administration cost (*long-run*)	0.13	1.1	1.2	4.2	8	4	1.7	0.8
R&D activity level increase (*short-run*)	0.3	2.6	3	10	17	9.6	4.2	2.1
R&D activity level increase (*mid-run*)	1	7.5	8.5	30	50	28	12	6.2
R&D activity level increase (*long-run*)	26	210	240	850	1500	800	340	170
Compliance cost (*short-run*)	0.2	1-1.8	1.2-2	2.1	2.1	0.9	0.4	0.3
R&D investment level growth (*short-run*)	0.16	1.3	1.5	5	8	5	2	1
R&D investment level growth (*long-run*)	13	105	120	430	750	400	170	85
R&D employment growth (*long-run*) (persons)	5-23	50-200	50-225	100-700	150-1300	100-700	70-300	40-150
Annual positive impact on the state budget (based on R&D employment growth)	0.5-5	6-40	6-45	9-105	13-200	9-105	6-45	4-23
R&D/GDP ratio change (percentage points)	0.08	0.14	0.15	0.4	0.6	0.4	0.3	0.2

Note: Short-run denotes implementation year, *mid-run* denotes the 3rd year, *long-run* denotes the 10th year.

The overall pure fiscal cost-effectiveness to R&D is almost the same for all tax subsidies (except for social security tax ceiling for all employees), and it is estimated at 160% for the 10-year period, i.e. if the state pays for 1 EEK of R&D activity, firms will add to that, on average, 60 cents of R&D expenditure in the 10-year period. This, however, does not encompass the spillover effects to the economy. An additional 10-20% will be added to the cost-effectiveness by tax returns to the state budget by the growing R&D activity.

When considering the impact size, the tax subsidy with the largest impact is the lowered social security tax rate for all R&D employees. Also, the lowered income tax rate for R&D employees and social security tax ceiling of € 300 are not far behind. Due to simplicity and the question of future social security compensation, the tax subsidy of choice out of these three, is the lowered income tax rate for all R&D employees.

When targeting is considered, three tax subsidies stand out, namely the social security tax ceiling for imported employees, the tax credit by R&D expenditure and the tax base reduction by the number of supplementary R&D employees. The first subsidy is important for knowledge importation, the second for pure user-cost reduction of the business enterprise sector R&D and the third as an incentive for R&D employment growth.

For those R&D tax measures that require companies to be profitable in order to benefit from the R&D tax incentive, we propose that these should be complemented by R&D grants. In general, R&D grants should be the driving factor for R&D growth in the initial years of the company's existence.

For those measures that do not require the companies to be profitable (wage tax incentives) the direct subsidies (EAS grants) could be complementary but should be very well targeted towards specific objectives that the tax incentive is unable to provide, e.g. the purchase of machinery and equipment. In any case, we propose that the selected R&D tax measure will be coordinated with the EAS grants available to avoid the overlapping in terms of targeting objectives as R&D grants and R&D tax incentives are generally substitutes.

As it is more difficult to keep track of foregone tax revenue than it is to keep track of "out of pocket" expenses, we find that tax audits during the first years of R&D tax incentive application are essential to be carried out.

Our analysis showed that several tax incentives can be implemented in the Estonian income tax system to encourage research and development. The short term costs as well as impact of different incentives vary. Which R&D tax incentive to implement eventually has to be carefully contemplated considering how much resources the government is willing to invest in R&D and which costs or objectives are the priorities.

1 Introduction

KPMG Baltics AS, TTU professor Karsten Staehr and PRAXIS Center for Policy Studies, with contributions by Marek Tiits (Institute of Baltic Studies) and Jaanika Meriküll (University of Tartu), have prepared this report at the request of the Ministry of Economics and Communication in order to provide an analysis regarding possible tax measures for the promotion of research and development (and innovation) (R&D) activities in Estonia.

The current report gives an overview of R&D tax incentives implemented in various countries around the world, a selection of incentives that could be implemented in the Estonian tax environment and their impact on investment to research and development. In addition, the report identifies Estonian tax policy measures that could help to promote R&D activities of companies, increase the number of high added value jobs and science-intensive companies.

According to the OECD Estonia is considered to have one of the most open and competitive economies in the world[2]. However, the majority of foreign direct investments in Estonia have been made to areas with low R&D capacity. Inbound investments have been oriented mainly to sectors the primary orientation of which is directed to domestic consumption and which have low export capability. Of the inbound investments of 2007 33.2% were made to financial sector, 26.8% to real estate sector and 13.4% to wholesale and retail sector. Only 14.6% of the investments were made into production sector. The actual R&D activities in Estonia are rather modest. The Estonian R&D strategy pursues the targets of R&D expenditure compared to the GDP to be 1.9% in 2010 and 3% in 2014, whereas the private sector R&D expenditure capacity targets are 0.9% and 1.6% respectively. In general, the R&D expenditure has steadily grown over the past few years.

The growth in Estonian R&D has been quite intense (approximately 25% per year during 2000-2007)[3]. However, the growth in the amount of qualified researchers and engineers has been problematic. According to the Estonian R&D strategy the target is to achieve 8 full time researchers and engineers per 1,000 occupants in the range of 15-74 years of age by 2013. In 2007 the respective characteristic was 5.37. An important role in the promotion of growth in the amount of researchers and engineers is the creation of initiative through offering attractive jobs in the private sector and growth in the demand for qualified workforce.

The challenges that Estonia faces are shortage of qualified R&D personnel, low number of R&D intensive businesses and low level of business R&D investments[4],. In this report we analyse these issues and seek the answer whether the establishment of R&D promoting tax measures could be feasible in order to overcome those.

One should note that the spending (whether on R&D or otherwise) or any kind of expenditure is not a goal in itself, if it does not create additional value to the economy and the society. Therefore, we have targeted our research not only to finding potential R&D tax measures which would simply increase the R&D expenditure, but which would also provide the highest benefit for the economy and society through creation of new jobs, attraction of investments and consequently increasing consumption and tax revenues and GDP.

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[22] OECD (2009): „Economic Survey of Estonia 2009: Enhancing the business environment to foster productivity",http://www.oecd.org/document/47/0,3343,en_33873108_39418677_42587887_1_1_1_1,00.html

[3] Public procurement document

[4] OMC Policy Mix Review Report, Country Report, Estonia (2007), http://ec.europa.eu/invest-in-research/pdf/download_en/omc_ee_review_report.pdf

We have prepared this report by conducting an overview of theoretical international literature, empirical literature, and country evaluation studies. In addition, we have made a qualitative analysis and a statistical analysis of R&D tax incentives. In some occasions, we have also used expert opinions from foreign KPMG offices.

We would like to thank Mihkel Randrüüt and Lauri Tammiste from the Ministry of Economics and Communication and Lemmi Oro from the Ministry of Finance for their useful comments. All the remaining errors are sole responsibility of the authors.

1.1 What is R&D?

The most authoritative definition of Research and Development comes from OECD Frascati Manual, published in its first edition 45 years ago. For today, the guidelines of the Frascati Manual have become *de facto* standard for both for collecting and analysing the research and development activities across the globe.

The latest edition Frascati Manual proposes the following basic definitions.

"Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications"[5]

Frascati Manual distinguishes also between basic research, applied research and experimental development.[6] Distinguishing between the three is not, however, particularly important for the purposes of the current work. It is much more important to note that the Frascati Manual distinguishes explicitly between R&D and a number of closely related activities, such as for example education and training, general purpose data collection, specialized health care, policy related studies and routine software development, etc.

In recent years, it has become a common misconception to treat R&D and innovation as synonyms. We would therefore like to draw the reader's attention to the fact that innovation is, according to Frascati Manual, a much broader term that may include R&D but does not need necessarily to do so:

"Technological innovation activities are all of the scientific, technological, organisational, financial and commercial steps, including investments in new knowledge, which actually, or are intended to, lead to the implementation of technologically new or improved products and processes. R&D is only one of these activities and may be carried out at different phases of the innovation process."[7]

Innovation is, thus, about successful introduction of something new and useful. The emphasis is of innovation is on actual introduction and application of novel ways of doing things. Innovation may include R&D, but it does not have to do so.

The rest of the report will focus on the promotion of R&D and not so much on innovation as R&D is considered as one of the primary inputs to innovation.

[5] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition. p. 31.

[6] Basic research is defined as theoretical work undertaken to acquire new knowledge, without any particular use of it in view. Contrastingly, applied research is directed primarily towards a specific practical aim or objective. Experimental development is defined, chain link model, as the following logical step, whereby the existing knowledge is used for producing new materials, products, processes or services. R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

[77] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition, p. 18.

1.2 Policy background for the analysis

Research and development are at the core of the knowledge-based society model in developed countries. Knowledge-based society is constantly developing, sustainability of the society is based on creating and using knowledge aimed at efficient operation of the society and innovative economy, to increase welfare of the people.[8]

Well-designed tax and expenditure systems that promote an efficient allocation of resources are a necessity for the public sector to make a full contribution towards growth and employment, without jeopardizing the goals of economic stability and sustainability. This can be achieved by redirecting expenditure towards growth-enhancing categories in line with Lisbon Strategy such as R&D. A key priority for the EU and the Estonian economy is to ensure that tax structures and their interaction with benefit systems promote higher growth through more employment and investment.[9]

Estonian RD&I Strategy 2007–2013 "Knowledge-based Estonia" focuses on sustainable development of the society by means of R&D&I. It contributes to achievement of the goals of Estonia's long-term development strategy "Sustainable Estonia 21" as well as the Lisbon Strategy (the strategy for growth and jobs).[10]

R&D needs skilled people and a competitive infrastructure, clear orientation towards Estonia's needs and opportunities as well as stable increase in financing. Challenges facing Estonian entrepreneurship and economy include increasing productivity as well as high added value export, creation of cooperation networks that encourage innovativeness; and a challenge for the public sector is to value the knowledge-based approach and design compatible policy-making processes.[11]

As for general indicators of implementation of the strategy, the total expenditure on research and development is planned to be increased to 3% of GDP by 2014, of which the business sector research and development investments cover more than a half (1.6% of GDP). The proportion of employees involved in research and development has to increase to 8 researchers and engineers per 1000 employees and the productivity of enterprises per employee has to reach 80% of the average of the European Union 25 member states (EU 25).[12]

So far, expenditure on R&D has been increasing stable. Although in 2007 the volume of R&D investments, measured as a percentage of GDP decreased from 1.14% to 1.11%[13], the nominal growth of the investments was up to 15%. On the other hand, this is three times less than in 2006 when the nominal growth was up to 45%.

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[8] KNOWLEDGE-BASED ESTONIA Estonian Research and Development and Innovation Strategy 2007-2013, http://www.akadeemia.ee/_repository/File/ALUSDOKUD/Knowledge-based%20Estonia%20II.pdf

[9] COMMUNICATION FROM THE COMMISSION TO THE SPRING EUROPEAN COUNCIL. INTEGRATED GUIDELINES FOR GROWTH AND JOBS (2008-2010) including a COMMISSION RECOMMENDATION on the broad guidelines for the economic policies of the Member States and the Community (under Article 99 of the EC Treaty) and a Proposal for a COUNCIL DECISION on guidelines for the employment policies of the Member States (under Article 128 of the EC Treaty) (presented by the Commission)

[10] KNOWLEDGE-BASED ESTONIA Estonian Research and Development and Innovation Strategy 2007-2013, http://www.akadeemia.ee/_repository/File/ALUSDOKUD/Knowledge-based%20Estonia%20II.pdf

[11] Ibid.

[12] Ibid.

[13] http://pub.stat.ee

As concluded in European innovation scoreboard 2008, Estonia is one of the Moderate innovators. Innovation performance is just below the EU27 average but the rate of improvement is above that of the EU27. Relative strengths, compared to the country's average performance, are in finance and support, firm investments, linkages and entrepreneurship and innovators and relative weaknesses are in throughputs. Over the past 5 years, finance and support and firm investments have been the main drivers of the improvement in innovation performance, in particular as a result from strong growth in private credit (16.8%), business R&D expenditures (20.0%), non-R&D innovation expenditures (29.3%) and community trademarks (17.6%). performance in innovators has remained stable.[14]

[14] European innovation scoreboard 2008. Comparative analysis of innovation performance.

2 R&D, knowledge and government intervention – conceptual issues

This chapter discusses a number of conceptual and theoretical issues regarding the impact of R&D on societal welfare and the possible rationales for government intervention. Investment in R&D entails costs and possible benefits; additional R&D investments are warranted to the extent that their benefits to society outweigh their costs.

As other types of investments, investment in R&D is undertaken by firms in the expectation that the investment brings future benefits in the form of lower production costs and/or higher revenues. Private investment in R&D may, however, be below the optimal level as seen from society's viewpoint. First, the knowledge derived from R&D may spill over to other firms and bring benefits to those. These spillover or externality effects are not taken into account by the individual firm. Second, the return to R&D investments is inherently very uncertain and this may make it difficult for firms to obtain external financing, simply because possible lenders will have even less information about the future return to the R&D investment than the firm undertaken it.

The possibility of underinvestment in R&D in a market economy suggests that government intervention may be welfare enhancing. A major problem in this context is that the socially optimal level of R&D investment is extremely challenging to estimate. R&D spillovers typically manifest themselves over a long period of time and may play an important role for the long-term growth of an economy. The spillover effects likely vary across different economies, dependent on their size, openness and development level.

The problems regarding the quantification of the benefits imply that it is impractical to apply standard cost benefit analysis when assessing government policies aimed at stimulating private R&D. Instead, studies frequently focus on the *effectiveness* of various government policies, i.e. the immediate effect of government policies on different measures of R&D activities. Such assessments of effectiveness are also undertaken in this report, but their limited value for policy analysis must be appreciated.

The difficulties assessing the societal effects of government programmes supporting private R&D also have policy economy repercussions. Gains from government subsidies are concentrated while the costs are dispersed; the potentially gainers have an incentive to exert political influence with the possible result that the subsidisation end up exceeding the socially optimal level.

The government can employ a number of policy instruments in order to stimulate private R&D. One important issue relates to the differences – and similarities – between direct subsidies and tax subsidies, and under which circumstances one of them is preferable. Whereas there are some differences between tax subsidies and direct subsidies *in economic terms*, the main differences relate to the institutional setup and administrative procedures of the two subsidisation methods.

The two different subsidy schemes may affect R&D investment differently depending on the underlying reason for the government intervention. If the main problem is that private firms cannot obtain financing of their R&D investments, direct subsidies may be most effective as they can immediate improve the cash flow in the firms. If spillover effects are the main concern, there are no major differences in economic terms across the two subsidisation methods.

Direct subsidies are arguably easier to target to particular (e.g. sector specific) or rapidly changing government objectives. Tax subsidisation is more suitable if the objective is broad-based support to R&D activities within a relatively stable framework. Some incentive problems may more easily be addressed using direct subsidies than tax subsidies: tax subsidies are often tied to the *costs* of all R&D undertaken, while R&D subsidies may more easily be tied to the results of R&D and to increments in R&D costs.

The private firms may also have different behavioural responses to the two different subsidy schemes, possibly because of different information and monitoring systems. The government's administrative costs and the firms' compliance costs also differ, although monitoring problems and the possibility of abuse are present irrespective of the choice of subsidy scheme.

The main conclusions to be drawn from this chapter are:

- *R&D undertaken by one firm may spill over to other firms and bring benefits to those*
- *R&D is a risky business – the return to R&D investments is inherently very uncertain and this may make it difficult for firms to obtain external financing*
- *Private investment in R&D maybe below the optimal level as seen from society's viewpoint*
- *The socially optimal level of R&D investment is extremely challenging to estimate*
- *Government intervention in order to stimulate private R&D may be welfare enhancing*
- *The main methods for financing R&D are direct subsidies and tax subsidies*
- *Whereas there are some differences to the direct subsidies and tax subsidies these can be regarded as substitutes*

2.1 R&D and knowledge accumulation – spillovers and social welfare

Research and development (R&D) can be defined as systematic efforts seeking to increase the stock of knowledge, applicable to individual firms, person or society at large[15]. The accumulation of knowledge through R&D and other means may be one of the most important factors explaining sustained long-term economic growth (see Appendix). Thus, knowledge accumulation is arguably of considerable importance for economic development and, hence, the welfare of individuals over time.[16] Some authors argue that modern high-income economies are "knowledge economies" as they perceive knowledge to be the major contributor to value-added at this development stage[17].

Private R&D is mainly undertaken by business enterprises ("firms"). Private investment on R&D resembles other investments undertaken by firms in the sense that an initial outlet is expected to generate returns in the future. An individual firm seeking to maximise its value will therefore have an incentive to investment in R&D up to the point where the additional costs equal the additional discounted expected return of the R&D.

The First Theorem of Welfare Economics posits that the allocation of resources in a market-economic equilibrium is efficient, i.e. that no redistribution of resources can make some economic agents better off without making some other agents worse off. The efficient allocation has the feature that no resources are wasted and in this sense may be seen as desirable from society's viewpoint[18]. The First Theorem of Welfare Economics is therefore often used as an argument for government not to intervene in the functioning of a market economy. The theorem is, however, a theoretical abstraction and builds on a number of restrictive assumptions, including that all goods are "private goods" without spillover properties and that all information is costless and publicly available. These assumptions are clearly *not* satisfied in the case of knowledge accumulation via private R&D. In particular, R&D investment activities differ from most other corporate investments in two of major ways[19].

Knowledge accumulation is characterised by substantial spillover (or externality) effects to other firms and society at large and the effects are likely to materialise over a long time horizon (see also Appendix). The spillover effects imply that the individual firm does not appropriate all the rents from its R&D activities and therefore lacks economic incentives to invest as much in R&D activities as would be socially optimal. In plain words, since the costs of R&D are borne by the individual firm, but many of the benefits are attained by other firms, R&D may be under-provisioned in private equilibrium. There are several spillover channels[20]:

- The main spillover channel of R&D activities emerges from the labour employed in such activities. The individual firm incurs a significant risk that the departure of key personnel would carry away a significant proportion of the investment in R&D. This phenomenon is characteristic to the "tacit knowledge" of labour, but not to other investment goods such as machinery. The fear of losing tacit knowledge to competitors may lead to a suboptimal level

[15] Frascati, M. (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", 6th ed., Organisation for Economic Co-operation and Development.
[16] Rodrigues, M. J. (2003): *European Policies for a Knowledge Economy*, Edward Elgar.
[17] Porter, M. (1990): *Competitive Advantage of Nations*, Free Press.
[18] Myles, G. D. (1995): *Public Economics*, Cambridge University Press.
[19] Selected other business investments, in particular investments into training and education of employees, share many of the characteristics of private R&D.
[20] Crespi, G., C. Criscuolo, J. E. Haskel and M. Slaughter (2008): "Productivity Growth, Knowledge Flows, and Spillovers", NBER Working Paper, no. 13959, National Bureau of Economic Research.

of production of new knowledge; this is especially the case for industries or periods of time, which are characterised by high labour mobility.

- The R&D spillovers may also take the form of competitors copying the designs or functionalities of new products. The result would again be under-provision of R&D investment as the individual firm is unable to appropriate all rents derived from the investments. The importance of this spillover effect will depend on the specific products and the new knowledge / technology embedded in the products.

The other feature of R&D, which may lead to under-provision of knowledge in private equilibrium, is that even the private return to R&D activities is very uncertain and potentially materialises over a long time. The uncertainty regarding the return of R&D activities implies that it may be virtually impossible to finance such activities through private capital markets. The capital markets may perceive that firms seek outside financing mainly to R&D projects which have a low probability of becoming successful (yielding a high return). The result of such "adverse selection" may be the absence of financing possibilities for risky R&D projects, possibly resulting in less knowledge accumulation than socially efficient.

The market-imperfections discussed above (spillovers, adverse selection) suggest that the level of R&D may be inefficiently low and, consequently, that government intervention may be able to improve social welfare. It is important, however, to examine to which extent private market solutions are able to address these problems.

One important example of a private solution to the spillovers problem is the *clustering* of firms that employ highly skilled personnel with specific knowledge[21]. Companies that operate within similar or related fields tend to cluster into *industrial districts* and effectively share a common labour pool and possibly also other factors of production. Such regional clusters are often characterised by a high level of knowledge accumulation, which has led to the theory of national or regional *Systems of Innovation*[22].

The market-imperfections discussed above (spillovers, adverse selection) suggest that the level of R&D may be inefficiently low and it is improbable that private market solutions will fully solve the problem of under-provision of R&D / knowledge accumulation. In any case it is of great interest to determine the optimal of knowledge accumulation as seen from the viewpoint of society. In the likely event that the knowledge accumulation is below the socially optimal level, government intervention may be able to improve social welfare.

Knowledge accumulation, for instance through R&D activities, generally incur costs to society as resources are channelled into activities that do not have *direct* effects on welfare. The costs of R&D imply that even if knowledge is under-provisioned in private equilibrium, there can also be excessive accumulation of knowledge. In other words, the challenge is to find the optimal level of knowledge accumulation and the corresponding level of R&D activities. The answer is

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[21] Marshall, A. (1890): *Principles of Economics*, Macmillan; reprinted by Prometheus Books, 1920.

[22] Lundvall, B.-A. (1985): *Product Innovation and User-Producer Interaction*, Aalborg University Press; Lundvall, B.-A. (2007): *Innovation System Research and Policy: Where it came from and where it might go*, Paper presented at CAS Seminar in Oslo, 4 December, www.cas.uio.no/research/0708innovation/Lundvall_041207.pdf;
OECD (2005): *Governance of Innovation Systems*, Volume 1: Synthesis Report, Organisation for Economic Co-operation and Development.

the Samuelson rule of public (or semi-public) good provisioning, where "semi-public goods" refer to goods with positive spillover effects[23].

The Samuelson rule states that the socially optimal level of knowledge accumulation emerges where the sum of the marginal benefits of knowledge across all individuals (over all future time periods) equals the marginal costs of providing the knowledge. This rule basically divulges the common sense that society should continue accumulating knowledge as long as the total benefits to society exceed the costs incurred.

It is worth noticing that the projects or policies, which are financed through payments from the government budget, usually carry an additional cost in excess of the actual payment. This is the consequence of the government usually raising revenue through distortionary taxation. Therefore, to reflect the true societal costs of projects or policies, the excess burden of the costs financed by the government would have to be added. This reasoning leads to the so-called Modified Samuelson rule where the marginal benefits are computed as before but where the marginal costs includes the (marginal) excess burden incurred by the government when raising the required revenue.

The Samuelson rules comprise the theoretical underpinning of modern social cost-benefit analysis of individual projects or policy initiatives. In cost benefit analysis, the monetary values of benefits and costs in all future time periods are estimated and aggregated through the calculation of the net present value (NPV). The standard rule of accepting all (non-exclusive) projects or policy initiatives for which NPV > 0 is the practical application of the Samuelson rules[24].

In practice, however, it is nearly impossible to use costs benefit analysis to assess the effect on social welfare of different policy schemes meant to stimulate private R&D. The main problem is the considerable uncertainty with which both costs and benefits are estimated[25]:

- The direct subsidisation costs for the government (in the form of payouts or missing tax revenue) may be assessed with some certainty, in particular if it is possible to provide estimations of the likely take-up of the subsidy. In principle, the private costs associated with the increased R&D activity will also have to be included. These costs may be relatively difficult to assess.
- The benefits are highly uncertain as they hinge on a long chain of effects from R&D support, via knowledge production and knowledge spillovers to increased value added in the future. The amount of knowledge generated in the firms is *sui generis* highly uncertain and may depend on a range of factors, including the capacity of the firms engaged in the R&D activities[26]. The benefits will pertain to the firm undertaking the R&D, but potentially also to a large number of other firms (and individuals) in the economy. Moreover, the benefits

[23] Myles, G. D. (1995): *Public Economics*, Cambridge University Press.
[24] Perkins, Frances (1994): *Practical Cost Benefit Analysis. Basic Concepts and Applications*, MacMillan.
[25] Kenneth, P. T. (2007): "Investment Incentives. Growing Use, Uncertain Benefits, Uneven Controls. An Exploration of Government Measures to Attract Investment", Global Subsidies Initiative (GSI), International Institute for Sustainable Development (IISD), Geneva, Switzerland, http://www.globalsubsidies.org/files/assets/GSI_Investment_Incentives.pdf.
[26] Crepon, B., E. Duguet and J. Mairesse (1998): "Research, Innovation, and Productivity: An Econometric Analysis at the Firm Level", NBER Working Papers, no. 6696, National Bureau of Economic Research.

are spread over time, arguably having effects in all future periods depending on the growth dynamics generated. Thus, the horizon of the analysis may affect results greatly[27].

The upshot is that the effects of different policy instruments are circumscribed by great uncertainty regarding, leaving standard cost benefit analysis relatively impractical. Instead, studies frequently focus on the *effectiveness* of various government policies, in particular the short-term effect of government policies on different measures of R&D activities. The studies typically investigate the effect on private R&D spending of various government subsidies, all measured in monetary units. Evidently, the value of such studies of effectiveness for policy analysis is limited as the effect is here interpreted as the spending on R&D, not the R&D results obtained. Other studies examine the results in the form of patents awarded or measures of knowledge accumulation reported by private firms.

[27] Griffith, R., S. Redding and J. Van Reenen (2001): "Measuring the Cost-Effectiveness of an R&D Tax Credit for the UK", *Fiscal Studies*, vol. 22, no. 3, pp. 375-399.

2.2 The political economy of subsidies

The Samuelson rules stipulate the socially optimal level of knowledge provision, but it is difficult to estimate this level with any degree of precision in practice. Such a setup occurs in many circumstances, such as (other forms of) industry protection or taxation of individuals and firms. The literature on the political economy of reform finds that the political processes may entail that the actually implemented policies deviate markedly from the socially optimal policies. Tax and subsidy schemes are likely to emerge from complex political processes and the result can be either excessive or insufficient government intervention[28].

Given the characteristics of R&D subsidisation, the focus will be on circumstances that lead to excessive government intervention[29]. As other tax and subsidisation scheme, subsidisation of R&D activities has redistributional effects; this implies that some firms and individuals will benefit even if the costs of subsidisation of R&D activities exceed the benefits attained by society. Using the political economy terminology, direct or tax-based R&D subsidisation has the potential to generate *rents* among the relatively few recipients of such subsidies. The prospect of obtaining such rents implies that the potential recipients have incentives to influence the political decision-making process with the aim to ensure that the subsidies are paid out[30]. The measures of rent seeking can take the form of "information" furnishing and various forms of lobbying and potentially also bribery.

Meanwhile, the costs of the subsidisation will essentially be borne by all individuals in society (for instance in the form of higher taxes or reduced government services), but the costs per individual are comparatively small. The individual has therefore little incentive to seek to influence the political decision-making process, since measures in this direction are costly while the perceived gains are small. In the end, the business interests exert substantial influence the political process, with the possible result that the subsidisation exceeds the socially optimal level.

It is reasonable to conjecture that excessive government activism is more likely if the outcome of the government policy is highly uncertain[31]. If it is very difficult to estimate the social optimal level of the government policy, it is easier to influence the political process as decision-makers would lack a "point of orientation". The same applies in the case of uncertainty regarding the effectiveness of different government policies or the (re)distributional effects of the policies.

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[28] Alt, J., I. Preston and L. Sibieta (2008): "The Political Economy of Tax Policy", The Institute for Fiscal Studies, http://www.ifs.org.uk/mirrleesreview/reports/political_economy.pdf.
[29] Grossman, G. M. and E. Helpman (1994): "Protection for Sale", *American Economic Review*, vol. 84, no. 4, pp. 833-850.
[30] Olson, M. (1965): *The Logic of Collective Action*, Harvard University Press.
[31] Alt, J., I. Preston and L. Sibieta (2008): "The Political Economy of Tax Policy", The Institute for Fiscal Studies, www.ifs.org.uk/mirrleesreview.

2.3 A primer on the theory of regulation – taxation and subsidies

This section provides a brief introduction to selected topics within the theory of government regulation. The main focus is on the targeting issues that arise when a government seeks to implement policies meant to stimulate knowledge accumulation in society. The main insights follow from the theory of corrective taxation / subsidisation and the crudely stated main rule is: "Shoot at the target and avoid collateral damage if possible".

The first point is the need to reconcile the number of objectives and the number of policy instruments. Except in rare circumstance – essentially reflecting coincidences – the number of instruments must exceed or equal the number of objectives if the objectives are to be *fully attained*. If the number of instruments is smaller than the number of the objectives, it will not be possible to fully attain all of the objectives[32]. This "counting principle" may be important in the case of policies meant to enhance R&D activities and increase knowledge accumulation, since such policies often have many objectives. For instance, R&D support might aim to increase knowledge in specific sectors, to support employment and/or to attract foreign direct investment. One policy instrument does not allow several goals to be fully satisfied simultaneously.

The tax literature distinguishes between two different types of taxes. Revenue taxes generate tax revenue for the government, while corrective taxes are meant to change the behaviour of firms and individuals. The optimal taxation literature seeks to device the tax structure inflicting the least burden on society. A main result is that revenue taxes should usually be as broad-based as possible, while corrective taxes should be as focussed as possible. Thus, corrective taxes should target the *specific* behaviour that is sought affected, and preferably avoid taxes seeking to affect behaviour indirectly. If CO_2 emission is the problem, the tax should ideally be on CO_2 emissions and not on broader activities such as heating expenses; the reason is that the broad taxation does not give direct incentives for individuals and firms to choose less CO_2 emitting means of heating and also causes behavioural changes that are unrelated to the intended behavioural change (people freezing). The conception that the corrective tax should specifically target the externality is sometimes labelled the "linkage principle"[33].

Evidently, the linkage principle also applies to "negative taxes", i.e. subsidisation of economic activities. The linkage principle suggests that the direct or tax-based subsidy measures should be targeted directly toward the objective. Broader-based subsidies provide less incentive to change behaviour and may also imply that firms or individuals would alter their behaviour in ways which are not directly related to objectives. Thus, if knowledge accumulation in society is the objective, a subsidy schemes should seek to link the subsidy with the knowledge accumulation objective.

Finally, the degree of regulatory subsidisation of an economic activity would ideally have to reflect the societal benefits of the spillovers generated by the activity[34]. Loosely speaking, the subsidies to each activity must be proportional to the benefits which the spillovers entail on other firms and households in the economy. Within regulation theory this conception is sometimes labelled the "proportionality principle". In the context of this report, the proportionality principle has clear policy implications. It would entail modest subsidies to

[32] Boersema, J. J. and L. Reijnders (2008): *Principles of Environmental Sciences*, Springer.
[33] Baumol, W. J. and W. E. Oates (1988): The Theory of Environmental Policy, Cambridge University Press.
[34] Sandmo, A. (1975): "Optimal Taxation in the Presence of Externalities", *Swedish Journal of Economics*, vol. 77, pp. 89-98.

knowledge accumulation with small spillovers and/or to knowledge accumulation with spillovers having little societal value. It would entail substantial subsidies to knowledge accumulation with large spillovers with large social value.

The preceding discussion of the theory of regulatory subsidisation can be summarised in three "principles": the counting principle, the linkage principle and the proportionality principle. The counting principle warns against over-ambitious goals in case few instruments are available – or the need to use many instruments in case of many goals. The linkage and proportionality principles are closely related, essentially summarising different aspects of the solution to the government's problem of maximising social welfare subject to spillovers of economic activities.

If the only market imperfection in the economy is (positive) spillover effects from knowledge accumulation, then it is possible to attain the "first-best" efficient allocation of resources if subsidies are precisely *linked* to the spillover effects and set *proportionally* to the societal benefits attained for each type of knowledge. These requirements underscore some important limitations of government intervention in the presence of spillovers:

- First, it is often difficult directly to link subsidies to the spillovers. This is also the case in the case of knowledge accumulation, where there is no easily observed metric of knowledge. Thus, in practice, subsidisation of knowledge accumulation will often be indirect, e.g. by targeting different proxies of knowledge accumulation (e.g. patents) or the costs of knowledge generation (e.g. R&D expenditures). Such indirect subsidisation will generally lead to unintended behavioural changes with associated distortionary losses.
- Second, it is often difficult to pinpoint precisely the spillover effects and their societal importance, as they may evolve over many years and interact with other societal developments, cf. Section 2.2 and Appendix. By means of example, R&D in software may lead to revolutionary new ways of communicating or yet another computer game. The socially optimal subsidy is likely to differ markedly across these two types of knowledge accumulation, but challenging to implement in practice.

The discussion above shows clearly that subsidisation schemes in practice will be some distance away from the theoretical requirements for attaining the first best solution. Targeting issues, information problems, uncertainty, implementation costs etc. mean that regulation policies in practice will never satisfy the linkage and proportionality principle. In practice, a subsidisation scheme which is instituted to make society better off in the presence of positive spillovers will always amount to a second-best policy. Unfortunately, even in theoretical models there are no "rules of thumbs" regarding second best policies. Thus, each policy instrument would have to be evaluated individually, for instance using cost-benefit analysis as discussed in Section 2.2. This is also the approach used when different subsidisation proposals are assessed in Chapter 5.

2.4 R&D tax subsidies vs. direct subsidies

Almost all countries have numerous programmes aimed at stimulating knowledge accumulation. The policy measures include the legal protection of property rights (patents, trademarks, designs); support to education, libraries and broadband communication; public production of R&D for instance universities and applied research institutes as well as a plethora of subsidisation programmes targeting private R&D. Private R&D can be subsidised directly via research grants and targeted support programmes and/or via tax allowances to firms engaging in R&D.

This section discusses a number of issues regarding the choice of instrument(s) through which to subsidise R&D activities. Ideally, such policies should be coordinated with other policies meant to increase knowledge accumulation; there might for instance be more cost-effective means to stimulate knowledge accumulation than support to private R&D. However, to reduce the dimensionality and complexity of the issues involved, the rest of this section considers only government subsidies to private R&D.

The main question being addressed is under which circumstances tax subsidies, respectively direct subsidies, are preferable from the viewpoint of society. *In principle* there is not much difference between tax subsidies and direct subsidies[35]. The same rules can apply regarding the determination of the subsidies and the only difference is then whether the subsidy is paid out as a tax rebate or as a direct transfer.

Most of the differences will relate to administrative and political economy issues, but there might also in practice be some differences in economic terms.

In the end, only empirical studies can shed light on the suitability in practice of different subsidy schemes; Chapter 3 provides surveys of the empirical literature and brings up country experiences from around the world.

2.4.1 Economic differences between tax subsidies and direct subsidies

a) Tax liability vs. no tax liability

A main economic difference between direct and tax subsidies emerges when the recipient business entity has no tax liabilities from which the tax subsidy can be rebated. The absence of a suitable tax liability could be the result of a business entity being tax-exempt (e.g. a research institution owned by a philanthropic foundation) or of a private firm having no "suitable" tax liability.

The question is what constitutes a suitable tax liability. In principle a tax subsidy for R&D can be tied to any tax liability of the firm, but in almost all cases where a tax subsidy for R&D has been introduced in practice, the tax subsidy has been given as a deduction in taxable corporate income or a rebate in payable corporate income tax (see Section 3.3). In these cases, firms with no corporate income tax liabilities will not be able to benefit from the tax subsidy in the short term. In the case of no corporate income tax liabilities, the value of a tax subsidy will depend on

[35] Brixi, H. P., C. Valenduc and Z. Swift (2004): *Tax Expenditures – Shedding Light on Government Spending through the Tax System. Lessons from Developed and Transition Countries*, Directions in Development series, World Bank.

the rules regarding the carry over of accumulated deficits and/or tax assets across different periods[36].

b) Financing constraints

The financial situation of the firm may affect the effectiveness of the two subsidy schemes. If the private firms cannot obtain external financing of their R&D investments, direct subsidies may be most effective; directly subsidies can be paid out at an early stage and thus improve the cash flow in the recipient firms. Tax subsidies will generally only be available with a lag of one or two years and thus not entail immediate relief if financing constraints restraint the R&D investments of the private firms.

c) Targeting of subsidies

It was argued above that tax subsides and direct subsidies *in principle* could address the same government objectives. *In practice*, however, the two subsidy schemes are applied differently, in part because of different administrative and organisational frameworks. Therefore, the ability of the two subsidy schemes to target various government objectives differs in practice. The differences are related to the fact that the linkage and proportionality principles being impossible to satisfy in practice because of information and monitoring problems.[37]

- Tax subsidies are generally targeted to the *spending* on R&D since they often entail deductions or tax rebates related to the costs incurred by the firm.[38] It may therefore be easier to use direct subsidies if the aim is to target the *results* of R&D, for instance by awarding contracts contingent on a certain research problem being solved or a specific technology being developed.
- The taxation system is spelled out in laws that are passed in parliament. Moreover, firms and individuals need a stable tax environment to plan for the future. For these reasons, tax laws cannot be changed very often and it is generally infeasible to target tax subsidies to R&D priorities which change frequently. Thus, direct subsidies might be preferable in case of specific or/and frequently changing R&D objectives.
- Most tax laws stipulate that the subject of taxation is a flow or stock of the variable, measured within a given period. For instance, income taxes are levied on the flow of income within a given period; inheritance taxes on the stock of assets inherited. Likewise, deductions are generally based on the flow or stock of the variable based on which the deduction is calculated, but seldom in *changes from earlier* in such a variable.[39] This may suggest that tax subsidisation of R&D is most appropriately used when the objective is to

[36] These issues might be particularly important in the case of Estonia, where only distributed corporate income is taxed and there, consequently, is no direct link between corporate income and corporate income tax obligations. These issues are discussed in more detail in Chapter 5.

[37] The findings correspond closely to those regarding corrective taxation and have affinity to the discussion on the use of market-based vs. compulsory instruments. See, for instance, Määttä, K. (2006): *Environmental Taxes: An Introductory Analysis*, Edward Elgar; Howlett, M. and M. Ramesh (1995): *Studying Public Policy: Policy Cycles and Policy Sub-systems*, Oxford University Press.

[38] There are, however, a few examples of tax subsidies being contingent on R&D results. For instance, royalty payments from patents are exempted from corporate income tax for 5 years in Singapore.

[39] Regardless, this report discusses in Chapter 5 a subsidy scheme entailing a subsidy per *additional* knowledge worker employed during a year.

support the volume of R&D spending within a given period (within stipulated R&D areas); in this case the deduction or tax rebate is made to depend on the R&D spending within a given period. In principle tax subsidisation could also be made contingent on *increments* in R&D spending, but such rules are uncommon in tax laws and may also invite the firms to engage in strategic tax thinking.

Overall, it may be concluded that tax subsidisation is most suitable if the government's objective is broad support to R&D activities within a relatively stable framework. Specific government objectives (e.g. specific or changing areas of R&D activities) may more readily be met via direct subsidies. Some incentive problems may more easily be addressed using direct subsidies than tax subsidies: tax subsidies tend to be tied to the costs of all R&D undertaken, while R&D subsidies may more easily be tied to the results of R&D and to increments in R&D costs.

d) Behavioural responses

Although it was argued above that tax subsidies and direct subsidies are very close substitutes, they may affect R&D activities differently dependent on the reaction of the firms to the different subsidy schemes. A different behavioural response may rest on the schemes having different features, but may also rest on the firms' knowledge and perceptions of the two subsidisation methods as well as the administrative and managerial setup in the firms. It is very difficult to provide general deductions regarding the firms' behavioural responses to the two subsidisation methods.

- There are a number of arguments suggesting that *tax subsidisation is most effective*. Firms are continuously engaged in managing and planning their taxes, so tax subsidies to R&D activities may in this way become part of the overall management of a firm. This may also imply that the information about the possibility of receiving R&D subsidies is readily available. Tax subsidies are laid down in the tax laws and therefore change relatively seldom. This implies that firms may be able to take tax-based R&D subsidies into their long-term planning, while this might be more difficult with less predictable direct subsidies schemes.
- There are also arguments suggesting that *direct subsidisation is most effective*. Direct subsidies may be considered isolated events; the opportunity to attain extraordinary funding may energise the managerial and technical resources of the firms. The application procedures and the understanding that the firm receiving a subsidy will be scrutinised may imply that the firm injects ample resources in the R&D effort. Direct subsidies that are paid out at an early stage may also make it easier for credit-constrained firms to allocate resources to R&D.

2.4.2 Administrative differences between tax subsidies and direct subsidies

A main difference between tax subsidies and direct subsidies relates to the administrative setup of the two schemes. In general, it is impossible to assess the relative merit of the two schemes in this context, but a number of points can be brought up.

- At the government level, *direct subsidy* schemes will generally require the setup of new administrative institutions and the build-up of capabilities at these institutions. The bureaucracy administrating the application procedures, selection between competing R&D

proposals and subsequent supervision and evaluation is bound to be complex and relatively expensive. *Tax subsidies* do not require establishment of new government institutions as they will be administered by the tax authorities. However, in practice tax subsidies will complicate the tax filings of the firms and therefore require additional resources, including personnel with specialist knowledge in the area.

- At the firm level, the two subsidies schemes may are also entail compliance costs. The costs of application procedures etc. may imply that tax subsidies are cheaper to comply with than direct subsidies, but the costs are likely to depend closely on the specific rules and administrative stipulations of the subsidy schemes.
- Any R&D subsidy scheme entails the risk of unintended abuse and "evasion" by firms standing to benefit from such behaviour. Spending unrelated to R&D activities might for instance be reclassified as R&D spending with the aim of attracting subsidies. It is evident that both tax and direct subsidy schemes require extensive monitoring, auditing and control structures in order to restrain possible unintended abuse. One may conjecture that direct subsidies will be easier to monitor and control than tax subsidies, given that the direct subsidies frequently are awarded on an individual basis.

2.4.3 Political economy differences between tax subsidies and direct subsidies

Section 2.2 discussed the political economy of the determination of subsidies in general. This subsection extends the discussion by focusing on possible political economy differences between tax subsidies and direct subsidies. The analysis is based on the finding that the more uncertain and/or "hidden" the costs are, the higher is the likelihood that the potential winners will be able to extract subsidies via the political process.

- Direct subsidies, which appear in the government budget and is subject to direct parliamentary scrutiny, are relatively transparent and easy to observe. Tax subsidies, on the other hand, reduce the tax intake but otherwise remain largely "hidden". This may suggest that tax subsidies will be easier to "extract" from the government than direct subsidies, and the risk of regulatory capture may thus be higher if tax subsidies are the favoured instrument[40].
- The risk of regulatory capture is particularly important in the context of a fast changing economic environment. Changes in the economic environment may entail that the optimal level of R&D subsidisation or the entire subsidisation scheme changes. In these circumstances, a tax-based subsidisation scheme may be more difficult to scale back or remove given that the costs of such a scheme are less transparent than of the direct subsidisation scheme. Eventually, this risk will depend on the political and institutional setup and the specificities regarding the subsidisation schemes.

[40] Alt, J., I. Preston and L. Sibieta (2008): "The Political Economy of Tax Policy", The Institute for Fiscal Studies, http://www.ifs.org.uk/mirrleesreview/reports/political_economy.pdf.

3 Overview of literature on the effects of R&D tax incentives

This chapter first discusses the empirical impact of R&D tax incentives on the level of R&D activity on a high level. Second, the chapter gives an overview of the R&D tax incentives used by different countries by dividing these to corporate income tax incentives and labour tax incentives. As special rules are generally applied to R&D expenditure and R&D employees in order to qualify for the tax incentive a general overview is given also on those issues. Third, the international experience we have identified with the application of R&D tax incentives in different countries is provided. Fourth, light is shed on the most important factors that influence R&D location decisions made by multinational companies.

The main conclusions to be drawn from this chapter are:

- *The social revenue of the tax incentives is equal to the social cost, i.e. one unit of money spent on the tax incentive brings one unit of money spent on R&D*
- *Spillover effects can be expected which makes the R&D incentives favourable even if social cost equals to social cost*
- *Direct funding as well as tax incentives are more effective when they are stable over time: firms do not invest in additional R&D if they are uncertain of the durability of the government support*
- *Direct subsidies and tax incentives are often used together, because direct subsidies are a tool for the government to channel the private R&D spending in the direction they feel it to be necessary but tax incentives are used to promote the R&D spending without interfering with its nature*
- *Most of the R&D tax incentives used by different countries aim at reducing corporate income tax liability of the company incurring R&D expenses. The exact measures can be volume-based, incremental, provide full or partial tax holidays or be combinations of the aforementioned. The level of the tax incentive may vary in terms of company size*
- *The main corporate tax incentives used by countries to promote R&D activities are enhanced R&D expenditure deduction from taxable income (also named as tax concession or tax allowance), tax credit and tax holidays.*
- *R&D expenditure has to meet certain conditions in order to be qualify for the incentive. Generally Frascati definition is followed and R&D expenditure is divided into three categories: basic research, applied research and experimental development.*
- *In addition, the tax measures can also be aimed at reducing the overall tax cost of the company (or even the individual) by reducing the taxes on labour.*
- *The main labour tax incentives used are reduced wage withholding tax, exemption of social security tax and personal income tax reduction or exemption.*
- *Countries use labour tax incentives in order to ease the tax burden on R&D labour because R&D activities are rather labour intensive. In addition, labour tax incentives are generally expected to increase the number of R&D workers.*
- *Two systems are used by OECD member countries to define and classify persons engaged in R&D - classification by occupation and classification by level of formal qualification. According to the OECD the classification of R&D personnel should follow the principle that*

all persons employed directly on R&D should be counted as R&D workers, as well as those providing direct services such as R&D managers, administrators, and clerical staff.

- *there have not been that many evaluation studies regarding the effects of R&D tax measure in different countries carried out*
- *Tax incentives used in different countries are difficult to compare as the preconditions (economic situation, level of education etc) as well as existence of other policy measures (e.g. direct subsidies) that may influence the outcome are very different. Hence, there is a lack of comparative instrument-specific estimations.*
- *The Norwegian study on the effects of their R&D tax credit system estimated that for every NOK lost in tax revenue the R&D activity of a firm doubled. In that sense, the Norwegian scheme seems to be successful as an input additionality factor of around two is high compared with what is commonly found in the international literature on the additionality of tax schemes. The study showed that R&D share would have fallen without SkatteFUNN. Based on user surveys, the firms' total costs for applications and final reporting make up around 4% of the total tax deduction. The share for administration costs is 2%, which is very modest.*
- *The negative sides of the Norwegian tax credit are that the tax credit has proven to resemble more closely a subsidy scheme than a tax deduction scheme in practice which, calls for a reconsideration of the suitability of the organisation of SkatteFUNN as a part of the tax system. In addition, because of small firms financing problems, changing the scheme to a subsidy scheme provides a better liquidity effect than the current scheme which could make it more attractive. There has been a fall over the years of the use of SkatteFUNN projects suggests that it may be that the firms exhaust their innovatitive capacity at some point and that there may not be a need for tax incentive on an annual basis. This gives reasons to believe that direct subsidies could be more efficient as granted on the basis of need.The innovations that the scheme mainly stimulates, are not of such a nature that major external effects should be expected (the type of stimulated R&D more of new products for a firm and not for market or production process). The majority of accountants believe that it is difficult to control whether the sums specified are actually spent on R&D. The most difficult aspect is whether the specified man-hours are realistic.*
- *The Netherlands survey on the effects of the R&D employees' wage tax reduction incentive shows that for every € lost in tax revenue a firm invests € 0.72 in addition. Users' additional R&D expenditure per euro WBSO exceeds the costs directly attributable to the implementation of the regulation, such as tax expenditures (1€), execution costs for tax authorities (0.02 €) and the administrative burden for users (0.07€). The overall administrative burden is therefore around 9% of the subsidy. The positive side of the WBSO is that more than 50% of the user dare to tackle R&D projects with a higher risk profile, perform R&D projects faster, plan R&D activities better, tend to keep R&D out of harm's way in the event of spending cuts and perform more R&D internally and contract less out. In addition, WBSO users achieve higher new product sales because of the increase in their R&D expenditure, and ultimately also see growth in their gross production. By benefiting from a cut in the wage costs, companies are able to reduce quickly, significantly and automatically the cost of research.*
- *From the somewhat negative side, the WBSO shows a wage effect of the R&D tax incentives program. Part of the R&D tax credits get transmitted into higher R&D wages because of inelastic labor supply, search costs for scientists and engineers, incentives given to R&D*

employees or bargaining power of R&D employees. The efficiency of the R&D tax incentive program could be enhanced if the wage effect could be avoided.

- *The Australian R&D tax concession showed one of the strongest impacts to the speed of the projects. This has strong commercial implications, because speed-to-market is a critical competency for successful new product development. Also the R&D Tax Concession had strong impacts (greater than 60% agreement) on behaviour including enhanced commitment to R&D, changes to R&D management, changes to business strategy and encouraging new collaboration with companies. The R&D Tax Concession also had a high impact (greater than 50%) on product commercialization, new collaboration with companies and the encouragement of new collaboration with universities. Although a trend analysis suggests a strong correlation between the availability of the R&D tax concession in Australia and the steady increase in business enterprise R&D, some caution is needed in imputing causation. The growth may have been driven by the internationalisation of the Australian economy in the 1980s and the resulting need for trade exposed companies to innovate to be competitive, as opposed to the effects of the Tax Concession.*

- *A study on Canadian scientific research and experimental development (SR&ED) tax credit system shows that the positive economic benefits associated with the SR&ED tax credit are derived from the spillovers that occur when the benefits of SR&ED extend beyond the performers themselves to other firms and sectors of the economy. These spillovers amount to about 46 cents per dollar of tax expenditure and more than offset the costs of the credit. Thus the SR&ED tax credit creates a gross economic gain of $1.11 for every dollar spent on it, and a net economic gain of 11 cents per dollar.*

- *In a survey studying the UK tax incentive over a third of participants said that R&D tax credits had enabled them to take on projects that needed a longer time to pay off. A quarter said that tax credits had enabled them to take on more risky R&D projects. One in seven claimants felt that the R&D tax credit had either enabled them to attract R&D projects from abroad or prevented R&D projects from migrating to overseas facilities.*

- *The Belgian R&D tax incentive turned out to be rather unsuccessful and was abolished in 2008. The evaluation study identified that many firms do not use the different measures because the associated administrative cost is too high compared to the potential benefit. The procedure to receive support is time-consuming, bureaucratic and lacking in transparency, while the aid itself is too unsubstantial. Firms have called for a simple, transparent and "user-friendly" system. Second, because R&D is a long-term process, any kind of government support should be available to the firm for many years, in a predictable and stable manner. Third, the present incremental system in Belgium was described by all firms as too small to influence significantly the cost of R&D activities.*

- *The reviewed studies show that the most relevant R&D location considerations are market size, quality of R&D personnel and labour market flexibility, quality of scientific institutions, legal framework and other non-tax conditions.*

- *There is very little evidence that R&D tax incentives play a significant role on the R&D location of multinational enterprises. Furthermore, pinpointing the most relevant tax considerations that drive the R&D location would be highly ambiguous. In addition, there is no reliable evidence that the R&D tax incentives have attracted R&D activities in high R&D performing countries or impact the R&D location decisions of multinational enterprise substantially.*

3.1 *Overview of empirical literature*

Corporate taxes exert a variety of effects on business behaviour. Empirical evidence assesses the magnitude of these behavioural margins of taxation. By reviewing and using existing empirical evidence, de Mooij and Ederveen[41] have computed for five decision margins the semi-elasticity[42] of the total corporate tax base. They suggest that empirical studies on profit shifting yield the largest tax base elasticities[43]. Also, studies on international investment responses yield substantial effects, both via marginal investments and especially via discrete location decisions. A few studies suggest that distortions on legal form might be substantial too. The reported semi-elasticity for financial leverage is relatively small. The five responses to tax cannot be simply added since they depend on different tax measures. If the different tax measures would all increase by 1%-point and we ignore interactions between responses, we would arrive at an aggregate effect on the tax base of -3.1.

The relatively large elasticity of profit shifting may explain why countries engage in fierce competition with their statutory tax rates in order to attract multinational profits. Indeed, there is a steady decline in these rates over the last few decades. Moreover, the large investment responses may explain why governments engage in tax competition for mobile capital. Especially average effective tax rates[44] seem to have been falling over the last decade, which is well understood by the large elasticity of discrete locations. From a normative perspective, the outcomes provide an argument for a neutral tax treatment of incomes earned in different legal forms. Moreover, they offer an argument in favour of tax harmonisation if governments would seek to minimize fiscal spillovers[45] via profit shifting and international investment distortions. As long as this harmonisation is not achieved, they rationalize a country's policy of corporate tax rate reduction, possibly combined with base broadening or shifting to other taxes[46].

It is important to note, that most surveys do not take into account the spillover effects of R&D spending and crowding out effects[47] of government support. This is simply because these effects are very complex and almost immeasurable.

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[41] de Mooij, R. A., S. Ederveen (2008): „Corporate Tax Elasticities. A Reader's Guide to Empirical Findings. Working Paper 08/22. Oxford University Centre For Business Taxation.

[42] Semi-elasticity compares a level change in one variable with a percentage change of the second variable. In R&D spending context, the level change of a tax rate is compared with a percentage change of R&D spending, investments, wages etc.

[43] Elasticity is the ratio of the percent change in one variable to the percent change in another variable. It is a tool for measuring the responsiveness of a function to changes in parameters in a relative way. Commonly analyzed are elasticity of substitution, price and wealth.

[44] Effective tax rate refers to the actual rate, the rate existing in fact. It is the amount of tax an individual or firm pays when all other government tax offsets or payments are applied, divided by the tax base (total income or spending). Both, average (the tax ratio) and marginal (the tax rate on the last unit of money) tax rates can be expressed as effective tax rates.

[45] Spillover (or externality) of an economic transaction is an impact on a party that is not directly involved in the transaction. In such a case, prices do not reflect the full costs or benefits in production or consumption of a product or service. This impact can be positive or negative. In the context of R&D spending, innovations and scientific breakthroughs are a good example of a positive spillover, since the beneficiary is not only the firm but potentially, other firms and consumers.

[46] de Mooij, R. A., S. Ederveen (2008): „Corporate Tax Elasticities. A Reader's Guide to Empirical Findings. Working Paper 08/22. Oxford University Centre For Business Taxation.

[47] Crowding out is any reduction in private consumption or investment that occurs because of an increase in government spending. If the increase in government spending is financed by a tax increase, the tax increase would tend to reduce private consumption. If instead the increase in government spending is not

Hall and van Reenen, using a sample of studies, give a general conclusion, that the social revenue of the tax incentives is equal to the social cost (tax money put to best use) or to put it in another way, one unit of money spent on the tax incentive brings one unit of money spent on R&D[48]. A similar conclusion is given by Bloom et al[49], who, using a panel of OECD countries, found that R&D spending reacts to its own user-cost[50] change with elasticity around unity. Since there is a significant variance over time and between countries, the fiscal incentives are effective. 10% decline in R&D user-cost has a 1% positive short-run effect and a little under 10% positive long-run effect on R&D spending.

Guellec and van Pottelsberghe[51] found that both fiscal incentives and direct subsidies stimulate private R&D investments, at least in the short run. In the longer run, direct subsidies are more effective than fiscal incentives. This is probably so because direct subsidies lead firms to launch new projects, whereas fiscal incentives mainly induce firms to accelerate ongoing projects. Apart from this principal result, three features seem to differentiate the effectiveness of these policies across countries.

First, countries that provide a level of subsidies that is too low or too high stimulate private R&D less than countries with an intermediate level of subsidisation. Indeed, the returns to government financed R&D seem to have an inverted U-shape, increasing up to a subsidisation rate of about 15 per cent, and decreasing afterwards. Over a level of 30 per cent, additional public money is likely to be substituted for private R&D. Second, countries with more stable fiscal and subsidisation policies are more likely to be effective than countries with less stable policies. Third, the two policy tools are substitutes, which implies, that the increased use of one of them reduces the effectiveness of the other.

The major results of another study conducted by Guellec and van Pottelsberghe[52] are the following: direct government funding of R&D performed by firms has a positive effect on business financed R&D (except if the funding is targeted towards defence activities); tax incentives have an immediate and positive effect on business-financed R&D; direct funding as well as tax incentives are more effective when they are stable over time: firms do not invest in additional R&D if they are uncertain of the durability of the government support. Direct government funding and R&D tax incentives are substitutes: increased intensity of one reduces the effect of the other on business R&D. The stimulating effect of government funding varies with respect to its generosity: it increases up to a certain threshold (about 10% of business R&D) and then decreases beyond. Defence research performed in public laboratories and universities crowds out private R&D. Civilian public research is neutral for business R&D.

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accompanied by a tax increase, government borrowing to finance the increased government spending would increase interest rates, leading to a reduction in private investment.

48 Hall, B. and J. van Reenen (2000): „How Effective Are Fiscal Incentives for R&D? A Review of the Evidence." Research Policy 29.

49 Bloom, N., R. Griffith, J. van Reenen (2002): „Do R&D tax credits work? Evidence from a panel of countries 1979–1997." Elsevier. Journal of Public Economics, 85.

50 User-cost (of R&D spending) is the change in the value of an asset to the owner, in this case, the R&D spending. The way that R&D incentives work, is by reducing the user-cost of the R&D spending, meaning that the government, directly or indirectly, participates in the spending, making it cheaper for the firm.

51 Guellec, D., B. van Pottelsberghe (1999): „Does Government Support Stimulate Private R&D?" OECD Economic Studies, No. 29, Paris.

52 Guellec, D., B. van Pottelsberghe (2000): „The Impact of Public R&D Expenditure on Business R&D." STI Working Paper 2000/4, OECD, Paris.

3.2 Overview of R&D tax instruments used in different countries

As previous analysis showed R&D tax measures are introduced because of high risk of R&D activity companies under invest in R&D (the public returns of R&D investment exceed those of the private return). However, as R&D investments are estimated to generate large spill-over effects to society and R&D tax incentives increase the private rate of return of the R&D investment by reducing the company's R&D costs, these measures are undertaken by governments.

Direct subsidies are an alternative widely used method for promoting R&D. These can be in the form of grants, government contracts or public procurements. Usually, subsidies and tax incentives are used together, because direct subsidies are a tool for the government to channel the private R&D spending in which ever direction they feel it to be necessary. Tax incentives are used to promote the R&D spending without interfering with its nature.

Most of the R&D tax incentives used by different countries aim at reducing corporate income tax liability of the company incurring R&D expenses. The exact measures can be volume-based, incremental, provide full or partial tax holidays or be combinations of the aforementioned. In addition, various differences exist in terms of the conditions for the eligibility of decreasing the corporate income tax liability of the company such as eligible expenditures, seeking for prior approval to the R&D projects from the government, territorialization issues etc.

There may also be variations to the target sectors (e.g. biotech, IT) or differences to volumes of tax incentives as per the size of the companies (aimed at SME-s or larger companies). In broad, the tax measures used in different countries can be divided into two groups: measures that are dependent on the current volume of the R&D expenditure and measures that are aimed at increasing the R&D. Expenses that qualify for the R&D tax incentives vary country-by-country as well. However, in the EU most of the R&D expenditure definitions follow or are moving in the direction of the definitions provided in the Frascati Manual[53].

In addition, the tax measures can also be aimed at either reducing corporate income tax liability directly or decreasing the overall tax cost of the company (or even the individual) by reducing the taxes on labour. Different countries use different definitions for R&D employees' to qualify under the R&D tax incentive. The aforementioned issues are also touched upon in this subchapter.

3.2.1 Corporate income tax incentives

Most of the investigated countries provide for volume based incentives for R&D expenditure. There are also several countries that use incremental incentives or the combination of both. In addition there may be several ceiling set to different incentives used. The main corporate tax incentives used by countries to promote R&D activities are enhanced R&D expenditure deduction from taxable income (also named as tax concession or tax allowance), tax credit and tax holidays. Below we have outlined the core elements of corporate tax incentives we have identified at the course of country policy screening.

[53] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition.

3.2.1.1 Volume based incentives

- Enhanced deduction

There are countries that provide for a more than 100% deduction of R&D expenditure reducing the company's taxable income (income tax base) and thus the CIT liability.
E.g. in UK R&D expenditure can be deducted by 130% and Small and Medium Sized companies can deduct 175% of R&D expenditure where the expenditure is capital in nature[54] (in UK this incentive is often referred to as research credit). In India a deduction of 150% of scientific research expenditure incurred (excluding expenditure on cost of land or building) is available on in-house research and development facility[55]. In case of R&D work outsourced to an Indian company the deduction is 125%[56]. In China 150% tax deduction is also available on qualified R&D expenses incurred during the current year, if such R&D expenses do not give rise to the formation of intangible assets[57]. Singapore also provides for a 150% deduction of actual expenditure on R&D carried out in Singapore[58]. Companies in Malaysia may deduct up to 200% of the eligible R&D expenditure against their business income. The R&D activities must be carried out in Malaysia for the benefit of the Malaysian operations[59]. Thailand also offers 200% deduction of R&D expenditure paid to the above government or private agencies, including expenditure on R&D conducted internally. Australia allows for 125% of R&D expenditure deduction for companies that can be claimed against taxable income if the annual R&D expenditures exceeds AUD 20,000[60] (often referred to as tax concession as well[61]).
In Austria an allowance of 125 % is granted based on the costs related to certain research and experimental activities.

- Tax credit

Several countries provide for tax credit on R&D expenditure that is dependent on the volume of R&D expenditure. Tax credit is applied by directly deducting the creditable amount (a % of R&D expenditure) from the company's income tax liability to reduce the amount of tax to be paid. Tax credit can be refundable or non-refundable. Refundable tax credits can reduce the tax owed below zero, and result in a net payment to the taxpayer beyond their own payments into the tax system. A non-refundable tax credit cannot reduce the tax owed below zero, and hence cannot cause a taxpayer to receive a refund in excess of their payments into the tax system. Some of the countries apply ceilings or thresholds on the creditable amounts.

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[54] KPMG LLP (UK) (2008): „Investment in the UK. The corporate tax regime", https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/Investment%20in%20the%20UK%20-%20CT%20regime%202008%20Feb%2008.pdf
[55] KPMG in India (2008): „Investing in India", https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/Investing%20in%20India.pdf
[56] KPMG (2008): „R&D incentives and services – adding value across ASPAC" , http://www.kpmg.com.au/Portals/0/ASPAC_TaxR&D_SummaryBrochure.pdf
[57] Ibid.
[58] Ibid.
[59] Ibid.
[60] Ibid.
[61] Expert Group on R&D Tax Incentives Evaluation (2008): "Comparing Practices in R&D Tax Incentives Evaluation", http://ec.europa.eu/invest-in-research/pdf/download_en/rd_tax_incentives_expert_group_report2008_rtd_final1.pdf pg 45.

Canada offers a R&D tax credit of 35% of up to $ 2 million and 20% on any excess[62]. Ireland also applies R&D tax credit of 20% in excess of baseline expenditure. Japan offers 10%-12% of tax credit of R&D expenditure with the maximum creditable amount of 30% of the annual corporate tax liability[63]. In South Korea 7% of the purchase price of the qualifying R&D equipment can be used to offset against corporate tax liabilities. In addition, expenses incurred by a R&D centre of a company engaged in a business can be eligible for a tax credit if they fall under the scope provided by relevant laws. The amount of the tax credit for small and medium sized companies is 15 % of the eligible expense amount. For non- small and medium sized companies, the tax credit is 6 % of the eligible expense amount in maximum. A Korean enterprise may opt for incremental incentive instead of tax credit (please see below). [64] Tax credit of 30% is also available in Taiwan. Tax credit incentives in Malta are provided for on a project basis and need prior approval. Different rates apply on a project and company size basis, ranging from 35%-75% of the eligible costs.[65]. Australia is considering the implementation of a R&D tax credit system of 45% refundable tax credit to firms with a turnover of less than $20 million per annum and a 40% tax credit to firms with a turnover of $20 million or more per annum instead of current R&D tax concession to be implemented in 2010-2011[66]. France offers research tax credit of 30% on first 100 million euro as of 2008. As an alternative for enhanced deduction, Austria provides for a 8% tax credit. Norway offers a general tax credit of 18% and a higher credit of 20% for small companies.

- Lower income tax rate

There are several jurisdictions that also exempt R&D companies from corporate income tax (offer tax holidays) or considerably lower the applicable tax rate.

In the Republic of Korea, R&D companies located in foreign investment zones are exempt form national corporate income tax for first 3 or 5 years and tax liability is reduced to 50% for the following 2 years. Local corporate taxes may be applied and there are several conditions in terms of the foreign investment volume as well as number and qualification of the employees [67]. In India, income tax holiday for the first 5 years of operations is granted for 100% of profits, for next 5 years of operations – 50 % of profits and 5 years of operations – 50% of profits (as credited to specified reserve). The incentive is available for companies engaged in specific

[62] KPMG LLP (Canada) (2008): „Tax Facts 2008-2009", https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/2008-2009%20Tax%20Facts%20-%20Canada.pdf

[63] KPMG Tax Corporation (2008): „Taxation in Japan 2008", https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/Tax%20Facts%20-%20Japan%202008.pdf

[64]. KPMG (2008): „R&D incentives and services – adding value across ASPAC" , http://www.kpmg.com.au/Portals/0/ASPAC_TaxR&D_SummaryBrochure.pdf

[65] Malta enterprise (2009): „INCENTIVE GUIDELINES." Assistance for Research and Development and Innovation, http://support.maltaenterprise.com/doc/ERDF/RD/ERDF.RD.1.pdf

[66] AusIndustry, http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxCredit/Pages/RDTaxCredit-FrequentlyAskedQuestions.aspx

[67]KPMG in Korea (2007): „Investment in Korea", https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/Investment%20in%20Korea%202007.pdf

sectors (e.g. pharmaceuticals) and should be setup in a “Special Economic Zone”[68]. The corporate income tax rate for Regional Operating Headquarters of foreign companies registered in the Philippines and engaged in R&D activities is reduced from 35% to 10%[69].

Any new undertaking or new business carried out by a company in Sri Lanka that invests not less than LKR 2 million in R&D and the investment is made within 1 year from the commencement of the undertaking benefits from profits and income exemption (other than the sale of capital assets) for a period of 5 years (3 years if activities commence 1 April 2008). Upon the expiration of the initial exemption period, the company will be liable to income tax at the rate of 15 percent for every year of assessment thereafter[70]. In Thailand certain R&D companies are also exempt from corporate income tax for 8 years and extended for further 5 years of 50% exemption if the company engaged in biotechnology is located in a science and technology park[71]. Vietnamese R&D companies also benefit from reduced corporate income tax regime.

In Malta reduced tax rates applied to:

(a) newly formed companies taxable at a reduced rate of 5% on profits up to MTL 25,000 (EUR 10,733 = EEK 170,000) per employee; and

(b) existing companies which will be taxable at a reduced rate of 10% on profits up to MTL 28,000 (EUR 12,020 = EEK 188,000) per employee.

However, these incentives were regarded as non-compatible with state aid rules and abolished as of 2009.

- Intellectual property related incentives

Intellectual property related incentives have become increasingly popular during the past years. There are various ways that the countries have adopted such incentives.

In Singapore tax exemption of foreign-sourced royalties or interest received is available for 5 years. The foreign-sourced royalties and foreign-sourced interest must be used to fund R&D activities and the resulting intellectual property must be owned and commercialized by the approved Singapore-based company [72].

The Luxembourg intellectual property (IP) tax regime is effective as from January 1, 2008. The hallmark of the IP tax regime is an 80 percent exemption on royalties and capital gains deriving from many types of IP. Companies benefiting from the new regime would be subject to an effective tax rate as low as 5.72 percent on qualifying “net” IP income (i.e., gross IP income reduced by “directly related” expenses, depreciations and write-downs)[73.]

A special regime, referred to as the ‘patents box’, was introduced in the Netherlands as from 1 January 2007 for income from self-produced patented intangible assets. The regime does not

[68] KPMG (2008): „R&D incentives and services – adding value across ASPAC” , http://www.kpmg.com.au/Portals/0/ASPAC_TaxR&D_SummaryBrochure.pdf
[69] Ibid.
[70] KPMG (2008): „R&D incentives and services – adding value across ASPAC”, http://www.kpmg.com.au/Portals/0/ASPAC_TaxR&D_SummaryBrochure.pdf.
[71] Ibid.
[72] Ibid.
[73] http://www.bnai.com/templates/maincontent.aspx?cat=304&obj=&country=1#a0b9d0g7w2

apply to trade marks and logos but has been extended, albeit subject to a benefit cap, as from 2008 to cover intangible assets generally derived from R&D that benefit from the R&D incentive regime for payroll tax. Under the patents box regime, the income attributable to qualifying assets in excess of development costs, with a maximum of four times those costs, benefits from an effective tax rate of approximately 10%[74].

Belgian patent regime is applicable as of 1st of January 2008 which allows companies to deduct 80% of patent income from their tax base. Patent income will face a maximum effective tax rate of 6.8% instead of general CIT of 33.99%. The deduction only applies for patent or extended patent certificates and thus not for 'intangible property' such as trademarks, trade names, designs, know-how or models[75.]

- Donations to R&D institutions

Some countries also provide preferential treatment of donations to R&D institutions or partnerships between businesses and research institutions as higher spillover effects are expected from science to business in this case. However, there is no empirical evidence on such effects76.

In Austria, donations in cash or in kind from a business enterprise for R&D purposes that are made to a number of listed organizations and institutions (universities, national museums, the Austrian federal states and communities, the Austrian academy of science, societies operating on a non-profit basis under certain circumstances etc) can be deducted from the income tax base. The deductible donations are limited to 10% of the profit of the preceding fiscal year of the donor77. Similar incentive is available in Denmark whereby amounts paid to a public R&D institutions (universities, hospitals, foreign public research institutions if member of International Association of Universities, foreign institutions within the EU or the EEA which are under public administration) are eligible for 150% deduction78. The Norwegian tax credit has a general ceiling of up to NOK 4 million, however, if the project is carried out jointly with an approved R&D institution, the ceiling is raised to NOK 8 million79.

3.2.1.2 Incremental incentives

Several countries use incremental incentives that are aimed at providing enhanced tax credit or enhanced deduction based on the increase in R&D expenditure. Incremental incentives are generally used as complementary policy measures to volume based R&D tax incentives.

In addition to regular tax credit (please see above), Japan offers tax credit of 5% on incremental R&D expenditure. If R&D expenditure is higher than 10% of the average sales proceeds, the

[74] KPMG N:V. and KPMG Meijburg & Co (2008): „Investment in the Netherlands", https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/Investment%20In%20-%20Netherlands%202008.pdf

[75]Dirk Van Stappen, Andres Delanoy and Yves de Groote (2007): "New Patent Taxation Regime: Patent Income Deduction Creates Opportunities for Innovative Companies" INTERNATIONAL TRANSFER PRICING JOURNAL, SEPTEMBER/OCTOBER.

[76] Czarnitzki, D. (2009): "Tax incentives for industry –science R&D collaboration. Draft version.

[77] IBFD (2004): "TAX TREATMENT OF RESEARCH & DEVELOPMENT EXPENSES"

[78] Ibid.

[79] Expert Group on R&D Tax Incentives Evaluation (2008): "Comparing Practices in R&D Tax Incentives Evaluation", http://ec.europa.eu/invest-in-research/pdf/download_en/rd_tax_incentives_expert_group_report2008_rtd_final1.pdf, pg 54

R&D tax credit can be increased further with the maximum creditable amount of 30% of the annual corporate tax liability. In addition to the tax concession Australia offers an R&D incremental (175% premium) tax concession for those companies increasing their R&D expenditure over the 3 preceding years base and who have a three-year history of registering and claiming the 125% tax concession, or of receiving grants for R&D projects from certain programs80

French incremental tax credit amounts to 5% on amount above increment over 2 past years in addition to regular volume based incentive81. In addition to regular tax credit, Taiwan applies 20% incremental tax credit. New Zealand offers a tax credit of 15% of eligible expenditure. A 25% incremental R&D tax credit is available in Ireland82.

In Singapore a company that incurs incremental qualifying R&D expenditure during the years of assessment 2010 to 2016 can utilize its R&D tax allowance during the same period, up to the amount of incremental R&D expenditure or the amount of assessable income for that year of assessment, whichever is lower 83.In Belgium profits were exempt up to an amount of EUR 12,780 (tax year 2006, assessment year 2007) per supplementary staff member hired for scientific research. For highly qualified employees appointed to carry out scientific research, the exemption was increased to EUR 25,570 (tax year 2006, assessment year 2007). A highly qualified employee is defined as an individual who has a PhD and has at least10 years of working experience (incentive was abolished as of 2008).

Instead of a tax credit a Korean small and medium sized company may opt for incremental tax credit which is computed as 50% (for big and medium sized companies the incremental tax credit is 40%) of the eligible expense amount in excess of annual average for the past four years[84].

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[80] AusIndustry, http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxConcession/Documents/Fact%20Sheets/RD%20Tax%20Concessions%20Sep09.pdf pg 1

[81] [81] Expert Group on R&D Tax Incentives Evaluation (2008): "Comparing Practices in R&D Tax Incentives Evaluation", http://ec.europa.eu/invest-in-research/pdf/download_en/rd_tax_incentives_expert_group_report2008_rtd_final1.pdf, pg 54

[82] Hardy, K. (2009): Tax Relief for R&D? Yes: You can Credit it http://www.kpmg.ie/services/tax/R&D/article3.htm

[83] KPMG Singapore (2009): „Asia-Pacific Taxation", https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/Investment%20In%20-%20Singapore%202009.pdf

[84]. KPMG (2008): „R&D incentives and services – adding value across ASPAC", http://www.kpmg.com.au/Portals/0/ASPAC_TaxR&D_SummaryBrochure.pdf

3.2.2 Wage tax incentives

Labour tax incentives have not been identified to be as popular as the corporate income tax incentives among different countries. However, countries use them in order to ease the tax burden on R&D labour mostly driven by the fact that R&D activities are rather labour intensive[85]. In addition, labour tax incentives are generally expected to increase the number of R&D workers. Incentives under wage tax legislation are available in Belgium, France, and the Netherlands.

- Wage tax incentives

In Belgium only 25% of the wage withholding tax for scientific researchers is required to be paid, to the tax authorities, by the research institutes and R&D companies. Reduction of payment obligation concerning wage withholding tax and general social security premiums is available in the Netherlands. The reduction amounts to 42% of the first EUR 110,000 of the total salaries of such employees and 14% on any excess (for 2004). The incentive may be increased to 60% of the first EUR 110,000 of the total salaries of such employees and 14% on any excess (for 2004). The maximum annual reduction per employer is EUR 7,941,154 (2004).

- Exemption from social security tax

In France new innovative companies that realize R&D projects benefit from a total exemption on social security contributions paid by employers with respect to compensation and other benefits paid to eligible employees participating to the research project.

- Personal income tax

Some countries also have aimed at reducing personal income tax liability of researchers. Korea offers 100% income tax exemption for the first 5 subsequent years to foreign engineers working for R&D centers in Korea. The engineers should have either (i) work experience in the same field for 5 or more years or (ii) work experience in the same field for 3 or more years and an academic background equivalent to a bachelor degree or above.[86]

In order to enable Danish businesses to attract foreign knowledge workers, tax provisions were introduced in 1992 offering certain foreign workers and researchers favourable tax treatment while working and living in Denmark. Under this scheme, key employees recruited abroad can obtain a significantly lower tax rate of 25% for a maximum of three years of residence in Denmark. The wages must total at least DKK 57,300 (EEK 114 600) per month after the deduction of Danish labour market supplementary pension contribution, labour market contribution, and special pension contribution.

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[85] COMMISSION OF THE EUROPEAN COMMUNITIES (2002): COMMUNICATION FROM THE COMMISSION. MORE RESEARCH FOR EUROPE. Towards 3% of GDP, http://www.iglortd.org/Content/ERA/Com02_499en.pdf

[86] KPMG (2008): „R&D incentives and services – adding value across ASPAC", http://www.kpmg.com.au/Portals/0/ASPAC_TaxR&D_SummaryBrochure.pdf

3.2.3 Eligibility criterion for the R&D tax incentives

Most of the countries have specific requirements for companies in order to qualify for the R&D incentives. E.g. Australia requires the companies that aim at benefiting from the R&D tax concession to be registered with Innovation Australia[87.], companies in Korea have to be registered in special economic zones. However, generally countries provide definitions for the R&D expenditure or R&D employees that are eligible for the benefit in questions. We have outlined the main characteristics of such definitions following the OECD guidelines (Frascati Manual).

In broad the R&D expenditure can be divided into three categories: basic research, applied research and experimental development. Most of the viewed countries follow similar definitions for R&D expenditure.

According to the OECD the classification of R&D personnel should follow the principle that all persons employed directly on R&D should be counted, as well as those providing direct services such as R&D managers, administrators, and clerical staff. Two systems are used by OECD member countries to define and classify persons engaged in R&D - classification by occupation and classification by level of formal qualification.

3.2.3.1 R&D expenditure

It is a general practice that the basis for tax relief related to R&D activities is the direct and indirect expenditure made in connection with R&D activities. According to OECD guidelines[88] three types of R&D may be distinguished:

1 Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

Basic research analyses properties, structures and relationships with a view to formulating and testing hypotheses, theories or laws. The reference to no "particular application *in view*" in the definition of basic research is crucial, as the performer may not know about actual applications when doing the research or responding to survey questionnaires. The results of basic research are not generally sold but are usually published in scientific journals or circulated to interested colleagues. Occasionally, basic research may be "classified" for security reasons.[89]

In basic research, scientists have some freedom to set their own goals. Such research is usually performed in the higher education sector but also to some extent in the government sector. Basic research can be oriented or directed towards some broad fields of general interest, with the explicit goal of a broad range of applications in the future.[90]

One example is the public research programmes on nanotechnology which several countries have decided on. Firms in the private sector may also undertake basic research, with a view to

[87]AusIndustry , http://www.ausindustry.gov.au/InnovationandRandD/RandDTaxConcession/Pages/RDTaxConcession.aspx

[88] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition , p. 30

[89] Ibid, p. 77

[90] Ibid, p. 77

preparing for the next generation of technology. Research on fuel cell technology is a case in point. Such research is basic according to the above definition as it does not have a *particular* use in view. It is defined in the Frascati Manual as “oriented basic research”.[91]

Oriented basic research may be distinguished from pure basic research as follows[92]:

- Pure basic research is carried out for the advancement of knowledge, without seeking long-term economic or social benefits or making any effort to apply the results to practical problems or to transfer the results to sectors responsible for their application.
- Oriented basic research is carried out with the expectation that it will produce a broad base of knowledge likely to form the basis of the solution to recognized or expected, current or future problems or possibilities.

The separate identification of oriented basic research may provide some assistance towards identifying “strategic research”, a broad notion often referred to in policy making[93].

2 Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Applied research is undertaken either to determine possible uses for the findings of basic research or to determine new methods or ways of achieving specific and predetermined objectives. It involves considering the available knowledge and its extension in order to solve particular problems. In the business enterprise sector, the distinction between basic and applied research is often marked by the creation of a new project to explore promising results of a basic research programme. The results of applied research are intended primarily to be valid for a single or limited number of products, operations, methods or systems. Applied research gives operational form to ideas. The knowledge or information derived from it is often patented but may be kept secret. It is recognised that an element of applied research can be described as strategic research, but the lack of an agreed approach in member countries to its separate identification prevents making a recommendation.[94]

3 Experimental development is systematic work, drawing on knowledge gained from research and practical experience that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed.

In the social sciences, experimental development may be defined as the process of translating knowledge gained through research into operational programmes, including demonstration projects undertaken for testing and evaluation purposes. The category has little or no meaning for the humanities.[95]

There are many conceptual and operational problems associated with these categories. They seem to imply a sequence and a separation which rarely exist in reality. The three types of R&D may sometimes be carried out in the same centre by essentially the same staff. Moreover, there may be movement in both directions. When an R&D project is at the applied research/ experimental development stage, for example, some funds may have to be spent on additional

[91] Ibid, p. 77-78
[92] Ibid, p. 78
[93] Frascati Manual (2002): “Proposed Standard Practice for Surveys on Research and Experimental Development”, Organisation for Economic Co-operation and Development, 6th edition, p. 78
[94] Ibid.
[95] Ibid, p. 79

experimental or theoretical work in order to acquire more knowledge of the underlying foundations of relevant phenomena before further progress can be made. Moreover, some research projects may genuinely straddle categories. For instance, study of the variables affecting the educational attainment of children drawn from different social and ethnic groups may involve both basic and applied research.[96]

The following examples illustrate general differences between basic and applied research and experimental development in the natural sciences and engineering and in the social sciences and humanities.[97]

Examples from the natural sciences and engineering[98]:

- The study of a given class of polymerisation reactions under various conditions, of the yield of products and of their chemical and physical properties is basic research. The attempt to optimise one of these reactions with respect to the production of polymers with given physical or mechanical properties (making it of particular utility) is applied research. Experimental development then consists of "scaling up" the process which has been optimised at the laboratory level and investigating and evaluating possible methods of producing the polymer and perhaps articles to be made from it.
- The study of a crystal's absorption of electromagnetic radiation to obtain information on its electron band structure is basic research. The study of the absorption of electromagnetic radiation by this material under varying conditions (for instance temperature, impurities, concentration, etc.) to obtain given properties of radiation detection (sensitivity, rapidity, etc.) is applied research. The preparation of a device using this material to obtain better detectors of radiation than those already existing (in the spectral range considered) is experimental development.
- The determination of the amino acid sequence of an antibody molecule is basic research. Investigations undertaken in an effort to distinguish between antibodies for various diseases is applied research. Experimental development then consists of devising a method for synthesising the antibody for a particular disease on the basis of knowledge of its structure and clinically testing the effectiveness of the synthesised antibody on patients who have agreed to accept experimental advanced treatment.

Examples from the social sciences and humanities[99]:

- Theoretical investigation of the factors determining regional variations in economic growth is basic research; however, such investigation performed for the purpose of developing government policy is applied research. The development of operational models, based upon laws revealed through research and aimed at modifying regional disparities, is experimental development.
- Analysis of the environmental determinants of learning ability is basic research. Analysis of the environmental determinants of learning ability for the purpose of evaluating education programmes designed to compensate for environmental handicaps is applied research. The development of means of determining which educational programme to use for particular classes of children is experimental development.

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[96] Ibid.
[97] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition, p. 78 - 79
[98] Ibid, p. 79-80
[99] Ibid, p.80

- The development of new risk theories is basic research. Investigation of new types of insurance contracts to cover new market risks is applied research. Investigation of new types of savings instruments is applied research. Development of a new method to manage an investment fund is experimental development.
- The study of a hitherto unknown language to establish its structure and grammar is basic research. Analysis of regional or other variations in the use of a language to determine the influence of geographical or social variables on the development of a language is applied research. No meaningful examples of experimental development have been found in the humanities.

In general, the definitions of R&D expenditure in other countries follow the OECD guidelines. In Austria[100], R&D costs are defined as all expenses incurred for the development of inventions, for instance direct labour expenses, cost of materials, energy costs, related interest expenses and depreciation in respect of fixed assets used for the purposes of R&D, but excluding administration and distribution costs. For this purpose, research and development also includes subcontracted research, and approval of tax office is not required. Austrian tax law contains three definitions in relation with R&D expenses, i.e. basic research, applied research and experimental development, which basically follow the Frascati Manual definitions.

In French legislation[101], R&D expenses include:

- expenses on activities having the character of fundamental research. These are the activities that contribute theoretically or experimentally towards solutions for technical problems, work towards the analysis of properties, structures, physical and natural phenomena in view or organize the facts obtained from that analysis by means of explicative schemes and interpretative theories;
- expenses on activities having the character of applied research. These are activities, the purpose of which is to discern the possible applications derived from the results of a fundamental research or to find new solutions to enable the company reach a pre-determined goal;
- expenses on activities having the character of experimental development operations. These activities aimed at combining all the necessary information, by means of prototypes or pilot installations, to provide all the technical elements necessary for decision-making in view of producing new materials, devices, products, process, systems, services or in view of improving them substantially.

In Sweden[102] R&D costs also include all expenses in connection with basic research, applied research and development work. R&D costs include all direct costs such as salaries, wages and other related costs of personnel engaged in R&D activities and the cost of materials and services used in R&D activities. R&D costs also include all indirect costs such as overhead costs related to the R&D activities. Further, the R&D costs include depreciation of equipment and facilities to the extent that they are used for R&D activities and other costs related to R&D activities, such as amortization of patents and licenses.

[100] IBFD (2004): "TAX TREATMENT OF RESEARCH & DEVELOPMENT EXPENSES"; p. 24
[101] Ibid; p. 58
[102] IBFD (2004): "TAX TREATMENT OF RESEARCH & DEVELOPMENT EXPENSES"; p. 171

In United Kingdom[103] the definition of R&D activities/expenses is also based on the “Frascati” definition used by the OECD for the purposes of R&D surveys. Qualifying R&D must be:

- pure research – to acquire new scientific or technical knowledge for its own sake;
- applied research – to gain new information directed at a specific practical objective; or
- development – using scientific or technical knowledge to produce new or improved materials, products or devices.

The United Kingdom also provides a list of activities that are not R&D activities:

- research in the social sciences, arts or humanities, except where it forms an integral part of the R&D;
- quality control routine testing and analysis;
- cosmetic or stylistic alterations to existing products;
- operational research such as management or efficiency studies;
- corrective action regarding breakdowns in commercial production;
- legal and administrative work concerning patent applications, and the protection, sale or licensing of patents;
- the construction, relocation or rearrangement of facilities or equipment which is not to be used wholly and exclusively for R&D activities;
- market research, testing or development, or sales promotion;
- exploring or drilling for minerals, oil or gas;
- scientific and technical information services unless they form part of a larger R&D project;
- routine computer maintenance and software development;
- routine medical care;
- the commercial and financial steps necessary for the marketing, production or distribution of new or improved products or services;
- administration and support services which are not undertaken wholly and exclusively in connection with R&D activities.

Software can qualify as R&D either as the object of the R&D or as the means to achieve the R&D.

In Norway, in order to qualify for an allowance, the R&D activity must be of such a nature that it comes under the definition of R&D which is very similar to that given in the Frascati manual. This entails the allowance being justified with limited and focussed work aimed at generating new knowledge, information or experience that can be regarded as beneficial for the firm in connection with the development of new or better products or processes. Standard product development with no research component is not covered by the scheme.[104]

[103] Ibid; p. 184-185

[104] Translation of chapter 1 of the summary report Å. Cappelen, E. Fjærli, F. Foyn, T. Hægeland, J. Møen, A Raknerud og M. Rybalka, Evaluering av SkatteFUNN, Rapporter 2008/2, Statistics Norway, Oslo.

3.2.3.2 R&D personnel

For the purpose of R&D tax incentives applicable to R&D personnel we have provided the definitions of R&D personnel based on the guidelines of international institutions and practice of other countries.

Based on the Frascati manual[105] it is recognized that R&D inputs are only one part of the input of a nation's human resources to the public welfare; scientific and technical personnel contribute much more to industrial, agricultural and medical progress through their involvement in production, operations, quality control, management, education and other functions.

In general, the view of OECD towards the classification of R&D personnel is that all persons employed directly on R&D should be counted, as well as those providing direct services such as R&D managers, administrators, and clerical staff. Two systems are used by OECD member countries to define and classify persons engaged in R&D - classification by occupation[106] and classification by level of formal qualification[107].

By the ISCO and the Frascati Manual, R&D personnel can be divided into three categories:

1. Researchers

Researchers[108] are defined as professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned. In ISCO-88, researchers are classified in Major Group 2, "Professionals", and in "Research and Development Department Managers" (ISCO-88, 1237).

Managers and administrators engaged in the planning and management of the scientific and technical aspects of a researcher's work also fall into this category. Their rank is usually equal or superior to that of persons directly employed as researchers and they are often former or part-time researchers.

Postgraduate students at the PhD level engaged in R&D should also be considered as researchers. They typically hold basic university degrees (ISCED[109] level 5A) and perform research while working towards the PhD (ISCED level 6).

Researchers, ISCO-88 classes[110]

(sub-major and minor groups):

21 Physical, mathematical and engineering science professionals

211 Physicists, chemists and related professionals

212 Mathematicians, statisticians and related professionals

213 Computing professionals

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[105] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition

[106] Linked to the International Standard Classification of Occupation – ISCO (ILO, 1990)

[107] Based on the International Standard Classification of Education – ISCED (UNESCO, 1997)

[108] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition, p. 93

[109] International Standard Classification of Education (***ISCED***) of the UNESCO

[110] The Measurement of Scientific And Technological Activities. Manual On The Measurement of Human Recouces Devoted To S&T. „Canberra manual", p. 80

214 Architects, engineers and related professionals

22 Life science and health professionals

221 Life science professionals

222 Health professionals (except nursing)

23 Teaching professionals

231 College, university and higher education teaching professionals

24 Other professionals

241 Business professionals

242 Legal professionals

243 Archivists, librarians and related information professionals

244 Social science and related professionals

plus Unit group 1237 Research and development department managers

2. Technicians and equivalent staff

Technicians and equivalent staff [111]are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences or social sciences and humanities. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers. Equivalent staff perform the corresponding R&D tasks under the supervision of researchers in the social sciences and humanities.

In ISCO-88, technicians and equivalent staff are classified in Major Group 3, "Technicians and Associate Professionals", notably in Sub-major Groups 31, "Physical and Engineering Science Associate Professionals", and 32, "Life Science and Health Associate Professionals", and in group 3434, "Statistical, Mathematical and Related Associate Professionals". Their tasks include:

- Carrying out bibliographic searches and selecting relevant material from archives and libraries.
- Preparing computer programmes.
- Carrying out experiments, tests and analyses.
- Preparing materials and equipment for experiments, tests and analyses.
- Recording measurements, making calculations and preparing charts and graphs.
- Carrying out statistical surveys and interviews.

Technicians and equivalent staff, ISCO-88 classes[112]

(sub-major and minor groups):

31 Physical and engineering science associate professionals

[111] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition, p. 94
The Measurement of Scientific And Technological Activities. Manual On The Measurement of Human Recouces Devoted To S&T. „Canberra manual", p. 80

311 Physical and engineering science technicians

312 Computer associate professionals

313 Optical and electronic equipment operators

314 Ship and aircraft controllers and technicians

315 Safety and quality inspectors

32 Life science and health associate professionals

321 Life science technicians and related associate professionals

322 Modern health associate professionals (except nursing)

plus Unit group 3434 Statistical, mathematical and related associate professionals

3. Other supporting staff.

Other supporting staff includes skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects.[113]

Other R&D supporting staff are essentially found in ISCO-88 Major Groups 4, "Clerks"; 6, "Skilled Agricultural and Fishery Workers"; and 8, "Plant and Machine Operators and Assemblers".

311. Included under this heading are all managers and administrators dealing mainly with financial and personnel matters and general administration, insofar as their activities are a direct service to R&D. They are mainly found in ISCO-88 Major Group 2, "Professionals", and Minor Group 343, "Administrative Associate Professionals" (except 3434).

Other supporting staff, ISCO-88 classes[114]

(major groups):

4 Clerks

6 Skilled agricultural and fishery workers

Plant and machine operators and assemblers

Plus Minor group 343 Administrative associate professionals (except Unit group 3434)

1 Legislators, senior officials and managers n.e.c.

OECD has also special guidelines for determining the amount of R&D personnel (head-count). For counting the R&D personnel, FM-93 (paras 289-294) suggests three options:

1. number of persons engaged in R&D at a given date (for instance, end of period);
2. total number of persons engaged in R&D during the (calendar) year;
3. average number of persons engaged in R&D during the (calendar) year.

It is suggested that head-count data could usefully be divided between persons:

[113] Frascati Manual (2002): "Proposed Standard Practice for Surveys on Research and Experimental Development", Organisation for Economic Co-operation and Development, 6th edition, p. 94
[114] The Measurement of Scientific And Technological Activities. Manual On The Measurement of Human Recouces Devoted To S&T. „Canberra manual", p. 81

1. working full-time on R&D (90 per cent or more);
2. working mainly on R&D (50-90 per cent of time);
3. working part-time on R&D (less than 50 per cent of time), with persons working less than 10 per cent on R&D excluded.

3.3 International experience on R&D tax incentives

To the surprise of the working group putting together this report, there have not been that many evaluation studies regarding the effects of R&D tax measure in different countries carried out. However, an overview of the evaluation studies we have identified with some insight from relevant KPMG offices regarding the effects of the R&D tax incentives used is given as follows.

It should be noted that the tax incentives used in different countries are difficult to compare as the preconditions (economic situation, level of education etc) as well as existence of other policy measures (e.g. direct subsidies) that may influence the outcome are very different. Hence, there is a lack of comparative instrument-specific estimations. In addition, it must be stated that the most successful innovators in the EU – Sweden and Finland, are not using tax incentives to promote R&D investment although Finland is planning on introducing these[115].

3.3.1 Norway [116]

SkatteFUNN scheme is a refundable tax credit scheme with a cap on deductions of NOK 4 million (if a cooperation project with R&D institute the cap is raised to NOK 8 million) and the project plan has to be approved by the Research Council of Norway (the SkatteFUNN secretariat).

The main purpose of introducing the SkatteFUNN tax credit system was to rise R&D expenditure in Norway to 3% of GDP, of which industry should finance 2% by 2010. This meant more than one per cent increase from the industry side.

The Norwegian evaluation study, first of all poses a very intriguing question: “how can we gain access to the international knowledge base and ensure the effective transfer of technology for domestic use and further development?”

The evaluation analysis found that firms that received support through SkatteFUNN have more growth in their R&D investments than other firms. Firms that previously invested less than the cap (NOK 4 million) have increased their R&D investments more than those previously above the ceiling. Firms that previously did not invest in R&D are more likely to start doing so since SkatteFUNN was introduced. The estimated input additionality derives mainly from firms that did not invest very much in R&D before SkatteFUNN was introduced. The additionality appears to be strongest in small firms, firms in non-central areas, firms in which the employees have a relatively low level of education and firms in industries that are traditionally not research intensive. The results must be viewed in context with the fact that these firms are not involved in R&D activities to any great extent, and that it is these types of firms that have been given an incentive to increase their R&D investments through the SkatteFUNN scheme.

The estimates of how much extra R&D that SkatteFUNN triggers per NOK in lost tax revenue varies between 1.3 and 2.9, which is high in international comparisons. The analysis estimates that on average R&D activity doubled for every NOK tax. However, the authors warn that not too much emphasis should be placed on the quantitative results of the analysis.

[115]http://www.tekes.fi/en/community/News/482/News/1344?name=Finland+plans+tax+incentives+for+companies+R%26D+activities

[116] Based on Evaluatin of the SKATTEfunn Tax Credit to Support R&D (a translation of chapter 1 of the summary report Å. Cappelen, E. Fjærli, F. Foyn, T. Hægeland, J. Møen, A Raknerudog M. Rybalka, Evaluering av SkatteFUNN, Rapporter 2008/2, Statistics Norway, Oslo.)

It is shown that the scheme contributes to the rate of innovation in the firms, however, does not contribute to innovative products to the market or firms' patenting. Also, SkatteFUNN projects have a positive effect on productivity and productivity growth, to about the same extent as other R&D activity. However, on average, the business profitability increases moderately as a result of SkatteFUNN.

The increased R&D work that the SkatteFUNN scheme leads to is shown to have the greatest positive effect in R&D-intensive industries and counties. This can imply positive external effects. However, the innovations that the scheme mainly stimulates, are not of such a nature that major external effects should be expected (the type of stimulated R&D more of new products for a firm and not for market or production process).

It is also worth noting that the study did not find a significant positive return on subsidies from the Research Council of Norway. However, the criteria for allocations of funds are linked to research-related results that do not necessarily correspond with a firm's economic returns.

SkatteFUNN polls results in firms with no or limited previous R&D activity initiating such activity show that a very high percentage of firms claim to have increased their focus on R&D as a result of SkatteFUNN and that the scheme has resulted in the firms having closer contact with universities, university colleges, research institutes, customers and suppliers.

The evaluation results show that firms with limited experience of R&D at the start-up of a SkatteFUNN project have changed their R&D behaviour most. Whether the firms have the determination, ability and resources to succeed with innovation, is vital to what effect public policy instruments have on the R&D behaviour.

One of the goals of SkatteFUNN was to increase R&D collaboration. In 2006, 19 per cent of the SkatteFUNN firms reported to the tax authorities that they had deductions for the purchase of R&D services from approved R&D institutes. The firms believe that these collaborative relations are important for the execution and success of projects. The results show that the probability of joint research projects with universities only increases slightly. Also, the input additionality effect of collaboration projects is slightly less than for R&D activities carried out solely in-house. There are indications that SkatteFUNN only stimulates collaboration between firms to a limited extent.

Having a SkatteFUNN project increases the likelihood of receiving direct R&D subsidies from the research council in the same year, but there are no indications of long-term effects. With regard to the individual firm, it therefore seems that direct project support and SkatteFUNN subsidies are complementary and support each other. After the introduction of SkatteFUNN, firms that had applied for direct support were much more likely to reapply. It therefore seems that SkatteFUNN has meant greater persistence in the use of other policy instruments.

The study also investigated to which extent are SkatteFUNN projects tax motivated. The majority of accountants believe that it is difficult to control whether the sums specified are actually spent on R&D. The most difficult aspect is whether the specified man-hours are realistic. Also the Tax Authorities regarded around 60 per cent of the project accounts (timesheets) to be of poor quality. A comparison of the usable parts of these timesheets with time spent on R&D in firms from the R&D surveys shows that times recorded per employee are between 50 and 100 per cent higher in the timesheets than what the difference in the average time spent on R&D between firms with and firms without SkatteFUNN would imply (based on the R&D surveys' figures for firms with positive R&D). This could be an indication that the time spent on SkatteFUNN R&D is overestimated in the project accounts.

Some firms have extremely high tax deductions, high budgeted SkatteFUNN costs measured per employee and unreasonably high personnel costs measured in relation to the firm's actual salary costs. However, it is difficult to ascertain an accurate picture of the scope of the inflating of R&D costs, beyond that it seems that the findings are particularly driven by the 5 to 10 per cent of the firms with the highest values. These firms are generally small, with less than 10 employees. Small firms with one employee will often be sole proprietor limited companies with an active owner, and are therefore well suited to assess tax-motivated disposals since other explanations such as the demand for expensive well-educated personnel is eliminated. Among these firms, we find that both the tax deduction and budgeted SkatteFUNN costs are often very high compared with the firm's actual salary payments (and accounting salary costs). This may indicate that tax adjustments are made via the reporting of inflated man-hours in SkatteFUNN, or that the hourly rate of pay used does not correspond with actual salary. With regard to the small sole proprietorships, where there is greater concordance between actual salary payments and budgeted personnel costs, the salary paid can on the other hand be very high, often despite a poor financial situation in terms of the operating profit. In similar firms with no SkatteFUNN activities, the operating profit adjusted for own salary is higher, while the actual salary is lower. This may indicate that tax adjustments are made via forcing up the calculation basis for the hourly rate of pay.

Comments from the firms show that a relatively high percentage is not familiar enough with the regulations. The firms would like it to be made clearer what is required for the project to be approved, i.e. more predictability. Numerous firms have therefore used consultants with extensive knowledge of SkatteFUNN to formulate applications, making it easier to get them approved. A number of firms also think that the actual process, currently involving three government bodies, needs to be simplified. With regard to approval of the professional content, the SkatteFUNN secretariat has the final word and receives the most criticism. A high number of firms complain about the detailed project accounts that are required by the Tax Administration. This is obviously not presented clearly enough in the guidelines to the scheme. A standard template has now been introduced for recording man-hours, and a standard accounts template is being prepared. These templates will improve the possibilities for controls in the scheme. Many firms are also critical to what they characterize as the Tax Administration's retrospective review.

Based on user surveys, the firms' total costs for applications and final reporting NOK 47 million (in 2006), assuming an hourly rate of NOK 365 and that consultancy costs are not included. This makes up around 4 per cent of the total tax deduction. Total costs for the firms and the public sector in 2006 were approximately NOK 75 million. This accounts for almost 7 per cent of the total tax relief in 2006. The share for administration costs is 2 per cent, which is very modest.

The study found that the SkatteFUNN scheme has a rather large and positive effect on industry's R&D activity. An input additionality factor of around two is high compared with what is commonly found in the international literature on the additionality of tax schemes. Even if the lowest additionality estimate of 1.3 should have been used and not 2, the R&D share would have fallen without SkatteFUNN.

Since 2003 when the scheme was made available to all firms, the number of applications has not increased, but fallen. Since 2004, both budgeted R&D expenses reported to the Research Council of Norway and actual R&D expenses reported to the Directorate of Taxes have fallen somewhat. The tax expenses have not increased either, but are slightly lower in nominal terms both in 2005 and 2006 compared with 2003 and 2004 despite the fact that the firms are not dissatisfied with the scheme and it is well known. The study suggests that there may have been a stored set of innovation ideas in the firms that the scheme triggered in 2002 and 2003, and that the subsequent fall in popularity primarily entails reaching a level for how much a scheme of this nature can prompt new projects on an annual basis.

The R&D that SkatteFUNN mainly leads to does not appear to have significant effects externally, nor does it entail innovations of the type that could be envisaged as having the most external effects. Most part of the total tax expense is paid as a subsidy as opposed to being the result of a tax deduction. The first component has nothing to do with externalities, while the second does and has been used to substantiate government R&D measures.

The authors of the study pose a question whether it is beneficial for the SkatteFUNN scheme to be formally a part of the tax system, when it really is a subsidy scheme. The study also suggest that because of small firms financing problems, changing the scheme to a subsidy scheme provides a better liquidity effect than the current scheme. Improved liquidity in the scheme could make it more attractive. Five years of experience with the current SkatteFUNN scheme, which in practice has proven to resemble more closely a subsidy scheme than a tax deduction scheme, calls for a reconsideration of the suitability of the organisation of SkatteFUNN as a part of the tax system.

The study also suggests that if the purpose of the scheme is to get firms with little R&D activity to increase this, the scheme should apply regardless of the size of the firm either in terms of number of employees or turnover; it is the extent of R&D activity that is important. The authors believe that SkatteFUNN should continue to be available to all firms regardless of the number of employees. In addition they believe it to be appropriate to use formulations of the R&D concept that copy the Frascati manual and not create more or less random deviations from this.

Furthermore, they do not recommend converting to a system that contributes to supporting the *increase* in R&D as opposed to the *level* of R&D, i.e. recommending to retaining a volume-based scheme rather than choosing an incremental scheme as volume-based schemes are the easiest to administer. An incremental scheme can provide special stimulants for firms that increase their R&D activity significantly and therefore produce higher input additionality than a volume-based scheme. However, international studies are not clear on this point. The study suggests that general assessments of simplicity and standardised schemes indicate that a single deduction rate of 20 per cent could just as well have been applied, as opposed to 20% deduction for SME-s and 18% for large firms as currently applied.

The cost structure of R&D expenses does not vary much from consumption expenses in civil public administration, where the salary expenses make up around 60 per cent of the total costs. If the deflator would be applied for civil public administration according to the national accounts as an indicator for the price increases in the firms' R&D expenses, the true value of the cap of NOK 4 million drops to NOK 3.5 million in 2006 measured in 2002 prices. This decrease in the real value of the cap can help to explain why fewer firms are now using the scheme than in previous years. However, it is important to understand that even in 2006 Norway was far from a situation where large numbers of the SkatteFUNN firms butted heads at the ceiling threshold. Nevertheless, the authors believe that the ceiling should be index adjusted at regular intervals.

3.3.2 The Netherlands

The Promotion of Research and Development Act (WBSO) took effect in 1994 in the Netherlands.

The WBSO provides for a fiscal facility that reduces wage costs for R&D employees by reducing wage tax and social insurance contributions. The first € 110,000 of R&D labour costs fall within the 42% remittance reduction band, and additional costs within the 14% band[117]*. The condition is that these employees should work on technological R&D activities aimed at the development of products, processes and software that are new to the company. The WBSO also provides for extra incentives for high-tech start-ups to conduct R&D.*[118] *A ceiling is applied to the reduced remittance a user can claim, which in 2005 was € 7.9 million.*

The WBSO is granted on the basis of the projects submitted in advance by the regulation's users, and finally credited on the basis of actual R&D hours. Users are obliged to maintain project records and timesheets[119].

The idea is that by reducing the main item of expenditure for conducting R&D, companies will be (further) encouraged to perform (more) R&D.

The Ministy of Economic Affairs study on the WBSO effects shows an increase of private R&D expenditure. This is evident from users' additional R&D expenditure per euro WBSO, which is sometimes referred to as ‘bang for the buck’, or BFTB.

The BFTB for the WBSO user population is probably between € 1.50 and € 1.94. The most probable point estimate is € 1.72, which means on balance that WBSO users spend the full tax incentive on R&D work, and also invest additional funds from their own resources.

Recalculated the BFTB for labour costs alone, the value is between € 1.05 and € 1.49, and the most probable value is € 1.27. This BFTB is also subject to some uncertainty, but at any rate is greater than one.

Users' additional R&D expenditure per euro WBSO exceeds the costs directly attributable to the implementation of the regulation, such as tax expenditures (1€), execution costs for tax authorities (0.02 €) and the administrative burden for users (0.07€). The overall administrative burden is therefore around 9% of the subsidy.

Some additional R&D expenditure of firms is destined for funding R&D staff salary rises. However, this has a modest impact, and does not contradict the conclusion that the additional R&D expenditure far exceeds the tax expenditures. WBSO raises the tax base for users, which is normally subject to profits tax (personal or corporate income tax). This means that the net-

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[117] Ministry of Economic Affairs (2007): „WBSO Evaluation 2001-2005. Impacts, target group reach and implementation”, http://www.worldcat.org/wcpa/oclc/206570082?page=frame&url=http%3A%2F%2Fappz.ez.nl%2Fpublicaties%2Fpdfs%2F07OI35.pdf%26checksum%3Dd306846155e157de440b43d2967a13b5&title=&linktype=digitalObject&detail=

[118] Evaluation of WBSO (Promotion of Research and Development Act), Tom Poot (Tudelft), Pim den Hertog (Dialogic, University Utrecht), Thomas Grosfeld (Ministery of Economic Affairs), Erik Brouwer (PwC, OCFEB-Erasmus)1

[119] Ministry of Economic Affairs (2007): „WBSO Evaluation 2001-2005. Impacts, target group reach and implementation”, http://www.worldcat.org/wcpa/oclc/206570082?page=frame&url=http%3A%2F%2Fappz.ez.nl%2Fpublicaties%2Fpdfs%2F07OI35.pdf%26checksum%3Dd306846155e157de440b43d2967a13b5&title=&linktype=digitalObject&detail=

impact of the WBSO received is lower for the user than the actual WBSO received and that some of the reduced remittance flows back into public funds. As a result, the net budgetary expenses are probably lower than the costs of the tax expenditures. Moreover, the WBSO does not differ in this respect from other tax facilities and subsidies.

In addition, the study revealed other impacts. Besides additional R&D expenditure, the WBSO also gives rise to changes in the type of R&D and users' behaviour. The WBSO ensures that more than 50% of the user dare to tackle R&D projects with a higher risk profile, perform R&D projects faster, plan R&D activities better, tend to keep R&D out of harm's way in the event of spending cuts and perform more R&D internally and contract less out.

Furthermore, using the WBSO improves firms' absorption capacity, in terms of firms' power to identify, absorb and apply valuable external knowledge. A sign that points in this direction is that WBSO users have a higher proportion of research staff; the difference is one percentage point. Other positive impacts are to be found in innovation and business performance. WBSO users achieve higher new product sales because of the increase in their R&D expenditure, and ultimately also see growth in their gross production. Data limitations meant that external impacts (knowledge spillovers) could not be demonstrated. However, studies executed previously in the Netherlands make it plausible that the knowledge accumulated by users through WBSO also has some benefit on other parties. The WBSO's social performance will therefore be better than the private performance.

The WBSO has a good target group reach, which is defined as the percentage of WBSO users among firms that perform R&D. Approximately 80% of the firms with R&D activities and ten or more employees make use of the WBSO.

SenterNovem and the Tax and Customs Administration have modest implementation costs of a mere € 0.02 per euro WBSO. The administrative burden for users as defined by the government is € 0.07 per euro WBSO, which is not exceptional in comparison with innovation grants schemes. It must be observed in this connection that most administrative burden is attributable to maintaining the compulsory R&D records, and that approximately two-thirds of the users state that they would keep these records even without WBSO. Correcting for this effect would almost halve the administrative burden.

In conclusion, the overall picture is that the WBSO is a properly functioning regulation that encourages private R&D expenditure. The only point for improvement that the study identified in the evaluation was that the regulation does not perform well for contract research conducted by knowledge institutes. Only 21% of the knowledge institutes stated in the telephone survey that they passed on the WBSO received to their clients as a discount. However, knowledge institutes are a small user group (which accounts for only 3% of WBSO grants).

A few other points for attention that we encountered demand closer scrutiny by policymakers. The WBSO appears not to be fully compatible with self-employed people. We find less additionality among self-employed people with no staff than among firms with 1-9 active employees. One possible cause is the lower limit of 500 R&D hours, and another is that the WBSO tax credit for self-employed people is a lump sum and therefore ceases to be an incentive for additional R&D once the hours limit has been reached.

The WBSO appears to be less attractive for large firms (250 or more active employees) from an international perspective. As it happens, these are the firms with the greatest opportunities for performing R&D in other countries.

Attention must be given to a possible broadening of the definition of R&D. There has been evidence in the past ten years that broadening the R&D definition has coincided with an improved target group reach. It will be hard to improve the target group reach with the current definition of R&D. Any redefinition must be accompanied by additional resources for the WBSO, in order to prevent dilution of the support for more fundamental research projects.

Concerns remain about the reach of the WBSO among small firms (1-9 active employees), although there has been some improvement.

A final suggestion is to avoid major changes in the organization and procedures of the WBSO. 65% of the users in the telephone survey stated a preference for leaving the details of the regulation unchanged. It goes without saying that there are no objections to an increase in reduced remittance rates or to broadening the R&D definition (which would allow new users in).

Lokshin and Mohnen [120] have found that there is also a wage effect of the R&D tax incentives program. Part of the R&D tax credits get transmitted into higher R&D wages because of inelastic labour supply, search costs for scientists and engineers, incentives given to R&D employees or bargaining power of R&D employees. The estimated elasticities of wages with respect to the R&D tax credit disbursement of the order of 10% in the short run and 12% in the long run. The authors find that the existence of a wage effect of R&D tax credits suggests that the efficiency of the R&D tax incentive program could be enhanced if the wage effect could be avoided. What goes into higher wages for scientists and engineers could go into more real expenditures on research and development.

3.3.3 Australia

The R&D Tax Concession is an entitlement program that assists and encourages industry R&D expenditure by Australian companies121.

The Australian R&D Tax Concession provides an increased deduction (150 percent in the period 1985–96, 125 percent thereafter) to be claimed on the volume of R&D expenditure, and this then reduces tax payable with tax loss firms entitled to carry the additional deduction forward. Between 1985 and 2008 there have been numerous changes to the Concession, most notably to the definition of R&D and, in 2001, the introduction of two new elements: the Tax Offset and the 175 percent Premium Concession. The 175 percent International Premium Concession was introduced in 2007.

Overall, most of the firms surveyed reported changes in behaviour as a result of using the R&D Tax Concession. It affected 86% of firms during their R&D project and after the project 98% of firms reported long-term behavioural change. An estimate of the economic impact of the behavioural additionality effects induced by the R&D Tax Concession was in the range of \$150m to \$300m in 2004-05. Estimating the economic benefit considered both savings in R&D costs (through changes to R&D management etc) and increased profits (by accelerating the R&D and changes to commercialization). One of the strongest impacts was that the projects proceeded faster. This has strong commercial implications, because speed-to-market is a

[120] Boris Lokshin and Pierre Mohnen, Wage effects of R&D tax incentives: Evidence from the Netherlands.

[121] How R&D Assistance Influences Company Behaviour. A survey investigating behavioural additionality effects of the R&D Tax Concession program. Commonwealth of Australia 2007, p. 5

"critical competency for successful new product development"[122]. Also the R&D Tax Concession had strong impacts (greater than 60% agreement) on behaviour including enhanced commitment to R&D, changes to R&D management, changes to business strategy and encouraging new collaboration with companies. The R&D Tax Concession also had a high impact (greater than 50%) on product commercialization, new collaboration with companies and the encouragement of new collaboration with universities.[123]

In the 1980s and earlier, when R&D Tax Concession was introduced, the prevailing model of business research centred around in-house corporate laboratories. Today the prevailing model is one of open innovation markets, where corporations exchange, collectively develop, or trade in technology or intellectual property. In addition the mix of product and process innovation is changing – and the line between them is blurring.[124]

The objectives of the R&D Tax Concession were[125]:

- to provide an incentive for greater levels of R&D in Australia;
- to concentrate new R&D efforts in industry by greater business investment in, and responsibility for, R&D;
- to provide positive support for R&D activities in industry, on the basis that significant benefits accrue both to industry and to the wider community through enhanced competitiveness of industry;
- to provide mechanisms for encouraging effective use of Australia's existing R&D expertise; and
- to encourage a capacity in industry to be aware of, and exploit, technological developments occurring in other countries. These objectives are part of a broader set of objectives which seek to encourage, through the Government's industry and technology policies, the development in Australia of internationally competitive, export oriented, innovative industries[126].

The Australian R&D Tax Concession provides an increased deduction (150 percent in the period 1985–96, 125 percent thereafter) to be claimed on the volume of R&D expenditure, and this then reduces tax payable with tax loss firms entitled to carry the additional deduction forward. Between 1985 and 2008 there have been numerous changes to the Concession, most notably to the definition of R&D and, in 2001, the introduction of two new elements: the Tax Offset and the 175 percent Premium Concession. The 175 percent International Premium Concession was introduced in 2007. The result has been fragmentation and complexity.[127]

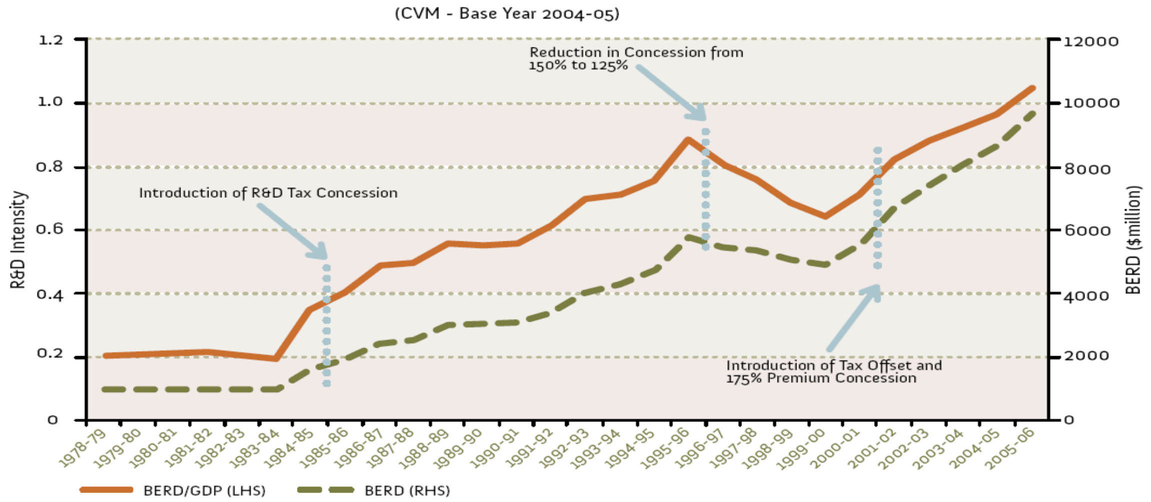
- The Tax Offset gives small firms in tax loss the option of receiving an early cash payment based on their eligible R&D expenditure, rather than a future entitlement to a deduction.[128]

[122] Lynn GS, Skov RB and Abel KD (1999). Practices that support team learning and their impact on speed to market and new product success. *Journal of Product Innovation Management* 16:439-454.
[123] How R&D Assistance Influences Company Behaviour. A survey investigating behavioural additionality effects of the R&D Tax Concession program. Commonwealth of Australia 2007, p. 5,6
[124] Venturous Australia. Building strength in innovation, p. 101
[125] Venturous Australia. Building strength in innovation, p. 102
[126] House of Representatives, Income Tax Assessment Amendment (Research and Development) Act 1986, Second Reading Speech.
[127] Venturous Australia. Building strength in innovation, p. 102
[128] Venturous Australia. Building strength in innovation, p. 102

- The 175 percent Premium R&D Tax Concession is for labour-related R&D expenditure (expenditures eligible under the 175 percent are called “incremental expenditures”) above the average of a firm's previous three-year expenditure.[129]
- The 175 percent International Premium Tax Concession is for those companies belonging to a multinational enterprise group for additional R&D expenditure on behalf of a grouped foreign company above a rolling three-year average of expenditure.[130]

The following figure shows the long run trends in business expenditure on research, with the Tax Concession milestones flagged.

Figure: Long run trends in business research expenditure[131]



Source: ABS, Australian System of National Accounts - 2005–06. Cat No. 5204.0

Whilst this trend analysis suggests a strong correlation between the availability of the Concession and the steady increase in BERD, some caution is needed in imputing causation. One question is how much of the growth was driven by the internationalisation of the Australian economy in the 1980s and the resulting need for trade exposed companies to innovate to be competitive, as opposed to the effects of the Tax Concession. Certainly, the decline from 1996 to 2000 following changes to the Tax Concession was sharp. It is, however, difficult to untangle the reduction of the concessional rate from the ending of tax syndication. It is estimated that syndication represented at least 30 percent of the Concession outlays by 1995 and had been a major driver of firm uptake of the Concession in the early 1990s. In the period after 2000 it remains inherently difficult to unbundle any additionality effects across inter-related innovation and assistance programs, including the expanding CRC program.[132]

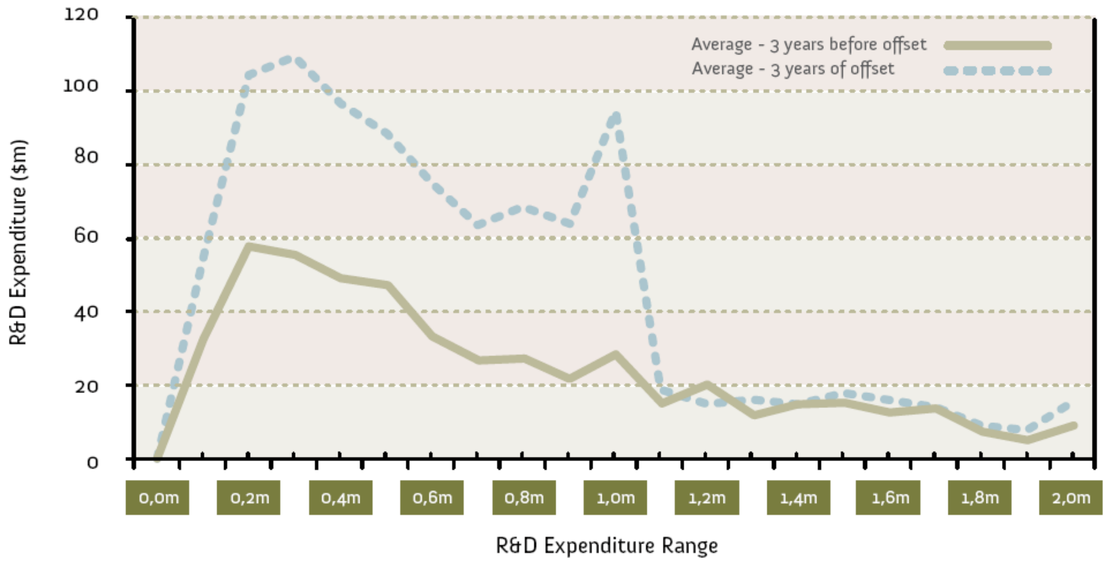
The inducement effects of a concession are likely to differ as between small technology based firms, and larger more mature firms. At one consultation with larger companies, 82 percent of those present indicated, when polled, that the incentive value was marginal or none, and no one said the 175 percent incremental premium scheme influenced their R&D activity. The reason for this is that firms were frequently unable to use the 175 percent Premium strategically because

[129] Venturous Australia. Building strength in innovation, p. 102
[130] Venturous Australia. Building strength in innovation, p. 102
[131] Venturous Australia. Building strength in innovation, p. 103
[132] Venturous Australia. Building strength in innovation, p. 103

the grouping rules mean that acquisition, merger or demerger activity prevents firms from planning their use of the scheme in advance.[133]

At the other end of the spectrum, the introduction of the Tax Offset element of the Concession for small tax loss firms has been highly successful, despite its limited coverage and the perverse effects of the rules around the $1 million cap on eligible expenditure on behaviour. This is shown dramatically in Figure.[134]

Figure: Illustrating the perverse effects from program design[135]



Source: Department of Industry, Tourism and Resources (2007)

Eligibility rules limit the number of firms that can benefit from the Tax Offset. Yet firms in tax loss are often the most innovative. Further, many start-up firms too large to qualify for the Tax Offset endure tax losses for the best part of a decade, particularly in sectors like biotechnology. Waiting this long to access the Concession hugely degrades its commercial value, particularly for firms engaging in high risk research. And of course many start ups are unsuccessful and so never access the Concession.[136]

In relation to R&D Tax Concession, researchers have made proposals as follows[137]:

- The researchers have proposed that smaller firms get access to R&D tax incentives. Further the researchers proposed that the Australian Government should dramatically lift the threshold beyond which firms are classified as large firms ineligible for the incentives.
- The simpler rules and consistency of approach will remove much of the complexity of the current schemes making it easier to evaluate its impact, and to fine tune the concessional parameters of the scheme over time.

[133] Venturous Australia. Building strength in innovation, p. 104
[134] Venturous Australia. Building strength in innovation, p. 104
[135] Venturous Australia. Building strength in innovation, p. 105
[136] Venturous Australia. Building strength in innovation, p. 105
[137] Venturous Australia. Building strength in innovation, p. 106-108

- Any delay in provision of support – currently the Offset is provided in the year post-expenditure – has a negative impact on firms' ability to undertake R&D. Indeed, other sources of capital are often contingent upon firms being able to provide assurance of existence of matching capital. For this reason, and providing issues of tax integrity and practicality are adequately addressed, firms should get the benefits of assistance as soon as possible. Currently the benefit is paid yearly in arrears. With sensible risk management strategies, and perhaps for firms with a track record, it should be possible to make assistance available to them earlier than this.

Since the scheme's inception there have been persistent tensions around the definition of eligible activity. In principle one would like a relatively generous definition because even marginal, incremental innovations are an important driver of growth and in many ways more easily copied than more fundamental innovations. Unfortunately, however, the abuses to which such a course would lead make it impracticable. The researchers would like to see the Concession made more widely available to innovators in services but acknowledges the practical difficulties.[138]

3.3.4 Canada[139]

The general rate of tax credit is 20 per cent and a 35 per cent rate is available to smaller Canadian-controlled private corporations (CCPCs). Scientific research and experimental development (SR&ED) tax credits may be deducted from federal taxes otherwise payable. Unused credits are refundable for smaller CCPCs at rates of: 100 per cent for up to $2 million of qualifying current expenditures; and 40 per cent for other qualifying expenditures. For other corporations, unused tax credits can be carried back three years or carried forward 20 years.

A recent Department of Finance working paper provides an economic evaluation of the SR&ED tax credit and finds that it creates a net economic gain for the Canadian economy. The study shows that the positive economic benefits associated with the SR&ED tax credit are derived from the spillovers that occur when the benefits of SR&ED extend beyond the performers themselves to other firms and sectors of the economy. These spillovers amount to about 46 cents per dollar of tax expenditure and more than offset the costs of the credit, estimated to be 36 cents per dollar of tax expenditure. Thus the SR&ED tax credit creates a gross economic gain of $1.11 for every dollar spent on it, and a net economic gain of 11 cents per dollar. These estimates are sensitive to the underlying assumptions used in the working paper, but the study shows that the SR&ED tax credit generates positive net economic benefits under a range of reasonable assumptions.

The manufacturing sector is the largest beneficiary of the SR&ED ITCs, accounting for nearly one-half of ITCs earned. Within the manufacturing sector, computer and computer product manufacturing, transportation equipment manufacturing and chemical manufacturing are the largest users of the SR&ED program. Service industries, particularly professional, scientific and technical industries, and information and cultural industries are also significant users of SR&ED tax credits.

Using Canadian tax incentive system and simulations, Russo[140] found that an R&D credit that initially costs 1% of revenue and is financed by a decrease in productive government

[138] Venturous Australia. Building strength in innovation, p. 108
[139] http://www.fin.gc.ca/activty/consult/sred_1-eng.asp#note11

infrastructure, produces a long-run increase in welfare of 17.6%. If government infrastructure in the model is not productive, the welfare increase is 45.6%. In the model, R&D tax credits always dominate other incentives.

3.3.5 The United Kingdom[141]

In UK R&D expenditure can be deducted by 130% and Small and Medium Sized companies can deduct 175% of R&D expenditure where the expenditure is capital in nature[142] *(UK research credit).*

According to an evaluation study conducted by BMRB Social Research most respondents had a positive view of the potential effects of R&D tax credits. Overall, 57 per cent of claimants and 58 per cent of non-claimants felt that R&D tax credits were an incentive to undertake further R&D.

Over a third (34 per cent) said that R&D tax credits had enabled them to take on projects that needed a longer time to pay off. A quarter (24 per cent) said that tax credits had enabled them to take on more risky R&D projects. One in seven claimants (16 per cent) felt that the R&D tax credit had either enabled them to attract R&D projects from abroad or prevented R&D projects from migrating to overseas facilities.

Companies that had claimed R&D tax credits were more likely than non-claimant companies to say that they had increased their spend on R&D over the last five years, while non-claimant companies were more likely to have kept their level of R&D spending about the same.

Using UK data, Harris et al (2009) studied the impact of R&D spending on output as well as forecasting the impact of a regionally enhanced R&D tax credit on the user cost of R&D expenditure and subsequently the demand for R&D. The example of a disadvantaged region is used – Northern Ireland. The results are that in the long run, R&D spending has a mostly positive impact on output across various manufacturing industries. In addition, plants with a zero R&D stock experience significant one-off negative productivity effects. As to the adjustment of R&D in response to changes in the user cost, the results suggest a rather slow adjustment over time, and a long-run own-price elasticity of around −1,4. Also, to have a major impact on R&D spending in Northern Ireland, the R&D tax credit would need to be increased substantially; this would be expensive in terms of the net exchequer cost.

3.3.6 Belgium[143]

One of the two Belgian policies to stimulate R&D can be regarded as a special allowance. However it differs from other policies as it offers fixed amount based incentive instead of percentages.

[140] Russo, Benjamin. A Cost-Benefit Analysis of R&D Tax Incentives. Blackwell Publishing on behalf of the Canadian Economics Association. The Canadian Journal of Economics / Revue canadienne d'Economique, Vol. 37, No. 2, May 2004, pp. 313-335.
[141] http://www.hmrc.gov.uk/randd/rand-taxcredits-final.pdf
[142] KPMG LLP (UK) (2008): „Investment in the UK. The corporate tax regime”, https://portal.ema.kworld.kpmg.com/tax/Member%20Firm%20Publications/Investment%20in%20the%20UK%20-%20CT%20regime%202008%20Feb%2008.pdf
[143] http://www.belspo.be/belspo/stat/papers/pdf/fiscRDJune03.pdf

For each additional employee used in scientific research in Belgium, the company is exempt from paying taxes on an amount of € 11,800 in the year of recruitment. This amount is annually indexed. For highly qualified researchers, i.e. employees holding a doctorate degree with 10 years of experience in scientific research, the exemption is equal to € 23,590.

Although most companies appear to be aware of the different incentives offered by the government, very few actually use the support that the government has put in place, be it the tax allowance offered for the recruitment of new researchers or for investment in R&D. Furthermore, there appears to be a serious misunderstanding among Belgian firms regarding the current incentive system. It is thought that the allowance for hiring new researchers is permanently obtained during the first year so that it would be beneficial to hire excessively one year and abandon the newcomers the next one. Such misinterpretations may be due to the fact that the current policy is probably too complex to be effectively used.

In the survey, the government support is almost never perceived as an "R&D stimulator": indeed, only one firm has declared that it had carried out an R&D project because the fiscal support was available.

First of all many firms do not use the different measures because the associated administrative cost is too high compared to the potential benefit. The procedure to receive support is time-consuming, bureaucratic and lacking in transparency, while the aid itself is too unsubstantial. Firms have called for a simple, transparent and "user-friendly" system.

Second, because R&D is a long-term process, any kind of government support should be available to the firm for many years, in a predictable and stable manner.

Third, the support should be substantial enough to generate a change in the R&D expenditure. Indeed, the present incremental system in Belgium is described by all firms as too small to influence significantly the cost of R&D activities.

According to the evaluation of the authors, the Belgian R&D tax incentives could be improved significantly. The following elements definitely appear to be putting the current Belgian policy at a disadvantage:

1. The exemption only relates to the first year of recruitment (incremental policies on a "rolling base" induce investment distortions and are not highly stimulating).

2. The amount of the exemption is not significant enough to be stimulating. The net cost saving is too small to have a real impact on business R&D decisions (the fiscal incentive is too weak).

3. In order to secure the exemption, the company has to deliver an attestation each year (it adds complexity and administrative costs to both the firm and the government).

4. In order to secure the exemption, the researcher in question has to remain working on a full time basis in the research department of the same company (adds complexity).

5. The tax allowance is nominative. This causes important administrative constraints on both the government and the firm (each year there is a need to track the employees who benefited previously from the fiscal incentive).

6. The conditions for highly qualified researchers are so severe that practically no researchers qualify (the definition of highly qualified personnel is too strict).

7. As the experience with the Austrian R&D tax allowance has shown, it is better to apply the internationally recognized definition of the Frascati Manual (OECD, 1993). In this context, it seems better to restrict the tax allowance to R&D activities only and to eliminate the

"development of the technological potential of the company" (it implicitly induces relabelling practices).

8. A better integration of the different governmental departments could result in substantial savings on the administrative cost of the policy. Currently some procedures include performing tasks that could be avoided by using information readily available in other departments.

The following recommendations were made for Belgium to improve their tax incentives:

1. The essential keywords for recommendation are the search for stability, visibility, simplicity and reliability.

2. Implement a level based tax credit of 25% on all R&D expenses (total expenses) if the 3% GDP R&D objective has to be reached. The introduction of a tax credit system of 25% on all business R&D expenditures were presented as the best feasible policy to stimulate R&D. Indeed, such a policy is likely to enable Belgium to reach the European target of 3% of R&D intensity by 2010.

3. Investigate the possibility to make monthly deductions of social security taxes, as in the Netherlands.

4. Limit the definition of eligible expenditures to the one in the Frascati manual. (See appendix 1 for the Frascati definitions). An in-depth company consultation process would allow refining the interpretation of the Frascati Manual.

5. Allow patent-related expenses to be deducted.

6. Allow R&D expenditure from outsourced or subcontracted activities to universities, public labs and high schools to be deducted.

7. Reduce most of the complexity associated with the current policy (full-time requirement, subsequent attestations in order to maintain the exemption, etc)

8. Increase the coordination between the various government institutions and ministries involved in any type of government support to business R&D, such as grants, subsidies and procurement.

9. Eliminate the requirement that R&D has to be technically new from a societal point of view. Firstly, it is almost impossible and costly for the government to control what is and what is not new from a societal point of view. Additionally it is relatively straightforward to keep track of what R&D the company previously did (by looking at the previous applications). Moreover, it is not excluded that redoing a similar research results in new findings.

10. Offer the facility to apply beforehand as well as afterwards for the tax incentive. This avoids the dilemma between the equally important arguments of certainty and flexibility for companies. This facility also offers potential benefits to the government as it spreads the applications over the whole year so that fewer human resources are required to cope with peak periods.

11. It is important to put a consistent policy in place. This has to be achieved at all levels of the policy: from the design, the communication, the application, the treatment of applications and the granting of the incentive to the monitoring itself.

12. There should be an independent evaluation put in place in order to assess the effectiveness of the new fiscal incentives.

13. In order to ensure a proper evaluation process, access to micro-level databases is indispensable.

According to the information received from Tax Partner, Dirk Van Stappen at KPMG Belgium (Antwerp) this measure has been abolished from assessment year 2008 as it was perceived to be rather burdensome from an administrative point of view. The outcome of the impact analysis of tax incentives on R&D-activities, including developing a statistical model to measure the impact may not be shared yet (report has been delivered to the Flemish Minister concerned). The report will be available at the end of 2009.

3.3.7 Other country evaluations

Corchuelo and Martínez-Ros[144] found, using a panel of Spanish industry sector firms that large firms are more aware of the tax benefits, but overall, a little more than half are aware of these benefits. Of these, less than half use them. If the firms without R&D spending are excluded, the situation improves, especially in SME's and low-technology sectors, but still, few use the tax benefits. If firms without the knowledge of tax benefits are excluded, the probability gap between large firm and SME tax benefit usage disappears. Also, tax benefits are more frequently used by firms than the state subsidizes. The second result is that the effect of tax incentives is positive, but significant only in large and high-technology sector firms.

Japan has a 10%-12% of tax credit of R&D expenditure. In addition to regular tax credit Japan offers tax credit of 5% on incremental R&D expenditure. If R&D expenditure is higher than 10% of the average sales proceeds, the R&D tax credit can be increased further with the maximum creditable amount of 30% of the annual corporate tax liability.

In Japan, according to Koga[145] the R&D tax price elasticity is about 0.68 when estimating it for all firms. However, considering the firm's size, the tax price elasticity is 1.03 in large firms. This means that R&D tax credit is effective in increasing R&D investment, especially in such firms.

Using the industrial data from Shanghai, Zhu et al[146] found that both government's direct funding as an incentive stimulating policy instrument and industrial sectors' own funding in science and technology activities have positive effects on the industrial R&D investment. The stability of the policy further enhances the positive effect. However, the effect of the tax incentives is not straightforward. The enterprises in the industrial sectors tend to switch to more general and less costly science and technology activities, which can be regarded as a less desirable effect of the tax incentives. Also, there is no significant effect of the bank loans and S&T funding from other financial resources, i.e. FDI.

[144] Corchuelo, M. Beatriz. Martínez-Ros, Ester (2009): The Effects of Fiscal Incentives for R&D in Spain. Universidad Carlos III de Madrid. Working Paper 09-23, Business Economic Series 02.
[145] Koga, Tadahisa (2003): Firm size and R&D tax incentives. Elsevier. Technovation, 23, pp. 643–648
[146] Zhu, Pingfang., Xu, Weimin., Lundin, Nannan (2006): The impact of government's fundings and tax incentives on industrial R&D investments—Empirical evidences from industrial sectors in Shanghai. North-Holland. China Economic Review, 17, pp. 51–69.

As an example of a developing economy, using Turkish manufacturing industry, Özçelik and Taymaz[147] found that public R&D support significantly and positively affects private R&D investment. There seems to be even an acceleration effect on firm-financed R&D expenditures. Smaller R&D performers benefit more from R&D support and perform more R&D. In addition, technology transfer from abroad and domestic R&D activity show up as complementary processes. Although larger firms are more likely to conduct R&D activities, within the group of R&D performers, smaller firms participate more in R&D support programs and have higher R&D investment per output.

[147] 53. Özçelik, Emre., Taymaz, Erol (2008): R&D support programs in developing countries: The Turkish experience. Elsevier. Research Policy, 37, pp. 258–275.

3.4 *Factors influencing R&D location*

In general, it is evident that tax matters influence foreign direct investment (FDI) and R&D activity location decisions of multinational enterprises. However, it should be noted that tax issues are not one of the main drivers of such decision-making.

One of the OECD studies has found that inbound FDI is recognized as being attracted by macroeconomic stability; a supportive legal and regulatory framework; skilled labour and labour market flexibility; well developed infrastructure; and business opportunities tied to market size (with profitability of the domestic market tied to the purchasing power of the population, and foreign markets reached via an extensive network of trade agreements). In other words, a number of non-tax factors are central drivers to FDI decisions. Sound tax policy establishes a basis for fiscal stability which strengthens the business climate. Additionally, in certain cases, tax may be an important factor influencing location decisions.[148]

Namely, effective rates inclusive of tax base provisions and tax-planning are factored in by investors. Taxes such as energy taxes and payroll taxes are important, and according to some officials, are becoming much more important. This is because companies "have already taken care of the corporate income tax", in the sense that corporate tax is paid at levels acceptable to managers. This observation lends weight to the perception that multinationals have many tax-planning techniques at their disposal, and may be able to effectively decide the level of host country tax on profit that they will pay. However, low host country tax burden cannot compensate for a generally weak or unattractive FDI environment. There are numerous past examples of where poor infrastructure and other weak investment conditions have deterred FDI.[149]

A report (September 2007) prepared for UK Trade and Investment and the Association of the British Pharmaceutical Industry states that "once a sufficient degree of quality is obtained, cost factors are likely to dominate the decision as to where to locate manufacturing. Corporate tax rates are likely to be the single most important factor in this decision, particularly where the technology required for successful manufacturing is available in a wide variety of locations". However, in practice, company's overall tax strategy is considered. The study concludes that countries can use R&D tax credit to help attract R&D, "however, such schemes might possibly add to, but no way substitute for, the provision of an underlying high quality environment"[150]

According to a survey[151] of over 200 multinational companies across 15 industries regarding the factors that influence decisions on where to conduct research and development shows similar results to those of the location of FDI. Regardless of where companies locate R&D, four factors stand out: output market potential, quality of R&D personnel, university collaboration, and intellectual property protection[152].

For companies locating in emerging economies, the most important attraction was the market growth potential, followed by the quality of R&D personnel, third most important reason were costs (net of tax savings), the expertise of university faculty, and the ease of collaborating with

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[148] OECD (2007): „Tax Effects on Foreign Direct Investment – No. 17. Recent Evidence and Policy Analysis", http://www.oecd.org/dataoecd/12/34/39866155.pdf

[149] Ibid.

[150] NERA (2007): „Key Factors in Attracting Internationally Mobile Investments by the Research-Based Pharmaceutical Industry", http://www.nera.com/image/PUB_MobileInvestments_Sep2007.pdf

[151] Thursby, J and M. Thursby, (2006); "Here or There? A Survey of Factors in Multinational R&D Site Location," http://www.kauffman.org/uploadedFiles/thursby_final_1206.pdf

[152] Ibid.

universities. When companies located R&D facilities either at home or in another developed economy, the most important factors were the quality of R&D personnel and the quality of intellectual property protection, next were the expertise of university faculty and the ease of collaborating with universities. Also important were market factors such as growth potential and the need to support sales of the company[153].

Thus output and input market factors, as well as the intellectual property infrastructure, are all paramount. A critical point on R&D input factors is that the most important factor is the quality of the inputs. The implication of this is that although cost, net of tax breaks, is high in developed countries, these economies can still have a comparative advantage in R&D because of the quality of personnel, particularly given the intellectual property environment[154]. In addition, the survey found that the argument that tax breaks and/or direct government assistance are luring firms to establish R&D facilities in developing or emerging economies can be reasonably rejected (Ibid p 24). However, their results suggest that tax breaks are more prevalent in developed countries (Ibid p 26).

The results of another study[155] on R&D location suggest that on average, the probability to locate in an EU region (NUTS 2) increases with the size of demand, agglomeration economies, low production cost, technological development, flexibility of labour markets, access to skilled labour and information technology (IT) infrastructure. The evidence suggests that after controlling for the R&D intensity of regions, EU structural funds and country level tax differences have had no significant effect in the attractiveness of regions to R&D foreign investment. In addition, multinationals locate foreign affiliates in more than one country and they optimize the tax on a global base. [156].

European Commission study concludes that “while skilled labour, high quality scientific institutions and market access may be key factors determining where firms choose to locate their R&D activity, R&D tax credits and the (corporate) tax system more broadly may also have a role to play”[157]. Another study has identified that in addition to world-class research infrastructure and skilled labour the dynamism of the national innovation system, a degree of interaction and collaboration among different firms and other “knowledge producing and diffusing organizations” (universities and research centres, consultants, industrial associations, etc.) is also important location driver[158]

Therefore, the probability of R&D activities location decision in a certain country/region can be said to be influenced by market size, quality of R&D personnel and labour market flexibility, legal framework and other non-tax conditions; tax considerations are not generally the first priority. There is very little evidence that tax incentives play a role on the R&D location. Furthermore, pinpointing the most relevant tax considerations that drive the R&D location would be highly ambiguous, because the reviewed studies emphasize either the level of general

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[153] Ibid.
[154] Ibid.
[155] Siedschlaga, D. Smitha, C. Turcub and X. Zhang (2009): „What Determines the Attractiveness of the European Union to the Location of R&D Multinational Firms?”, DYNREG working papers, https://www.esri.ie/research/research_areas/international_economics/dynreg/papers/WP46.pdf
[156] Ibid.
[157]Expert Group on R&D Tax Incentives Evaluation (2008): “Comparing Practices in R&D Tax Incentives Evaluation”, http://ec.europa.eu/invest-in-research/pdf/download_en/rd_tax_incentives_expert_group_report2008_rtd_final1.pdf
[158] Guimón, J. (2008): „Government strategies to attract R&D-intensive FDI”, OECD Global Forum on International Investment, http://www.oecd.org/dataoecd/45/4/40310856.pdf

corporate income tax or the overall tax burden on the level of group of companies taking into account tax planning opportunities. In addition, there is no reliable evidence that the R&D tax incentives have attracted R&D activities in high R&D performing countries or impact the R&D location decisions of multinational enterprise substantially.

4 Research and technological development in Estonia

Estonia has been increasing the level of R&D expenditure to R&D constantly during the past years, however is still lagging considerably behind the European forerunners in terms of number of researchers employed in business sector as well as contribution of R&D investment to GDP.

The main conclusions to be drawn from this chapter are:

- *An in increase of Estonia's private sector R&D investment prerequisites a substantial increase in R&D personnel in business enterprise sector.*
- *Estonia's public sector expenditure on R&D is fully comparable to European average but despite recent rapid growth, business sector R&D investment continues to lag significantly behind Finland, Sweden and others.*

4.1 Number of researchers in Estonia

In 2007 and 2008 the total R&D personnel in Estonia has been above nine thousand persons (five thousand in full-time equivalent). The above includes 6,800 researchers (3,700 researchers in full-time equivalent), while the rest are technicians and supporting staff.[159] This is, in absolute terms, a relatively small number of researchers that is comparable to a single research lab of a major multinational corporation.

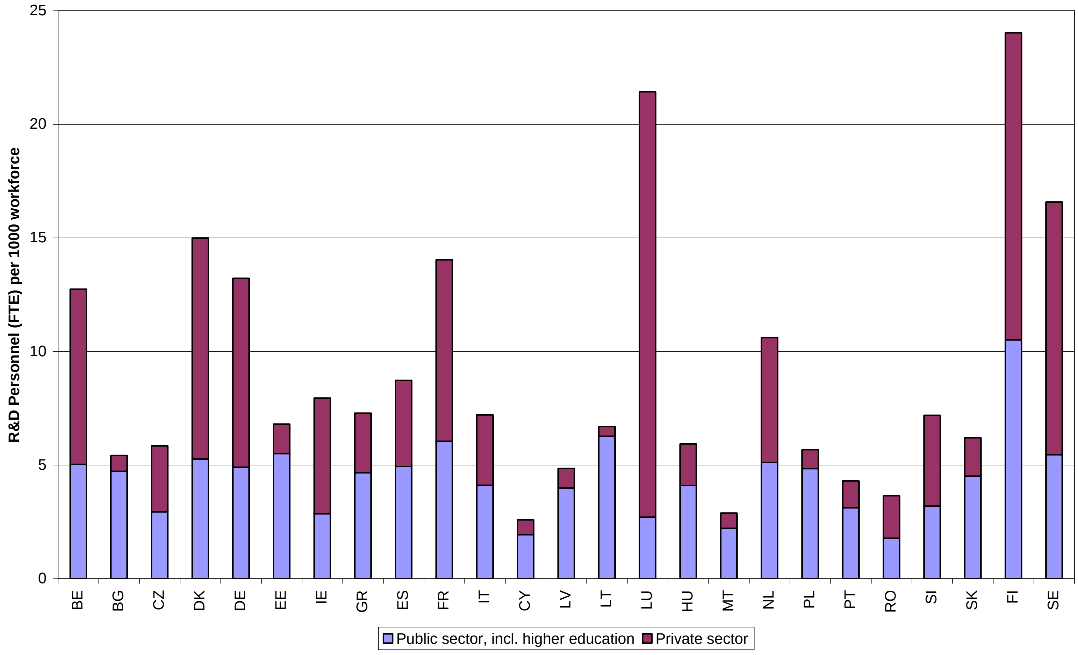
The fact that the full-time equivalent of R&D personnel varies in Estonia significantly from the total number of R&D personnel is explained by two reasons. About one half of the R&D personnel in Estonia is employed in higher education sector, whereas majority of the R&D personnel acts there half-time as researcher and half-time as teaching staff. Similarly to the above, in enterprise sector, most of the R&D staff undertakes various other tasks besides R&D activities (e.g., product development, market research, etc) than pure R&D.

Figure 1 shows that Estonia's R&D personnel per 1,000 employment lags significantly behind the European R&D champions (Finland, Sweden, Germany, etc). Therefore, not surprisingly the Estonian R&D strategy *Knowledge-based Estonia 2007-2013* has set an objective to increase the share of full-time R&D personnel by 2013 to the level of European forerunners, which is 8 persons in 1,000 employment.[160]

We notice also that the share of full-time equivalent of the public sector R&D staff in work force in Estonia is fully comparable to the respective figure in any other Member State. Consequently, the foreseen growth has to come primarily from the private sector.[161]

[159] Statistics Estonia, August 2009, http://www.stat.ee.
[160] *Knowledge Based Estonia - Estonian R&D and Innovation Strategy 2007-2013*, Ministry of Education and Research, Tartu, 2007, http://www.hm.ee/index.php?popup=download&id=7669.
[161] The 21% average annual growth rate of full-time R&D personnel of business enterprise sector in 2001-2006 has been indeed remarkable. This is one of the highest growth rates in the EU-27 in this period. Eurostat, Statistics in focus, 91/2008.

Figure 1. The share of FTE of R&D personnel in 1,000 work force, 2003.[162]



Source: Eurostat, author's calculations.

In 2007 Estonian business enterprise sector had altogether 2,686 R&D personnel (1,689 in full-time equivalent). Computer related activities were in terms of employment of R&D personnel the single most significant economic sector employing 714 persons (553 persons in full-time equivalent), or approximately 1/3 of the private sector R&D staff.

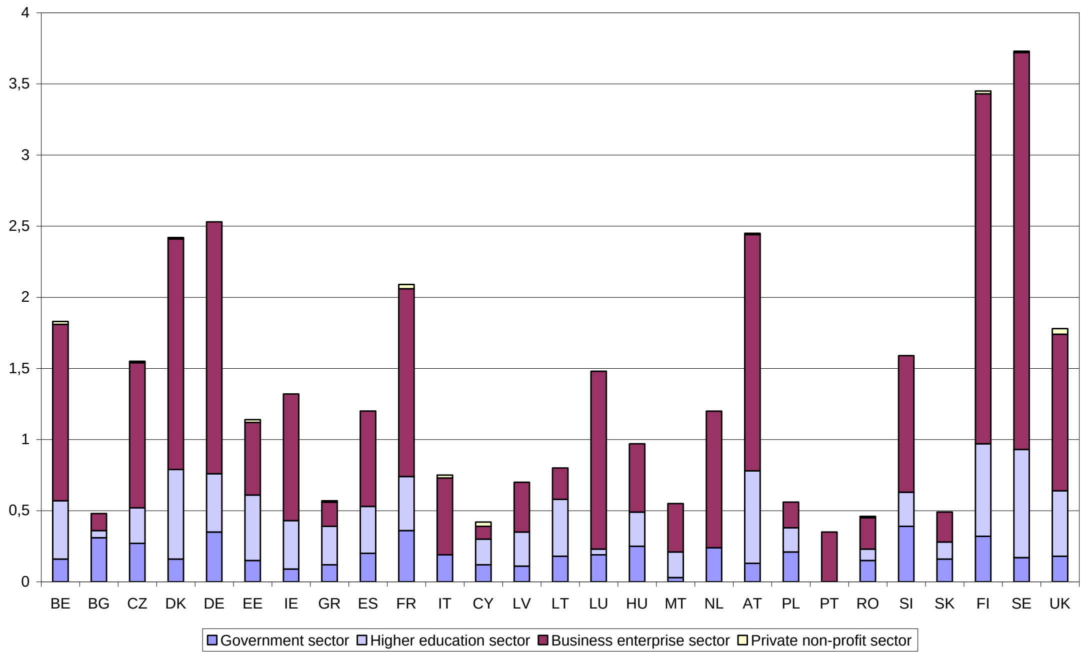
4.2 Research and technological development investment in Estonia

Estonia has witnessed in recent years very rapid increase of research and technological development (RTD) investment. Albeit from a low level, it has been one of the fastest increases of R&D investment in Europe reaching more than 25% per year over the last five years. In 2007, Estonia's gross domestic expenditure on R&D (GERD) reached 1.14% of GDP.

A comparison of Estonian GERD with that of the other Member States reveals that Estonia's public sector expenditure on R&D is fully comparable to European average. However, despite recent rapid growth, business sector R&D investment (BERD) continues to lag significantly behind Finland, Sweden and others. (Figure 2)

[162] The above Eurostat data is unfortunately outdated, but there is no more recent data available to calculate the share of FTE R&D personnel for individual Member States. Also, the data for the United Kingdom is missing. However, for most of the countries, the number of R&D personnel changes rather slowly. Therefore, we deem the use of this data for our purposes of the above argument justifiable.

Figure 2. Total intramural R&D expenditure (GERD) by sectors of performance, 2006.[163]



Source: Eurostat, author's calculations.

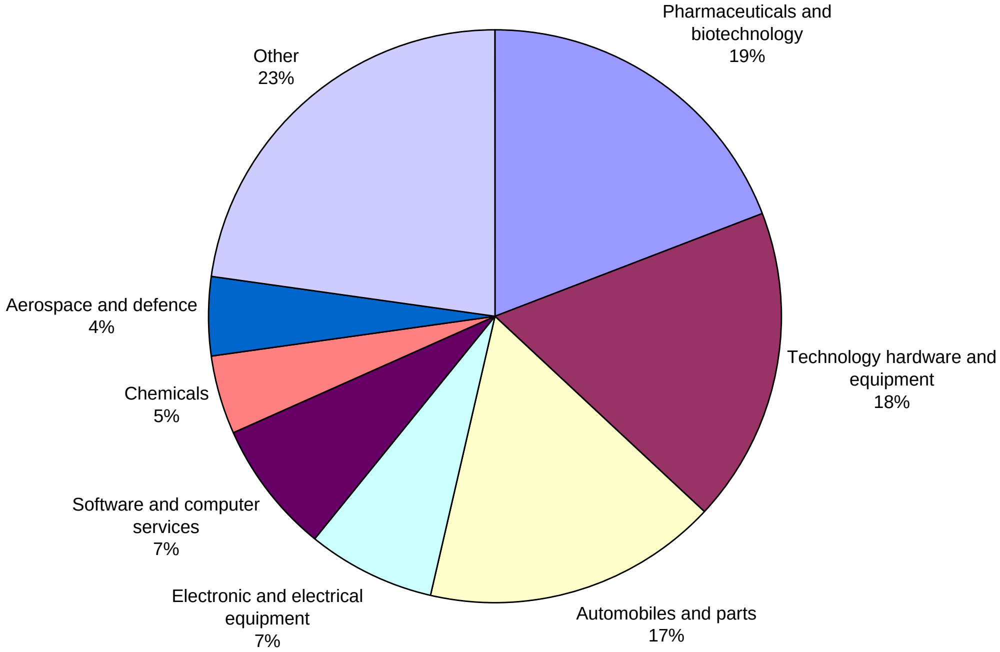
Thus, the objective of *Knowledge based Estonia 2007-2013* to increase the Estonia's R&D expenditure by 2014 to 3% of GDP[164] remains challenging. We find it especially challenging as comparing figures 1 & 2 reveals that there is a rather clear correlation between the number of R&D private sector personnel and private sector R&D investment. In other words, an increase of Estonia's private sector R&D investment prerequisites a substantial increase in R&D personnel in business enterprise sector.

A closer look at the structure of business sector R&D investment reveals also that majority of business R&D investment is intramural investment, i.e., the investing enterprise itself implements the respective R&D activities. This, of course, reinforces once more our argument on the need to increase the number of business sector R&D personnel.

Furthermore, we highlight the fact, based on Pavitt's typology, that R&D and knowledge intensity of various industries varies significantly and information and communications technology (ICTs) has a crucial role to play when it comes to devising significant increase of business R&D investment.[165] According to *Industry Classification Benchmark* five industries of 37, namely ICTs, bio-pharmaceutical and automotive industries, account for 2/3 of global private R&D investment. (Figure 3)

[163] Due to the lack of data in Eurostat Figure 2 does not reflect public R&D expenditure in Portugal. Also data about higher education sector R&D expenditure in Italy and Netherlands is missing..
[164] *Ibid.*
[165] See also: Geomina Turlea *et al*, *The 2009 report on R&D in ICT in the European Union*, European Commission - Joint Research Centre, Luxembourg, 2009, 45.

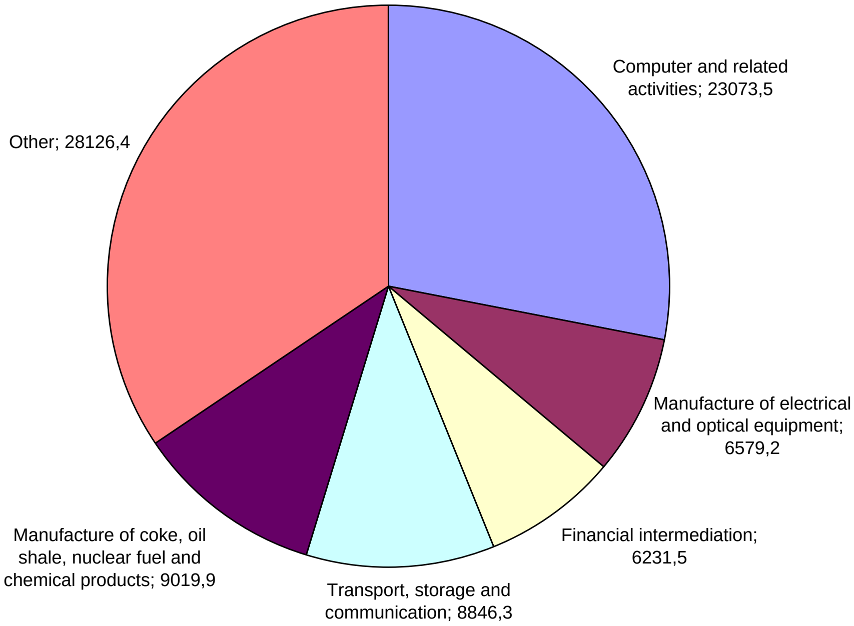
Figure 3. Private R&D investment by major industries .



Source: *The 2007 EU Industrial R&D Investment Scoreboard*, European Commission, DG JRC/IPTS, http://iri.jrc.ec.europa.eu/research/scoreboard_2007.htm.

The structure of intramural business R&D expenditure varies obviously from country to country depending on presence and comparative strengths of individual industries. Nonetheless, Estonian BERD figures fit largely the above global pattern. In 2007 computer related activities, manufacturing of electrical and optical equipment; and transport, storage and communication accounted for one half Estonian business sector intramural R&D investment. Financial intermediation as intrinsically ICT intensive services sector; and manufacturing of chemical products contributed also significantly. (Figure 4)

Figure 4. Intramural R&D expenditure in Estonian business sector, 2007, in kEUR.



Source: Statistics Estonia, July 2009, http://www.stat.ee; authors' calculations.

Thus, ensuring availability of qualified R&D personnel - especially so in information and communication technologies and biotechnologies - has a crucial role to play in making the Estonia's aspirations reality and allowing for significant increase of business sector R&D investment.

5 Options for tax subsidization of R&D in Estonia

This chapter analyzes R&D tax incentives to promote research and development activities in Estonia. As the previous analysis showed, business sector generally under-invests in R&D from the socially optimal perspective. R&D tax incentives are aimed at reducing the costs of such activity.

R&D tax incentives reduce the tax burden related to R&D activities of public and private sector players with the emphasis on private sector R&D expenditure growth. This is because business sector R&D investment (BERD) continues to lag significantly behind Finland, Sweden and others whereas Estonia's public sector expenditure on R&D is fully comparable to European average (please see chapter 4.2). The aim of the selected incentives is to reduce the corporate tax liability (income tax on dividends) or ease the tax burden on labour costs of a company making R&D expenditures or receiving income from R&D activities.

Personal income tax incentives are also included as much as income tax is considered as part of labour cost for the company. The selected tax incentives are not aimed at promoting individuals' R&D investments. Therefore, sole proprietors (FIE) are left out of the scope of the analysis.

The incentives are selected on the basis of international experience and modified to suit the Estonian corporate income tax system that is rather different from the classical corporate income tax systems used by other countries. In addition, the authors of this report have found that some of the tax incentives used by other countries breach the EC state aid rules or are in conflict with EU Treaty freedoms. Therefore, some of the selected tax incentives have been modified/left out from the analysis in order to avoid future disputes. Therefore, these issues are also discussed in this chapter.

We have also defined the R&D costs and R&D personnel for the purpose of implementation of the selected incentives in Estonia. In addition, possible tax avoidance under the R&D tax incentives is addressed. Chapter 5 also gives an overview of the implications, trade-offs and effects of different selected incentives.

The main conclusions to be drawn from this chapter are:

- *The Estonian current tax system was meant to be favouring reinvestment as opposed to classical corporate income tax system that is not aimed at favouring such activity. However, it cannot be said that Estonian corporate tax system is an R&D tax incentive in itself as it does not make a difference between the investment opportunities available.*
- *Under the current income tax system the companies have an option to just accumulate profits and not to reinvest these, i.e. there is no incentive to invest in R&D as opposed to any other investment opportunity that may provide faster profits.*
- *Based on the international experience, the R&D tax incentives selected for the Estonian purposes are aimed firstly at increasing the private sector R&D expenditure in order to reach the target of 2% target of GDP and secondly at increasing the number of R&D workers to reach the goal of 8 R&D personnel per 1,000 employed persons.*
- *The selected tax incentives that can be applied in the Estonian Corporate Income Tax (CIT) system are divided into two subcategories: corporate income tax incentives and wage tax incentives.*

- *For the purpose of this report corporate income tax is calculated on dividends distributed to shareholders and the R&D CIT incentives are designed to reduce the tax burden on distributed dividends.*
- *CIT incentives encourage companies to invest in R&D as opposed to any other investment opportunities and distribute profits.*
- *The positive qualitative effects of the R&D tax incentive based on a deduction of a certain lump sum amount from CIT base per supplementary R&D personnel hired compared to the previous period in which dividends were distributed are:*
    - *Increase in the number of R&D personnel in the business sector.*
    - *Targeted at the labour intensive sector rather than other sectors. However, as R&D is perceived to be a rather labour intensive activity we estimate that the labour costs make up about half of the R&D expenditure in business sector and therefore should be well targeted.*
- *The negative qualitative effects of the R&D tax incentive based on a deduction of a certain lump sum amount from CIT base per supplementary R&D personnel hired compared to the previous period in which dividends were distributed are:*
    - *Not benefitting the non-profit sector or companies not making a profits(e.g. start-ups)*
- *The positive qualitative effects of the R&D tax incentive based on a 10% of tax credit available of total R&D expenditure with the maximum ceiling at 30% of corporate income tax payable, excluding the expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies:*
    - *Increase in the total business sector R&D expenditure.*
    - *Level of R&D employees will increase.*
    - *Reflects the real spending patterns of companies (all R&D expenditures qualify).*
- *The negative qualitative effects of the R&D tax incentive based on a 10% of tax credit available of total R&D expenditure with the maximum ceiling at 30% of corporate income tax payable, excluding the expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies*
    - *Not benefitting the non-profit sector or companies not making profits*
    - *We have also considered to restricting the implementation to intramural R&D and R&D subcontracted to non-profit organizations (universities) to avoid cumulation of credits available. If applied to all R&D espenditure the method encourages cooperation between R&D players irrespective of available credits in other countries. Then cumulation is not avoided of R&D tax credit (the same cost can serve as a basis for double tax reduction).*
- *The positive qualitative effects of the R&D tax incentive based on an exemption of 80% of royalty income from patents from income tax on dividends are:*
    - *Similar incentives are introduced in several countries and e.g. in Belgium the scheme is already generally perceived to be conceptually simple, covering broad number of transactions, and seemingly less burdensome compared to other incentives.*

- *Well targeted because it targets the end result (creation of intellectual property) as opposed to the means (employees, expenditure) that may, but also may not, result in additional welfare gains.*
- *Competitive on the international level as generates 5.3% of effective tax rate on income from royalties (in Luxembourg is 5.72%, Netherland 10%, Belgium 6,8% and in Singapore such foreign sourced IP income is exempt from income tax for 5 years).*
- *Encourages Estonian companies to patent their products or services.*

- *The negative qualitative effects of the R&D tax incentive based on an exemption of 80% of royalty income from patents from income tax on dividends are:*
  - *Not benefitting the non-profit sector or companies not making profits*
  - *Estimated impact of this incentive is not as broad as for other incentives*
  - *The benefits of this incentive can be enjoyed with possibly a relatively large time-lag.*
  - *Developing and registering a patent is a costly process and the patent tax incentive alone may not be attractive to companies.*
- *Currently, the private R&D intensity is grater in the computer related activities, manufacturing of electrical and optical equipment; and transport, storage and communication, financial intermediation and manufacturing of chemical products and therefore, it is expected that in the short run that these are the sectors that will benefit the most from the proposed R&D incentives.*

- *Current Estonian tax system relies heavily on labour taxes. Considering the fact that labour costs make around half of the total R&D costs, Estonian system is rather unfavourable in terms of labour-intensive R&D. Thus, wage tax measures have a great potential in the R&D incentive context in Estonia.*

- *The positive qualitative effects of the R&D wage tax incentives are:*

- *Wage tax incentives do not require taxable profit, i.e. relevant for new innovative companies as those may not be profitable during the start up period and non-profit sector*
- *Wage tax incentives tend to favour internal R&D as opposed to contracting the R&D activities out which stimulates the investment in human capital.*
- *Increasing the number of R&D personnel and the R&D expenditure in terms of wages.*
- *Positive effect on companies' cash flows as benefits of the incentive can be enjoyed on a monthly basis which is especially beneficial to small companies*
- *Will benefit the business sector as well as the non-profit sector*
- *Favourable effects in terms of the breakdown of the by the type of R&D activity, e.g. most of the basic research is done in universities thus the breakdown may not be distorted.*

- *The negative qualitative effects of the R&D wage tax incentives are:*

- *Not specifically targeted at business sector R&D performance.*
- *Target the R&D labour costs as the most prominent input to R&D activity but do not target the other inputs, like investment to machinery.*

- *It should be borne in mind that the possible R&D tax incentives to be implemented in Estonia do not infringe EU Treaty freedoms and are compatible with state aid rules*
- *For the Estonian purposes we advise to focus on the classification of R&D personnel based on occupation dividing them into three categories: researchers; technicians and equivalent staff; and other supporting staff.*
- *For the Estonian purposes the we suggest that the OECD geneal framework guidelines for qualification of R&D expenditure are followed similarly to other country experience including basic research, development and applied research.*
- *As it is more difficult to keep track of foregone tax revenue than it is to keep track of real out of pocket expenses we find that tax audits during the first years of R&D tax incentive application are essential to be carried out.*
- *In addition, if the appropriate tax incentive(s) for Estonia have been chosen these should be coordinated with the existing government grants to R&D activity to avoid overlapping in terms of targeting objectives as R&D grants and R&D tax incentives are generally substitutes.*

5.1 Possibilities for R&D Tax measures in the EU legal framework

In this chapter we have considered the possibilities of implementation of R&D tax incentives from the EU Treaty perspective. First, an overview of the state aid rules from the R&D tax incentives perspective is given, and second the EU treaty freedoms are discussed from the R&D tax incentives perspective.

5.1.1 R&D measures vs. state aid rules

Article 87 (1) of the EC Treaty defines the state aid as „any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market".

The principle of incompatibility with the common market and the derogations from that principle apply to aid "in any form whatsoever", including certain tax measures[166].

To be termed aid, within the meaning of Article 87 of the EC Treaty, a measure must meet the cumulative criteria described below:

Firstly, the measure must confer on recipients an economic advantage which relieves them of charges that are normally borne from their budgets. The advantage may be provided through a reduction in the firm's tax burden in various ways, including:

- a reduction in the tax base (such as special deductions, special or accelerated depreciation arrangements or the entering of reserves on the balance sheet);
- a total or partial reduction in the amount of tax (such as exemption or a tax credit), deferment, cancellation or even special rescheduling of tax debt.[167]

For example, the county of Aland in Finland introduced an amendment to its tax law under which captive insurance companies meeting certain criteria could benefit from lower taxation (equal to 10 percentage points) than that would normally apply to companies. Consequently, captive insurance companies paid a lower overall rate of corporation tax than the standard rate of 25 percent applicable at that time. In it's decision, the EU Commission points out that a lower rate of taxation confers an advantage on a company by enabling it to retain a greater proportion of its profits either for distribution to its members or shareholders or for reinvestment and therefore confers an advantage on eligible companies.[168]

Secondly, the advantage must be granted by the State or through State resources. A loss of tax revenue is equivalent to consumption of State resources in the form of fiscal expenditure.[169]

In 1984, rules were introduced according to which a company satisfying certain conditions (amongst which only non-residents may have a beneficial interest in the shares of the company) could obtain a Qualifying Company certificate. A Qualifying Company was liable to taxation on its profits at a rate which was always lower than the normal corporate tax rate, which at that time stood at 35 percent. The rate of tax applied was negotiated between the company concerned and the Finance Centre Division, part of the Gibraltar Government's Department of

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[166] Commission notice on the application of the State aid rules to measures relating to direct business taxation (98/C 384/03) (Hereinafter „Commission notice ...")

[167] Commission notice ...

[168] 2002/937/EC

[169] Commission notice ...

Trade, Industry and Telecommunications. There was no statutory guidance for the conduct of these negotiations. The vast majority of Qualifying Companies paid a rate of tax of between 2 and 10 percent and the policy of the Gibraltar authorities has been to ensure that all Qualifying Companies paid between 2 and 10 percent taxes.

In that case, the EU Commission considered that the tax advantage, for the purposes of Article 87(1) EC Treaty, is granted through State resources, since the origin of this advantage is the renunciation by the Member State of tax revenue which it would normally have received. In the absence of the ring fenced tax advantage, the activities of Qualifying Companies, to the extent that they occur under the jurisdiction of the Gibraltar authorities, would be subject to the full rate of tax in Gibraltar. This difference in tax rate represents the tax revenue foregone.[170]

Thirdly, the measure must affect competition and trade between Member States. This criterion presupposes that the beneficiary of the measure exercises an economic activity, regardless of the beneficiary's legal status or means of financing. The mere fact that the aid strengthens the firm's position compared with that of other firms which are competitors in intra-Community trade is enough to allow the conclusion to be drawn that intra-Community trade is affected.[171]

As an example, the former special tax regime applicable in France to takeovers of companies active in certain highly competitive sectors provided for a 2 years corporate income tax exemption in the case where newly set up companies took over the assets of companies which had been, or were about to be, wound up. To qualify for this exemption, the takeover had to involve either a company the transfer of which had been ordered by a court or a company which was nearly insolvent. Moreover, companies exempted from corporate income tax could also be exempted from trade tax ("*taxe professionnelle*") and property tax ("*taxe foncière*") for two years.

In this case the EU Commission considered that the measure at issue, especially when applied to certain highly competitive sectors, such as shipbuilding, the motor industry, holding companies, the printing industry, the leather industry, the paper industry, the chemical industry and the production of telecommunications equipment, affect intra-Community trade and distort or threaten to distort competition. The fact that the aid is relatively small in amount does not alter its nature. Second, aid given to newly created companies is still aid that affects intra-Community trade even if it is authorisable in certain cases.[172]

Lastly, the measure must be specific or selective in that it favours “certain undertakings or the production of certain goods”. For example, a scheme is considered “selective”, if the authorities administering the scheme enjoy a degree of discretionary power[173]. If in daily practice tax rules need to be interpreted, they cannot leave room for a discretionary treatment of undertakings. Every decision of the administration that departs from the general tax rules to the benefit of individual undertakings in principle leads to a presumption of State aid and must be analysed in detail. As far as administrative rulings merely contain an interpretation of general rules, they do not give rise to a presumption of aid.[174]

The Court of Justice acknowledges that treating economic agents on a discretionary basis may mean that the individual application of a general measure takes on the features of the selective

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[170] 2005/77/EC
[171] Commission notice ...
[172] 2004/343/EC
[173] Vademecum. Community law on State aid; 30.09.2008;
http://ec.europa.eu/competition/state_aid/studies_reports/studies_reports.cfm
[174] Commission notice ...

measure, in a particular where exercise of the discretionary power goes beyond the simple management of tax revenue by reference to objective criteria.[175]

Regarding the question whether the tax authorities have a discretionary power, the EU Commission has concluded that the aid is not granted automatically and shall therefore be considered as selective if “the application submitted by the recipient is examined beforehand by the local authorities, which, after carrying out the examination, may, if appropriate, grant the aid”.[176]

The selectivity criterion is also satisfied if the scheme applies to only part of the territory of a Member State (this is the case for all regional and sectoral aid schemes). The selective advantage involved here may derive from an exception to the tax provisions of a legislative, regulatory or administrative nature or from a discretionary practice on the part of the tax authorities.[177]

For example, in order to allow firms in the Azores (an autonomous region of the Portuguese Republic) to overcome the structural handicaps resulting from their location in an insular and outmost region, the regional authorities adopted a regional decree N° 2/99/A on 20 January 1999 which provided for a reduction in the personal income tax rate of 20 percent (15 percent for 1999) and a reduction in the corporate income tax rate of 30 percent for taxpayers in the region. The ECJ concluded that the present measure is selective, since the tax reduction is offset by the financing mechanism which is managed at the Portuguese level.[178]

However, the selective nature of a tax measure may be justified by the nature or general scheme or overall structure of the system, as mentioned by the ECJ, if the Member State concerned can show that that measure results directly from the basic or guiding principles of its tax system[179]. In that connection, a distinction must be made between, on the one hand, the external objectives of a particular tax scheme and, on the other, the objectives which are inherent in the tax system itself[180].

State aid must be selective and thus affect the balance between certain firms and their competitors. “Selectivity” is what differentiates State aid from so-called “general measures” (namely measures which apply without distinction across the board to all firms in all economic sectors in a Member State (e.g. most nation-wide fiscal measures)).[181]

As an example, Italian government has tried to provide for the temporary and partial reduction of social charges pertaining to family allowances for companies belonging to the textile industry only. The ECJ decided that any measure intended partially or wholly to exempt firms in a particular sector from the charges arising from the normal application of the general system without there being any justification for this exemption on the basis of the nature or general scheme of this system constitutes State aid.[182]

Tax measures which are open to all economic agents operating within a Member State are in principle general measures. They must be effectively open to all firms on an equal access basis,

[175] Case C-241/94 France v Commission
[176] 2002/540/EC
[177] Commission notice ...
[178] Case C-88/03 Portugal v Commission
[179] Cases 173/73 and C-88/03
[180] Commission notice ...
[181] Commission notice ...
[182] Case 173/73 Italy v Commission

and they may not *de facto* be reduced in scope through, for example, the discretionary power of the State to grant them or through other factors that restrict their practical effect. However, this condition does not restrict the power of Member States to decide on the economic policy which they consider most appropriate and, in particular, to spread the tax burden as they see fit across the different factors of production. Provided that they apply without distinction to all firms and to the production of all goods, the following measures do not constitute State aid:

- tax measures of a purely technical nature (for example, setting the rate of taxation; provisions to prevent double taxation or tax avoidance),
- measures pursuing general economic policy objectives through a reduction of the tax burden related to certain production costs (research and development (R&D), the environment, training, employment).[183]

The fact that some firms or some sectors benefit more than others from some of these incentives does not necessarily mean that they are caught by the competition rules governing State aid. Thus, measures designed to reduce the taxation of labour for all firms have a relatively greater effect on labour-intensive industries than on capital-intensive industries, without necessarily constituting State aid. Similarly, tax incentives for environmental, R&D or training investment favour only the firms which undertake such investment, but again do not necessarily constitute State aid.[184]

5.1.2 R&D tax incentives vs. EU Treaty freedoms

The European Union is based on the free movement of goods, people, services and capital. Therefore, all R&D tax incentives implemented by Member States, including Estonia, must conform to the fundamental Treaty freedoms and the principle of non-discrimination. In particular, any R&D tax incentive imposing restrictions on where the R&D is performed (territorial restrictions) has to be scrutinized to verify compatibility with EC Treaty Articles 43 (freedom of establishment) and 49 (freedom to provide services).[185]

An example of an explicit restriction is a legal provision which restricts the benefit of an R&D tax incentive to activities performed domestically. Territorial restrictions infringe upon the freedom of establishment by excluding companies from conducting or outsourcing their R&D elsewhere in the EU.[186] The ECJ, has expressed that Article 49 EC precludes legislation of a Member State which restricts the benefit of a tax credit for research only to research carried out in that Member State. The objective of Community R&D policy is to fully exploit the potential of the internal market through the removal of legal and fiscal obstacles to cooperation between undertakings.[187]

An example of implicit territorial restriction is a tax incentive covering the costs of subcontracted R&D, but limiting the proportion of R&D that can be subcontracted to nonresident entities. However, a tax incentive limiting the proportion of R&D that can be

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[183] Commission notice ...
[184] Commission notice ...
[185] Commission of the European Communities, Communication from the Commission to the Council, the European Parliament and the European Economic and Social Committee. Towards a more effective use of tax incentives in favour of R&D, p.3, Brussels 2006
[186] Communication ..., p. 5
[187] ECJ Case C39/04

subcontracted without making any distinction between resident and non-resident subcontractors would be acceptable.[188]

In principle, the ECJ has recognized that restrictions on the scope of tax incentives could, under certain specific circumstances, be justified, either by an exemption expressly provided for by the Treaty[189] or on other grounds recognized by the ECJ as overriding requirements in the general interest. However, the ECJ accepts such a restriction only where it is certain that the aims sought cannot be achieved using a less restrictive measure (principle of proportionality). In the past, Member States have sought to defend territorial restrictions before the ECJ on the basis of several arguments:[190]

a) Fiscal supervision

In principle, a Member State has the right to apply measures to ascertain clearly and precisely the amount of costs deductible as research expenditure (Baxter[191], Fournier). It may also require a non-resident taxpayer to demonstrate clearly and precisely that the losses he claims to have incurred correspond, under domestic rules governing the calculation of income and losses, to the losses actually incurred (Futura and Singer[192]). However, the ECJ has so far concluded that the restrictions in these specific cases are not proportionate to the aims sought. For example, in Baxter and Fournier, the ECJ concluded that national legislation that does not accept evidence submitted by a taxpayer as valid for R&D carried out in other Member States cannot be justified by the need for effective fiscal supervision. In these cases, reference is made to the fact that Member States should be able to obtain the relevant and necessary information under that Mutual Assistance Directive or through bilateral tax treaties.[193]

b) Loss of tax revenue

Member States have argued in several cases that preventing the loss of tax revenue could justify the imposition of a restriction. However, the ECJ has so far been very clear that budgetary arguments are not acceptable as such.[194]

c) Prevention of tax avoidance

The ECJ has, in principle, recognized that the prevention of tax avoidance could justify restriction of the fundamental freedoms. However, the ECJ would rather favour legislation aimed at preventing, on a case-by-case basis, wholly artificial arrangements. Furthermore, to prevent tax evasion, the ECJ has also referred to the possibility for a Member State to use the Mutual Assistance Directive.[195]

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188 Communication ..., p.6
189 EC Treaty Art 46 and 55
190 Communication ..., p.6
191 C254/97
192 ECJ C250/95
193 Communication …, p. 7
194 Communication …, p. 7
195 Communication …, p. 7

d) Promoting national R&D and competitiveness

In the Fournier case, the ECJ stated that promoting R&D may be considered an overriding requirement relating to public interest which may justify a restriction on the exercise of fundamental freedoms. It noted, however, that the refusal by a Member State to grant R&D tax relief on the basis that the R&D was carried out in another Member State is contrary to the objectives of Community R&D policy, which, according to Article 163 (1) of the EC Treaty, includes strengthening the scientific and technological bases of Community industry and encouraging it to become more competitive at international level.[196]

In conclusion, the R&D incentives selected or/and designed for Estonian purposes provided in this document are, as to our understanding, not in violation with the State aid rules and can be treated as general measures that will be compatible with the common market. They are not regional or local and do not intend to promote the economic development of a region; they are not sector specific nor intend to promote the production of certain goods or services; they do not favour only national products which are exported. None of the measures provided, depend on the status, size or the strength or the residency of the undertakings or is restricted to certain types of undertakings or to some of their functions. The tax incentives proposed in this document are open to all economic agents operating in Estonia.

In addition, it is our understanding that the designed measures do not conflict with the EU Treaty Freedoms. Namely, we have designed the R&D tax incentives so that any explicit, and implicit, form of territorial restriction would be avoided as these would not be considered to be in accordance with the EC Treaty. There is ample and consistent evidence that territorial restrictions on the application of R&D tax incentives are unlikely to be accepted by the ECJ[197]. This does not however preclude territorial restrictions which simply reflect the territoriality of the tax competence of Member States. For example, a wage tax or social security incentive for R&D personnel might by its nature be limited de facto to persons performing R&D activities in the Member State in which they are taxed or pay social security contributions.

[196] Communication …, p. 7
[197] Communication …, p. 7

5.2 Options for R&D tax incentive in the current Estonian tax environment

The current Estonian tax system is unique and it is our understanding that it can be perceived to be rather successful in term of tax competition as generating an effective average corporate income tax rate of about 17% as compared to a European average of 22.3 %[198].

The Estonian current tax system was meant to be favouring reinvestment as opposed to classical corporate income tax system that is not aimed at favouring such activity. However, it cannot be said that Estonian corporate tax system is an R&D tax incentive in itself as it does not make a difference between the investment opportunities available. Furthermore, under the current income tax system the companies may just accumulate profits and not to reinvest these. Currently there is no incentive to invest in R&D as opposed to any other investment opportunity that may provide faster profits.

In addition, in terms of R&D costs our current tax system relies very heavily on labour taxes. Considering the fact that labour costs make around half of the total R&D costs, Estonian system is rather unfavourable in terms of labour – intensive R&D.

Based on the international experience, the R&D tax incentives selected for the Estonian purposes are aimed firstly at increasing the private sector R&D expenditure in order to reach the target of 2% target of GDP and secondly at increasing the number of R&D workers to reach the goal of 8 R&D personnel per 1,000 employed persons.

Currently, the private R&D intensity is grater in the computer related activities, manufacturing of electrical and optical equipment; and transport, storage and communication, financial intermediation and manufacturing of chemical products (please see chapter 4.2). Therefore, it is expected in the short run that these are the sectors that will benefit the most from the proposed R&D incentives.

This chapter gives firstly an overview of the selection criteria of the suitable R&D tax incentives from the Estonian perspective. Secondly, the conditions for R&D expenditure to qualify for the tax incentives are given. Thirdly, R&D personnel definition for Estonian purposes is provided. Fourth, we have outlined the direct tax incentives that could be applied in Estonia on the basis of international experience.

5.2.1 Selection of R&D tax incentives for Estonia based on international experience

In classical corporate income tax systems corporate profits are taxed as they are earned. In Estonia, corporate income tax is payable only if and when the profits of an Estonian company are distributed. Reinvested profits are not subject to taxation.

In addition, there are several special rules applicable to R&D expenditure in different countries that are not relevant from the Estonian corporate income tax point of view. E.g. there are conditions for deductibility and tax treatment of R&D expenditure in several countries (Austria, Belgium, Cyprus, France, Germany, Greece, Denmark, Finland, Italy and Luxembourg etc.). The conditions may relate to deductibility, amortization, enhanced amortization, carry back and carry forward of losses, tax depreciation, tax deferrals regarding R&D expenditure for tax purposes etc.

[198]http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_papers/taxation_paper_14_en.pdf

For Estonian corporate income tax purposes the deductibility of R&D expenditure is relevant inasmuch as the R&D expense is related to the business of the company. Business related costs are not taxable; or are deductible if put in the context of classical corporate income tax system. Thus, Estonian corporate income tax system already entails the R&D cost deductibility measure as long as the R&D costs have been incurred for the purposes of deriving income from taxable business or are necessary or appropriate for maintaining or developing such business and the relationship of the expenses with business is clearly justified (Income Tax Act § 32 subsection 2). Therefore, these measures do not have an impact on the CIT liability of an Estonian company from the R&D expenditure point of view, provided that the R&D relates to the business of the company.

In addition, there are no special tax treatment requirements for R&D expenditure regarding amortization or depreciation in Estonia. Simply accounting regulations have to be followed. We have not considered it to be reasonable to include special tax treatment for amortization or depreciation of R&D expenses as these will complicate the simple Estonian CIT system and bring along further administrative costs for the companies in the form separate tax accounting. We have also not considered the possibilities for carry back and carry forward of tax losses as these cannot arise in the current corporate income tax system. Tax deferral is in principle already available in the Estonian corporate income tax system as CIT is payable upon dividend distribution and not at the time the income is earned or recognized for accounting purposes.

Enhanced deduction of R&D expenditure is in principle possible to implement in Estonia. Thereby, R&D expenditure would be taken into account as business related cost in more than 100% of expenses incurred. However, since enhanced deduction, tax credit and reduced income tax rate incentives based on the R&D expenditure would in principle bring along the same CIT liability we have chosen only tax credit incentive for our analysis.

In Austria, donations in cash or in kind from a business enterprise for R&D purposes that are made to a number of listed organizations and institutions (universities, national museums, the Austrian federal states and communities, the Austrian academy of science, societies operating on a non-profit basis under certain circumstances etc) can be deducted from the income tax base. The deductible donations are limited to 10% of the profit of the preceding fiscal year of the donor (IBFD report pg 28). However, the Commission has started an infringement procedure against Austria to end the discriminatory treatment of these institutions. According to the Commission, donations to certain institutions established in Austria such as universities, art colleges or the academy of science, may be recognized and deducted as operating expenses by any person making such donations, while donations to comparable institutions in other countries may not be deducted.

Secondly, without taking the place of establishment into account for certain other donation recipients engaged in research or educational activities, the donations are only recognized as deductible expenses if the related activities are carried out for the benefit of Austrian science or the Austrian economy. The Commission considers these rules to be incompatible with the freedom to provide services and the free movement of capital (IP/09/428; the Commission's case reference number 2007/2079[199]). According to the explanations received from Helmut Mayer, a Tax Partner at KPMG Austria, it is expected (according to the actions regarding previous policies of the Austrian Government) that the current discriminatory measures will be

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[199]http://europa.eu/rapid/pressReleasesAction.do?reference=IP/09/428&format=HTML&aged=0&language=en&guiLanguage=en

enlarged to cover also donations to other countries and the related activities do not have to be carried out for the benefit of the Austrian economy.

In Estonia, similar possibilities currently exist under the Income Tax Act § 49 subsection 2. Namely income tax is not charged on gifts and donations made to a person who owns a hospital, to a state or local government scientific, cultural, educational, sports, law enforcement or social welfare institution, or a manager of a protected area in a total amount not exceeding 3 per cent of the amount of the payments subject registered social tax made by the taxpayer during the same calendar year or 10 per cent of the profits for the last financial year of a taxpayer ended as of 1 January of a calendar year. The Commission has also started an infringement procedure against Estonia to comply with the Community legislation. In consequence, according to the proposed amendments to the Income Tax Act[200] gifts and donations to state or local government scientific, cultural, educational, sports, law enforcement or social welfare institution, or a manager of a protected area will be left out of the scope of § 49 subsection 2.

It may be argued that Estonia could take the other way and also extend the scope of § 49 subsection 2 to the qualifying recipients of the other EU countries. However, in our view this is not necessary as the companies could transfer funds to such institutions based on cooperation or service agreements. Any expense made by a company is not subject to income tax (is deductible) if it's related to the business activity of the company. Thus, if an Estonian company concludes cooperation or services provision agreement with a university, hospital, scientific institution etc. and may enjoy the benefits of such agreement at a later stage (there is economic substance to the agreement) income tax consequences will not follow for the company. Thus, we have discarded this incentive from our analysis.

Most of the R&D tax incentives used in other countries are aimed at reducing corporate income tax liability of a company active in R&D. There are some non-EU countries that use also value added tax (VAT) incentives. In China import VAT and customs duty may be exempted on qualified import of R&D equipment, in Pakistan the incentive reduces customs duty on importation of specified goods to 0 percent in some cases and to 5 percent in some other cases, as well as provides zero-rating or exemption from sales tax. In Vietnam import duty and VAT exemption applies for qualified R&D equipments, trial products are not subject to VAT, import of R&D machinery and equipments, which cannot be produced domestically, are exempted from VAT import and import duty. In discussion with Lemmi Oro from the Ministry of Finance of Estonia we have decided to drop the VAT incentives from the current R&D tax incentive measures study as VAT legislation has been harmonized in most part by the Directive 2006/112/EC. Thus, from the Estonian perspective it would be very difficult to adopt effective R&D VAT measures in the context of the Directive or push through changes at the European level. Thus, we have disregarded the abovementioned VAT measures used in other countries from our analysis. This applies also to customs duty measures.

5.2.2 Selected R&D tax incentives for Estonia and implementation

The selected tax incentives that can be applied in the Estonian Corporate Income Tax (CIT) system are divided into two subcategories: corporate income tax incentives and wage tax

[200] http://eoigus.just.ee/?act=10&subact=1&ESILEHT_ELEHT=266699&did=266693&kkring=266699&ver=&nr=1

incentives. Some of the incentives used by other counties are modified so that these can be implemented in the Estonian CIT system and some are left unchanged in principle.

In addition, we have designed the tax incentives so that they will be implemented without termination date as the international practice shows that the tax incentives work better if they are designed to last[201]. The corporate income tax incentives should be applied both to resident companies as well as permanent establishments of foreign companies in Estonia as there can be no discrimination between these according to the freedom of establishment. The wage tax incentives should be also applied both to resident as and non-resident employees equally in order to avoid discrimination.

In addition, we have designed the tax incentives to be as simple as possible to avoid high administrative and compliance costs and to be in line with the current Estonian corporate income tax system that is perceived to be very simple in terms of international standards[202]. Also, as per the European Commission Task force on fiscal incentives[203], the incentives should be simple, incur low administrative and compliance costs, they should be reliable and stable in long term. While selecting the tax incentives for Estonia these recommendations have been taken into account.

In addition, as the theory on R&D tax incentives shows (please see chapter 2.3) we have designed the tax incentives so that they would target one single aim. There are possibilities to combine the different single goal tax incentives with others; however, this is more of a political choice to make. In addition, if the appropriate tax incentive(s) for Estonia have been chosen these should be coordinated with the existing government grants to R&D activity to avoid overlapping in terms of targeting objectives as R&D grants and R&D tax incentives are substitutes.

We have not made any selection based on the size of the company the tax incentives should apply to. This is because we believe that the overall R&D costs should be increased and it may be that the R&D that different firms of different sizes carry out may be complementary[204].

5.2.2.1 Corporate income tax incentives

The R&D tax incentives outlined in this chapter can be used to decrease the corporate income tax liability of a resident company as well as a permanent establishment (PE) of a foreign company in Estonia. Corporate income tax is generally calculated on dividends distributed to shareholders (in case of a PE the assets taken out of the PE without receiving any assets, goods or services in return); fringe benefits; taxable proportion of gifts, donations, entertainment expenses; non-business related expenses and other payments not related to the business of the taxpayer.

In our view, the CIT incentives for R&D should merely be applied to dividends and similar distributions made by the PE (for both cases further referred to only as “dividends”). It is our understanding that the costs and expenses not related to the business activity of a company do not generally create added value for R&D purposes and thus the tax incentives should not apply

[201] Guellec, D., B. van Pottelsberghe (2000): „The Impact of Public R&D Expenditure on Business R&D.” STI Working Paper 2000/4, OECD, Paris. Please also see the recommendations to the Dutch R&D policy analysis pg. 53.
[202] OECD Economic Surveys: Estonia 2009, pg 132.
[203] EC Task force on fiscal incentives
[204] Please see the recommendations to the Norwegian policy analysis pg. 50.

to costs that are not related for the business of the company. In addition, the other distributions mentioned do not benefit the shareholders of the company as opposed to dividend distributions that directly benefit the shareholders. Therefore, reducing the tax liability on dividends is most reasonable from the shareholder's perspective. For those reasons, the taxable proportion of gifts, donations and entertainment expenses and fringe benefits is also left out from the corporate income tax base relevant for R&D tax incentives.

The current Estonian CIT system somewhat favours investments but does not make a difference between investments as long as the investment can be perceived to bring future profits. In addition, the current system may favour the accumulation of liquid funds and therefore the Estonian companies are rather cash-heavy. There no direct link between corporate income and tax obligation in terms of timing as well as size as these are discretionary company decisions. Therefore, the corporate income tax incentives for R&D purposes encourage companies to invest in R&D as opposed to any other investment opportunities and distribute profits.

5.2.2.1.1 Reduction of CIT tax base on the basis of number of additional R&D employees

Following the Belgian example of profit exemption from CIT based on the number of additional R&D employees we have considered a similar measure to be implemented in Estonia. In Belgium profits were exempt up to an amount of EUR 12,780 (tax year 2006, assessment year 2007) per supplementary staff member hired for scientific research. For highly qualified employees appointed to carry out scientific research, the exemption is increased to EUR 25,570 (tax year 2006, assessment year 2007). A highly qualified employee is defined as an individual who has a PhD and has at least 10 years of working experience. Unfortunately, the outcome of the impact analysis of the Belgian tax incentive on R&D-activities will be available at the end of 2009.

Although this measure has been abolished from assessment year 2008 in Belgium as it was perceived to be rather burdensome from an administrative point of view we have considered it relevant to be investigated because one of the targets of the Estonian R&D strategy *Knowledge-based Estonia 2007-2013* has set an objective to increase the share of full-time R&D personnel by 2013 to the level of European forerunners, which is to 8 persons in 1,000 employment. We expect that this tax incentive will bring about the increase in the number of R&D personnel in the business sector. This measure is not intended to benefit the non-profit sector because the public-sector R&D staff in work force in Estonia is fully comparable to the respective figure in any other Member State already. Therefore, the incentive is designed so that the business sector would benefit from the incentive as long as it will increase the number of R&D staff. This incentive is different from the other R&D employee related incentives in the way that it only targets businesses as opposed to other employee related incentive which target also public sector.

This incentive is targeted at the labour intensive sector rather than other sectors. However, as R&D is perceived to be a rather labour intensive activity we estimate that the labour costs make up about half of the R&D expenditure in business sector and therefore should be well targeted.

For the Estonian corporate income tax purposes we have simplified the Belgian measure to be implemented as

- *a deduction of a certain lump sum amount (EEK 300,000 per additional employee are considered) from CIT base (amount of dividends to be distributed) per supplementary R&D personnel hired compared to the previous period in which dividends were distributed.*

The definition of R&D personnel will be expressed in full time equivalents and has to meet the criteria described in chapters 5.2.3 and 5.2.4.

5.2.2.1.2 R&D expenditure tax credit

There are several countries that use income tax rate reduction for R&D companies, tax credit, tax allowance or enhanced deduction based on the volume of R&D expenditure. In principle, all of the mentioned R&D expenditure tax incentives work roughly the same way in the current Estonian corporate income tax system. We have selected R&D tax credit system for the Estonian corporate income tax purposes because we find it the simplest to implement to reduce the administrative costs, and is more transparent than the other similar measures mentioned above.

Tax credit is applied by directly deducting the creditable amount (a percentage of R&D expenditure) from the company's income tax liability to reduce the amount of tax to be paid. Tax credit can be applied when profits are distributed in the amount of qualifying R&D expenditure incurred to that date. The company may also opt for not using the tax credit every time dividends are distributed and postpone the creditable amount to the future.

Currently, the Estonia's public sector expenditure on R&D is fully comparable to European average. However, despite recent rapid growth, business sector R&D investment (BERD) continues to lag significantly behind. Therefore, this incentive is designed to increase the business sector R&D expenditure. One of the components of this is also R&D employee costs, meaning that the level of demand for R&D employees should also increase. If there is sufficient supply of R&D employees it may be expected that the level of R&D employees will increase as well. The advantage of including all current R&D expenditures, and not only wages, is that it reflects better the real spending patterns of companies. As such it might be more stimulating for companies if they know that all current expenditure can be included.[205]

There are several ways in which tax credits can be implemented. Simple volume based tax credit of a certain percentage would benefit all companies that incur R&D expenses regardless of their level of R&D expenditure at the moment. In addition, tax credit can be implemented so that a certain minimum limit is set (in either lump sum amount or in percentage of R&D expenditure) and a tax credit would be allowed if the company exceeds that limit. Tax credit can be also implemented so that a certain level of R&D expenditure would give a certain percentage of R&D tax credit and the amount exceeding that limit would give a lower (or higher) percentage of tax credit in addition (two tired credit). Tax credits can also be implemented with a ceiling.

We have not selected an incentive with a minimum expenditure ceiling in order to encourage all companies to engage in R&D investment and because setting a minimum expenditure requirement would possibly harm small companies. The Norwegian study also suggests that if the purpose of the scheme is to get firms with little R&D activity to increase this amount, the scheme should apply regardless of the size of the firm either in terms of number of employees or turnover; it is the extent of R&D activity that is important.

We have not considered a two tired credit because we estimate that the administrative costs of implementing a two tired system would lead to higher administrative burden and corrupt the current simple system. We have, however, set a ceiling to the maximum creditable amount because we estimate that unlimited tax credit would lead to too heavy burden on state budget. Instead of capping the credit with a certain lump sum amount we have opted for a percentage. This is because the lump sum threshold should be changed accordingly as the Norwegian system shows.

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[205] http://www.belspo.be/belspo/stat/papers/pdf/fiscRDJune03.pdf

We have not considered the tax credit system to be implemented as refundable as the theory suggests that the subsidy part has little to do with externalities cf. Hall (2002). In addition, as the Norwegian experience shows most part of the total tax expense is paid as a subsidy as opposed to being the result of a tax deduction. Therefore, the authors of the Norwegian study pose a question whether it is beneficial for the SkatteFUNN scheme to be formally a part of the tax system, when it really is a subsidy scheme. The Norwegian study also suggest that because of small firms financing problems, changing the scheme to a subsidy scheme provides a better liquidity effect than the current scheme. Five years of experience with the current SkatteFUNN scheme, which in practice has proven to resemble more closely a subsidy scheme than a tax deduction scheme, calls for a reconsideration of the suitability of the organization of SkatteFUNN as a part of the tax system.

For the Estonian corporate income tax purposes we have designed the R&D tax credit to be implemented as a simple credit with maximum ceiling. We have considered two options for that purpose:

- *10% of tax credit available of total intramural R&D and subcontracted R&D to non-profit organizations (e.g. universities*[206]*) expenditure with the maximum ceiling at 30% of corporate income tax payable (the credited amount cannot be more than 30% of the total corporate income tax payable on dividends). The expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies are excluded.*

- *10% of tax credit available of R&D expenditure (including subcontracted R&D) with the maximum ceiling at 30% of corporate income tax payable (the credited amount cannot be more than 30% of the total corporate income tax payable on dividends). The expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies are excluded.*

The first credit method is designed to be implemented to only intramural R&D activities and subcontracted R&D activities to non-profit organization in order to avoid cumulation of credits available. E.g. if an Estonian company subcontracts R&D to another company of a country where R&D tax incentives are also available both companies benefit from the R&D incentive on the same cost incurred. In case of Universities and other non-profit organization, this is not generally a problem, because non-profit organizations do not earn profit and cannot benefit from the same incentive. The non-profit organizations could include Estonian as well as foreign institutions, however, could also be limited to EEA institutions. There are some countries (e.g. Belgium, France, and Netherlands) that provide for R&D wage tax incentives that are generally also available for non-profit organizations. However, we do not estimate that this would entail intensive cumulation of R&D tax benefits. E.g. the UK excludes the subcontracted research expenditure from the tax measure, however, allows it for subcontracted R&D to universities and other research institutions. France, Ireland and Japan restrict the application of subcontracted R&D in certain amounts.

The second credit method is favourable because it encourages for cooperation between R&D players irrespective of available credits in other countries. However, it does not avoid the cumulation of R&D tax credit (the same cost can serve as a basis for double tax reduction). In addition, transfer pricing principles have to be applied for subcontracted R&D.

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[206] The Belgian R&D policy analysis suggests that outsourced R&D to universities, public labs and high schools to be eligible, please see pg. 60.

It should be noted that the R&D tax credit cannot be available for the company if the R&D costs are financed from public finds, i.e. government grants or other publicly funded resources (EAS grants, EU grants). This is because such funding does not foster the private R&D spending and grants a double benefit for the same fund.

For the purpose of this incentive we have also defined the R&D expenditure that qualifies for the incentive in chapter 5.2.3. Similarly to the incentive mentioned in section 5.2.2.1.1. this incentive targets the business sector, but is broader than the one based on the number of additional R&D employees.

5.2.2.1.3 Exemption of income from royalties (patents)

Recently, several countries (Singapore, Belgium, Luxembourg, the Netherlands) have considered the income from royalties to be (partially) excluded from the corporate income tax base. The Belgian new patent system is already generally perceived to be conceptually simple, covering broad number of transactions, and seemingly less burdensome compared to other incentives. As the new regime is, in principle, applicable to all Belgian companies and branches in Belgium, and as Belgium does not impose a requirement with regard to the location of the R&D activities, the new Belgian tax regime for patent income is compliant with the rules and initiatives of the European Union with regard to unlawful state aid, the free movement of capital and harmful tax competition [207]. The shift towards encouraging patent protection has also been suggested so that private returns of the R&D undertaken would increase as well[208].

According to our knowledge the patent income regimes have not been analysed in any of the countries. The Netherland patent box regime will be evaluated in 2010[209].

In our view, this incentive is very well targeted because it targets the end result (creation of intellectual property) as opposed to the means (employees, expenditure) that may, but also may not, result in additional welfare gains. However, the estimated impact of this incentive may not be as broad as for the R&D expenditure or R&D wage tax based incentives. It generally takes several years to develop a patent and therefore the benefits of this incentive can also be enjoyed with a time-lag. In addition, there are currently an average of 8-9[210] patents registered in Estonia per year in Estonia by persons living or registered in Estonia, meaning that just a few companies would benefit from the incentive currently. Furthermore, developing and registering a patent is a costly process (cost for filing European patents is € 50,000 per patent, e.g. five times higher than in the US [S&T2003][211]) and the patent tax incentive alone may not be attractive to companies. Therefore, we are considering this incentive to be more effective to be implemented together with any of the other incentives that also give relief with regard to the developing costs incurred (either R&D expenses in general or only labour costs).

From the Estonian perspective we have considered that:

- *80% of royalty income from patents is exempt from income tax on dividends.*

This means that only 20% of the patent income (royalties) distributed as dividends will remain taxable according to general rules. In order to design the incentive to be comparable at the international level we have designed the tax incentive to generate 5.3% of effective tax rate on income from royalties. For comparison, effective tax rate on IP income in Luxembourg is 5.72%[212], Netherland 10%[213], Belgium 6,8%[214] and in Singapore such foreign sourced IP income is exempt from income tax for 5 years.

[207] Dirk Van Stappen, Andres Delanoy and Yves de Groote "New Patent Taxation Regime: Patent Income Deduction Creates Opportunities for Innovative Companies" INTERNATIONAL TRANSFER PRICING JOURNAL SEPTEMBER/OCTOBER 2007, p. 291-296)

[208] Assessment of the Belgian Fiscal Incentives for business R&D; Van Pottelsberghe B., Nysten S. and Megally E.; June 2003, SSTC and CEB Working Paper, Solvay Business School, ULB

[209] http://www.managingip.com/article/2215289/Patent-related-tax-benefit-for-Dutch-corporations.html

[210] www.epa.ee

[211] ftp://ftp.cordis.europa.eu/pub/ist/docs/embedded/final-study-181105_en.pdf

[212] http://www.kpmg.lu/Download/Brochures/2009/Luxembourg%20-%20A%20tailor-made%20IP%20Location.pdf

[213] http://www.us.kpmg.com/microsite/TNF-Europe/2009/Aug/TNFEUR09_33Netherlands.html

The deduction will apply only to arm's length patent income and not for royalties on trademarks, trade names, designs, know-how. Only the income from patents that are developed by the company itself (Estonian company has economic and legal ownership and bears the risks and expenses of the development of the patent) can benefit from the deduction. In case the company has acquired the patents, the income will only benefit from reduced taxation provided that the company has further developed the patented products if this further development has led to additional patents.

If all patent related income (not self-developed) would be exempt in Estonia multinational companies would just use Estonian subsidiaries for tax planning purposes (take out the royalty income tax free) and very little benefit would arise for the Estonian economy.

The royalty income incentive should encourage Estonian companies to patent their products or services.

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[214] Dirk Van Stappen, Andres Delanoy and Yves de Groote "New Patent Taxation Regime: Patent Income Deduction Creates Opportunities for Innovative Companies" INTERNATIONAL TRANSFER PRICING JOURNAL SEPTEMBER/OCTOBER 2007, p. 291-296)

5.2.2.2 Wage tax incentives

We believe that wage tax measures have a great potential in the R&D incentive context in Estonia. They are appealing as the application of these measures does not require taxable profit. This would be especially relevant for new innovative companies as those may not be profitable during the start up period. In addition, non-profit sector can benefit from these incentives.

However, these incentives are not designed to specifically target the business sector R&D performance. In addition, these incentives do not target the R&D expenditure as a whole; they target the R&D labour costs as the most prominent input to R&D activity but do not target the other inputs, like investment to machinery. This does not, however, mean that there is no additionality to the other inputs as well as shown by the WBSO study. The WBSO ensures that more than 50% of the user dare to tackle R&D projects with a higher risk profile, perform R&D projects faster, plan R&D activities better, tend to keep R&D out of harm's way in the event of spending cuts[215]. In addition, as the evidence from the Netherlands shows, the wage tax incentive tends to favour internal R&D as opposed to contracting the R&D activities out. Furthermore, an incentive on wages can stimulate the investment in human capital. This is very beneficial as human capital, considered much less mobile than plants or companies, remains in the country in the event of a delocalisation of a company or its production facilities[216]. The idea is that by reducing the main item of expenditure for conducting R&D, companies will be (further) encouraged to perform (more) R&D.

The tax incentives discussed herein are aimed at reducing either the personal tax liability of an R&D employee or reducing the employer social tax burden. Formally, in Estonia the current 33% social tax is the liability of the employer, but in reality the companies always take into account the total salary expense which makes the salaries of the employees also lower. KPMG has published a study of the personal income tax and social tax rates in 2009[217] where the Estonian 21% flat personal income tax seemed rather attractive, compared to over 60% personal income tax in Denmark in case of USD 100,000 annual earning. However, one has to note that there is no separate social tax in Denmark – all the social sector is financed from the same personal income tax. Therefore, if we unite the Estonian personal income tax and social tax to one single withholding tax, we reach the result that in Estonia the tax rate would be approximately 41% in the same calculation. Considering the difference in development and general welfare, this kind of tax burden is clearly not attractive or even competitive.

All of the wage tax incentives are primarily targeted towards increasing the number of R&D personnel and the R&D expenditure in terms of wages. However, these incentives are not as broad based as e.g. R&D expenditure tax credit and may leave other R&D expenses untouched. However, these incentives may be more favourable to small companies as the benefits of the incentive can be enjoyed on a monthly basis as opposed to corporate income tax incentives which can be applied when and if dividends are distributed. Therefore, wage tax incentives have positive effect on companies' cash flows.

In addition, since wage tax incentives will benefit the business sector as well as the non-profit sector, these may have favourable effects in terms of the breakdown of the by the type of R&D

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[215] http://www.worldcat.org/wcpa/oclc/206570082?page=frame&url=http%3A%2F%2Fappz.ez.nl%2Fpublicaties%2Fpdfs%2F07OI35.pdf%26checksum%3Dd306846155e157de440b43d2967a13b5&title=&linktype=digitalObject&detail=

[216] http://www.belspo.be/belspo/stat/papers/pdf/fiscRDJune03.pdf

[217] http://www.kpmg.com/SiteCollectionDocuments/Individual-Income-Tax-Rates-Survey-2009_v2.pdf

activity as the share of business sector basic research amounts to only 5% of total R&D expenditure in the EU on average[218].

5.2.2.2.1 Reduced personal income tax

As the tax incentives mentioned in the previous chapter are only relevant for business sector, we have also included R&D tax measures that are relevant also in the public sector and private non-profit sector. Reduced personal income tax rate for R&D employees will reduce the wage cost of the R&D employers which is relevant because R&D activities are generally rather labour intensive. This measure somewhat copies the Belgian incentive whereby only 25% of the wage withholding tax for scientific researchers is required to be paid, to the tax authorities, by the research institutes and R&D companies as from 1 January 2009. According to the comments from Tax Partner, Dirk Van Stappen at KPMG Belgium this measure is very popular as being rather easy to implement and as the entitlement does not require taxable profit.

In the Estonian context we are proposing that:

- *the withholding income tax rate for R&D employees will be reduced to 10%.*

The incentive is proposed to be implemented with no maximum ceiling and does not depend on the size of the salary. The incentive can be implemented with direct benefit to the employee or the employer: either the withheld income tax will be reduced to 10% (with the employee as the immediate beneficiary) or the withheld income tax is 21%, but the employer will transfer only 10% of the withheld income tax to the tax authorities' account and retains the rest (immediate beneficiary is the employer).

The reduced personal income tax rate will have an impact also on the local government budgets as 11.4% of the personal income tax collected by the tax authorities is transferred to the local governments based on the registered domicile of the individual taxpayers. Thus, depending on the location of the R&D employees' activity, some local governments will be more effected than others.

5.2.2.2.2 Reduced social tax rate

Similarly, to the reduced income tax rate for R&D employees, the reduced social tax rate will also benefit the public and non-profit sector in addition to the business sector. This incentive will benefit employers regardless whether the R&D employees are high or low income earners as the social tax in Estonia is borne by the employer.

We propose that the

- *Social tax rate will be reduced to 15% for R&D employees.*

In addition to the benefit of employers this incentive also targets the employees, because it the business planning the companies base their expenditure calculations on the actual salary fund of the employees (including social tax and unemployment insurance contributions). Therefore, one could expect that if the proportion of social tax is reduced, the R&D individuals' contracted salaries would also be higher (at least partially if not proportionally), resulting in an immediate benefit for the employee as well.

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[218] http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-07-120/EN/KS-SF-07-120-EN.PDF

5.2.2.2.3 Ceiling on social tax paid

Similarly, to the reduced social tax rate for R&D employees, the ceiling on social tax contributions will also benefit the public and non-profit sector in addition to the business sector. We have considered capping the gross wage on which social tax is payable. Thus:

- *Any monthly income in excess of either EUR 500, EUR 400 or EUR 300 will not be subject to social tax.*

Similarly to the previous incentive, this incentive may benefit the employers as well as the employees.

5.2.2.2.4 Ceiling on social tax for imported workers

This incentive is aimed at knowledge import by reducing the wage costs of highly qualified imported employees. This incentive is similar to the Danish income tax incentive, however, we are proposing to implement it to social tax as in Denmark, social security contributions only account for approximately 1.3 % of gross salary[219]. In addition, social tax is much more burdensome on employers than income tax. We are considering two possible alternatives:

- *Social tax is capped at EUR 1000 in absolute value (meaning EUR 3000 salary with 33% social tax rate) for imported R&D employees, who spend 3 years in Estonia. After 3 years, the social tax is 33%.*
- *Social tax is capped at EUR 1000 in absolute value (meaning EUR 3000 salary with 33% social tax rate) for imported R&D and innovation employees, who spend 3 years in Estonia. After 3 year, the social tax is 33%.*

This incentive is aimed at importing knowledge generated abroad to the benefit of Estonian economy. This may have very favourable effects as the benefits of foreign knowledge can be enjoyed without contributing to such knowledge generation. This incentive may be the answer to the question posed by the Norwegian evaluation study: “how can we gain access to the international knowledge base and ensure the effective transfer of technology for domestic use and further development?”

5.2.2.2.5 Social tax ceiling for all employees

Currently it has been publicly discussed whether a ceiling on the social tax (not only to R&D workers) should be established in Estonia in order to attract more high value foreign employees and make it easier for the local companies to employ such personnel. However, this incentive is not directly related to R&D promotion but rather benefits high income earners in general and was commissioned by the Ministry of Economics and Communication as additional work. We have been asked to calculate the effects with a ceiling on annual wage of 250 000. However, for the purpose of the analysis we have considered it more feasible to peg the ceiling to double of average wages as in our view it is easier from the political perspective to implement such ceiling as opposed to fixing the ceiling every year to a lump sum amount.

- *Any annual income in excess of double of the annual average wage (270 000 EEK) is not subject to social tax.*

[219] https://portal.ema.kworld.kpmg.com/tax/Content/Individual_Income_Tax_Rates-Survey_2009.pdf

5.2.3 R&D Expenditure definition for Estonian purposes

In order to establish R&D tax measures in Estonia which would be connected to R&D expenditure we must determine the R&D activities to which such expenditure could relate.

In Estonia, any expenditure that is related to the business activity of the company is not taxable (or is "deductible" for tax purposes to put in the context of classical corporate income tax systems). According to the Income Tax Act § 32 subsection 2, an expenditure is related to the business of a company if they have been incurred for the purposes of deriving income from taxable business or are necessary or appropriate for maintaining or developing such business and the relationship of the expenses with business is clearly justified. Thus, the first crierion for the R&D expenses to qualify as non-taxable is that the R&D cost is related to the business activity of the company.

Secondly, for the geneal framework we suggest that the OECD guidelines for qualification of R&D expenditure are followed[220]. Similar definitions already exists in the Estonian Organization of Research and Development Activities Act[221] § 2 subsections 1, 2 and 6 and thus the undertaken R&D should meet at least one of the following criteria:

The very same principles have been implemented in the Estonian Organization of Research and Development Activities Act, namely Article 2 of it stipulates as follows:

1) „Basic research" means theoretical or experimental work undertaken in order to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view;
2) „Development" means work, drawing on existing knowledge gained from research and experience, that is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed;
6) „Applied research" means original investigation undertaken in order to acquire new knowledge and directed primarily towards a specific practical aim or objective to be achieved within a relatively short period of time;

Thus, all costs and expenses (labour costs of personnel engaged in R&D activities, cost of materials and services used in R&D activities, related interest expenses, including subcontracted research) related to any or all of the abovementioned R&D activities qualify for the R&D expenditure related tax incentives.

However, we suggest that the expense does not qualify under the definition of R&D expenditure if it is funded by a government grant (such as EAS subsidies) as basically granting double subsidy for the same expense. In addition, e.g. any loan acquired for the purpose of future R&D expenditure does not automatically qualify as R&D expenditure but all expenses made at the expense of borrowed funds have to qualify under the R&D expenditure definition separately and have to be clearly justified.

Innovation is about successful introduction of something new and useful. The emphasis is of innovation is on actual introduction and application of novel ways of doing things. Thus, innovation may include R&D, but it does not have to do so. Therefore, for the purpose of R&D tax incentives we suggest that the broad definition of innovation is left out of the scope of the

[220] Please also see the suggestion made by the authors of the Belgian R&D policy analysis pg. 59 and 60.
[221] https://www.riigiteataja.ee/ert/act.jsp?id=12825121

R&D expenditure definition as it may not include R&D. More specifically, we suggest that the activities mentioned in the Estonian Organization of Research and Development Activities Act (ORDAA) § 2 subsections 5 to be left out of the scope of the R&D definition:

5) „Innovation" means the utilisation of new ideas and knowledge in order to implement innovative solutions, including development and modernisation of products and services (product innovation); winning and expanding relevant markets (market innovation); creation and introduction of new methods of production, delivery and sale (process innovation); innovation in management and organisation of work (organisational innovation) and development of the working conditions and skills of the staff (staff innovation);

Several countries provide that the activities qualifying for the R&D expenditure definition have to be novel to the world or industry not just novel for the company. This of course is very hard to estimate by the companies themselves as well as tax authorities. In addition, as the Belgian evaluation study revealed, it is almost impossible and costly for the government to control what is and what is not new from a societal point of view. Additionally it is relatively straightforward to keep track of what R&D the company previously did (by looking at the previous applications). Moreover, it is not excluded that redoing a similar research does not result in new findings.[222]

In our opinion, the definition of R&D activities should not include habitual activities and overhead costs (energy costs, administration and distribution costs). We find it reasonable to add a similar list of activities or expences related to these activities that are not classified as R&D as part of guidelines for R&D tax measures application.

In conclusion, as the definitions of R&D presented in OECD Frascati manual are already integrated into the Organisation of Research and Development Activities Act, it would be reasonable to use the same definition for the Income Tax Act purposes. The same bases for defining R&D costs/expenditure are used in Austria, France, Sweden and United Kingdom for example.

R&D expenditure concept have to be implemented in the Estonian income tax framework possibly at the level of Minister of Finance regulation or the Government regulation as these can more easily be amended according to the needs or changes in economic environment.

[222] http://www.belspo.be/belspo/stat/papers/pdf/fiscRDJune03.pdf

5.2.4 R&D personnel definition for Estonian purposes

Two systems are now used by OECD member countries to define and classify persons engaged in R&D - classification by occupation[223] and classification by level of formal qualification[224].

For the purposes of Estonian possible R&D tax measures we consider it not feasible to use the ISCED basis for classification of R&D personnel as this is purely related to the educational degree of people and is in no way related to their occupational duties. The Belgian policy analysis also shows that the nominative character of the deduction should be removed, as the administrative burden is too high[225]. Such a classification could be used for pure R&D institutes, but in the Estonian corporate income tax context that would not serve the purpose of the possible R&D tax measures. Consequently, we focus on the classification of R&D personnel based on occupation (ISCO).

By the ISCO and the Frascati Manual, R&D personnel can be divided into three categories:

researchers;

technicians and equivalent staff; and

other supporting staff.

In terms of Estonian perspective we would recommend to include in the R&D personnel the first two categories – researchers and technicians and equivalent staff. We do not consider including the third category of other supporting staff feasible as this would provide grounds for manipulation through categorization of employees with little or no connection with actual R&D work as R&D personnel. In addition, their direct contribution to R&D activities would be quite ambiguous to estimate. Consequently, the framework of tax measure would be vaguer than otherwise. Moreover, for the R&D tax incentive purposes the R&D personnel includes e.g. researchers and researcher-professors mentioned in the Estonian Organization of Research and Development Activities Act (ORDAA) § 8, §9^1 respectively.

For Estonian tax purposes we consider it the most feasible to include in the head-count of R&D personnel the average number of persons engaged in R&D during the last 6 consecutive months working full-time on R&D. We consider an average number less manipulative than a total number of R&D personnel during a certain time or a certain number of R&D personnel at a certain point of time.

As the determination of full-time work could lead to ambiguity we would suggest applying the concept of *Full-Time Equivalents* (FTE) established by OECD:

One FTE may be thought of as one person-year. Thus, a person who normally spends 30 per cent of his or her time on R&D and the rest on other activities (such as teaching, university administration, and student counselling) should be considered as 0.3 FTE. Similarly, if a full-time R&D worker was employed at an R&D unit for only six months, this results in an FTE of 0.5. Since the normal working day (period) may differ from sector to sector and even from institution to institution, it is impossible to express FTE in person-hours.

Theoretically, the reduction to FTE should be made for all R&D personnel initially included. In

[223] Linked to the International Standard Classification of Occupation – ISCO (ILO, 1990)
[224] Based on the International Standard Classification of Education – ISCED (UNESCO, 1997)
[225] http://www.belspo.be/belspo/stat/papers/pdf/fiscRDJune03.pdf

practice, it may be acceptable to count all persons spending more than 90 per cent of their time on R&D (e.g. most persons in R&D laboratories) as one FTE and, correspondingly, to completely exclude all persons spending less than 10 per cent of their time on R&D.

The persons qualifying for the definition of R&D personnel must carry out one of the activities mentioned in ORDAA § 2 subsections 1, 2 and 6.

5.2.5 Tax avoidance under R&D tax incentives

This section addresses the question of avoidance within the R&D regime. With any system that provides tax incentives there will be those who seek to exploit them by artificial means either without actually carrying out the required activities, or by doing so on a smaller scale than claimed. It is necessary to be alert to avoidance attempts, but without this colouring the approach to the vast majority of genuine claimants.[226] The most critical part of the incentives provided is defining the R&D personnel and expenditure.

In terms of tax incentives related to R&D tax personnel it is crucial to define the R&D workers with due precision in order to avoid the manipulation with the classification of workers in terms of their actual R&D occupation. Seeking for tax avoidance possibilities is evident also from the Norwegian policy study which finds that both the tax deduction and budgeted SkatteFUNN costs are often very high compared with the firm's actual salary payments (and accounting salary costs). This may indicate that tax adjustments are made via the reporting of inflated man-hours in SkatteFUNN, or that the hourly rate of pay used does not correspond with actual salary.

As provided in section 5.2.4, we would recommend including in the R&D personnel researchers and technicians and equivalent staff only. We do not consider including other supporting staff feasible as this would provide grounds for manipulation through categorization of employees with little or no connection with actual R&D work as R&D personnel. In addition, their direct contribution to R&D activities would be quite ambiguous to estimate. Consequently, the framework of tax measure would be vaguer than otherwise.

One of our proposed tax incentive – reduction of tax base by EEK 50 or 100 thousand per added R&D employee is potentially prone to manipulation with the amount of R&D workers, since the tax credit is directly linked to the difference. Due to this we consider it the most feasible to head-count the R&D personnel according to the average number of persons engaged in R&D during the last 6 (six) consecutive calendar months (e.g. prior to the distribution of dividends) working full-time on R&D. We consider an average number less manipulative than the aggregate number of R&D personnel during the particular day of profit distribution.

As the determination of full-time work could lead to ambiguity we would suggest applying the concept of Full-Time Equivalents (FTE) established by OECD. FTE means that if a company employs 2 people, both of which are engaged in R&D activities ½ of their working time, the company is deemed to have one FTE R&D worker.

Whenever there are tax incentives provided by the government to increase the private sector R&D expenditure, there is always a risk for artificial avoidance arrangements. Such arrangements commonly involve the company representing that it has spent more on R&D than it has actually incurred in terms of economic cost.

Where a transaction is attributable to arrangements entered into wholly or mainly with a purpose of gaining an R&D tax relief that would not otherwise be available, or of increasing the amount of deduction beyond what was otherwise available, then the transaction can be disregarded in determining the amount of any R&D tax relief or payable credit.[227] The similar principle is provided under the § 84 of the Estonian Taxation Act.

We propose that only the expenditure wholly and directly for the need of R&D should be counted as a qualifying expenditure. These expenses have to be proved with documents

[226] http://www.hmrc.gov.uk/manuals/cirdmanual/CIRD97050.htm
[227] http://www.hmrc.gov.uk/manuals/cirdmanual/CIRD97150.htm

(invoices etc.). This would exclude possible artificial arrangements for partly related expenditure (e.g. general management and administration cost). Also, qualifying R&D expenditure should not involve government grants for R&D. For example grants provided by Enterprise Estonia should be excluded.

In case of outsourcing, the R&D expenditure should be taken into account only when outsource is necessary for the company's own, larger R&D project. This would help to avoid cumulating the effect of R&D tax incentives. Also, transfer pricing rules should be taken into consideration in terms of outsourcing, ie. if some of the R&D expenditure is related to R&D activities outsourced to a related party, it should be clarified that a failure to conduct the transactions at arm's length value would not only bring a transfer pricing adjustment, but would also cause a tax incentive used based on such R&D expenditure to be disregarded.

Intellectual property related incentives have become increasingly popular during the past years in many countries. To avoid the abuse of incentives proposed in this field, we find it necessary to limit the term "intellectual property" with only royalties from patents. This is to avoid abusing the incentive by formulating service contracts as license agreements and charging tax beneficial royalties instead of service fees. We believe that the patent registration and protection process is sufficiently sophisticated and expensive to guarantee the precise targeting of the tax incentive.

It is possible to provide a restriction that the recipient of the royalty has to be the beneficial owner of the royalties. Manipulations in case of multinational group companies paying royalties to an Estonian company in order to benefit from the tax measure and transferring this money back to a foreign group company immediately after receiving the tax benefit can be avoided with general anti-avoidance rules, because Estonian companies have to be able to prove that the expenses are related to their business. In addition, transfer pricing regulation would apply in such cases.

In the interest of getting an overview of the entrepreneurs using the incentives the tax administrator may consider the creation of a register for those companies. However, it should be carefully observed that the administrative rules would not be too burdensome and therefore limit the number of entrepreneurs who could benefit from the incentives.

In terms of corporate tax incentives we would propose to amend the Form TSD Annex 7 (the tax return form of profit distributions) with supportive tables for R&D tax reduction. In addition to clarity in terms of tax calculation if a tax incentive is used, the supportive tables are considered parts of tax declarations which are subject to the Taxation Act. Therefore, taxpayers are held liable for any misstatements in those tables, even if the ultimate tax amount is unchanged. This would serve as an additional safeguard against negligence in filing tax returns.

Mansfield (1986) estimates, on the basis of a survey conducted in Canada, Sweden and the US that in the first years after the introduction of a tax credit, 13% to 14% of the increase in R&D expenditure is actually due to "relabelling". After this period "relabelling" stops. Mansfield also points out that the effect is facilitated if a broad definition of qualifying R&D is used. Similarly, the OECD (1998) recommends the definition of qualifying R&D expenditure to be unambiguous. In addition to the results of Mansfield, Hall (1996) finds the "relabelling" risk to be relatively small. In case the threat of "relabelling" really becomes an issue, it can be interesting to look if this threat can be avoided by narrowing the definition of qualifying R&D

expenditure to labour expenditures only. This could be an advantage if wages and salaries of R&D workers are easier to control than other, more vague, expenses such as overheads.[228]

Because fiscal measures reduce the amount of tax due, they do not lead to any out of pocket expense for the government but rather to a loss of revenue. This typology characteristic of fiscal measures implies that such a policy requires close monitoring in order to determine the real cost of the policy. This is the case because it is more difficult to keep track of foregone tax revenue than it is to keep track of real out of pocket expenses.

Stemming from the above, we find that tax audits during the first years of R&D tax incentive application are essential to be carried out. Since the R&D tax incentives will be reflected on the tax return forms, it is rather easy to pick the audit targets.

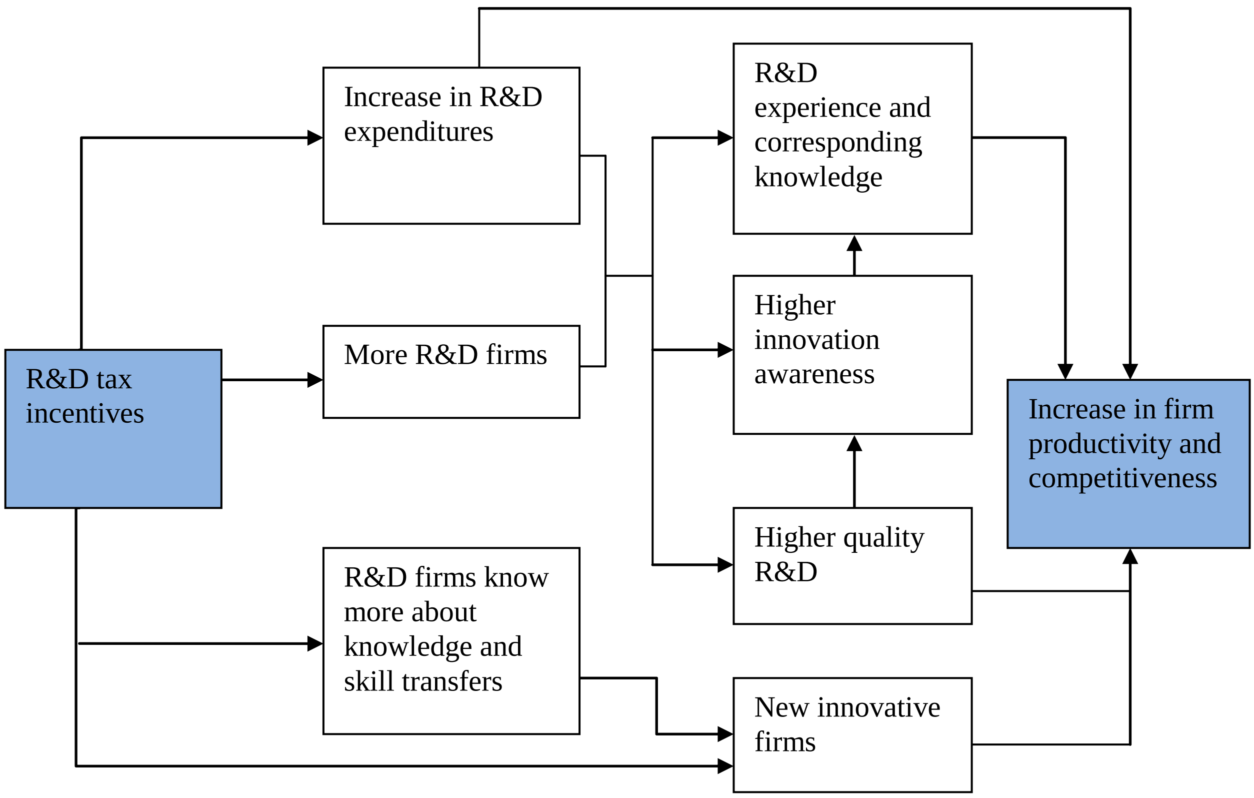
[228] http://www.belspo.be/belspo/stat/papers/pdf/fiscRDJune03.pdf

5.3 *Qualitative and quantitative implications of different options*

Both economic theory and empirical analysis emphasise that R&D plays a key role in achieving productivity gains and economic growth, and that it has the characteristics of a public good, meaning that the social return of the investment is higher than the private return to the investing firm. In presence of such market failure, which unchecked would lead to under investment in R&D by business, public intervention is justified. In effect, Member States have introduced a variety of instruments to support business R&D, such as direct grants or subsidies, tax incentives, guarantee mechanisms or support to risk capital. Their combination and intensity differs from one country to the other, depending mainly on policy objectives, the structure of the economy and the strengths and weaknesses of the national research and innovation system. Moreover, evidence suggests that instruments cannot easily be substituted and must be carefully designed to ensure consistency and synergy.[229]

One way of looking at the mechanisms of how R&D tax subsidies influence productivity, is given by Jürgenson[230] on chart 5.3.1. (see below). The idea here is that increasing R&D activities lead to increased knowledge, experience and cooperation, which increases productivity and competitiveness.

Figure 5.3.1. R&D tax incentives impact logic[231]



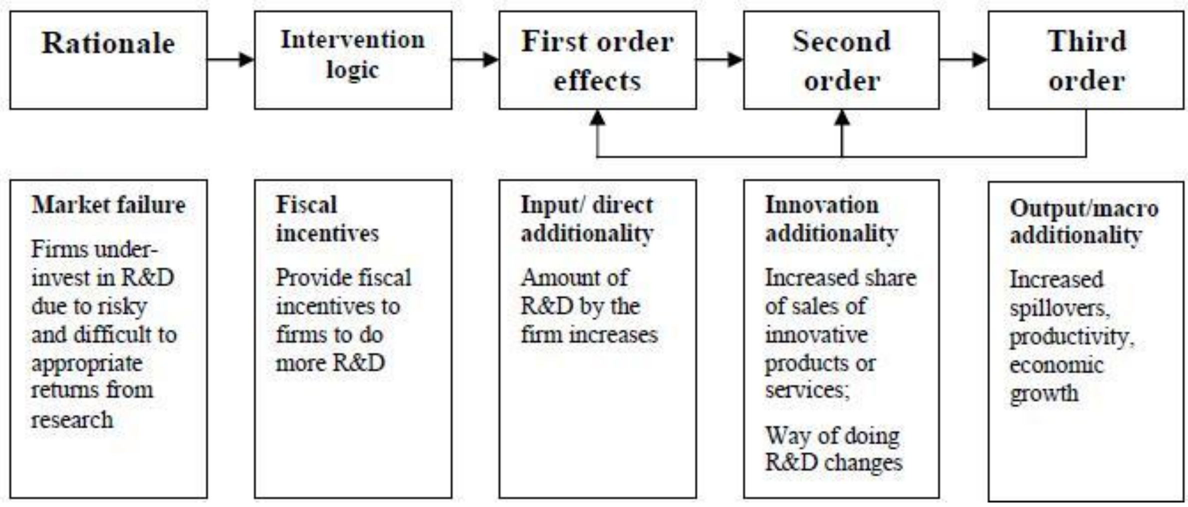
[229] Commission Of The European Communities. Towards a more effective use of tax incentives in favour of R&D. Annex to the communication from The Commission To The Council, The European Parliament And The European Economic and Social Committee. Commission Staff Working Document. COM(2006) 728 final. Brussels, 22.11.2006, 18p.

[230] Jürgenson, Anne. The impact assessment of R&D financing programs. Praxis working paper no. 36, October 2007, 40 p.

[231] Based on Jürgenson, Anne. The impact assessment of R&D financing programs. Praxis working paper no. 36, October 2007, 40 p.

Figure 5.3.2. (see below) presents a framework for analyzing the rationale behind R&D tax credits and the expected effects of the policy intervention. Three types of effects might be expected, of which "first order" and "second order" effects normally happen at the firm level followed by the ultimate "third order" effect to take place at the economy or international level. It has to be noted that the framework is highly stylized and probably depicts more theory than practice, as all these effects can reinforce each other through a feedback loop.[232]

Figure 5.3.2. Intervention logic for fiscal R&D incentives.[233]



[232] Expert Group on R&D Tax Incentives Evaluation. Comparing Practices in R&D Tax Incentives Evaluation. Final Report. European Commission, Directorate General – Research. Brussels, 2008, 139 p.

[233] Based on John Clark and Eric Arnold, *Evaluation of Fiscal R&D Incentives*, Report to CREST OMC Panel, Technopolis, September 2005, p.5.

5.3.1 Assessment methodology and background

In this chapter, based on the above-mentioned, estimation methodology for the first order effects have been given. Higher order effects are much harder, if not impossible to estimate. So, these are not in focus, but it has to stressed, that higher order effects are significant. A logical sequence based on Jürgenson[234] is quantified, and the sequence is as follows:

Tax subsidy for employees or profit distribution (state budget and administration costs)

Increased R&D activity and compliance costs

1. Increased employment rate
2. Increased investments in assets

The reliability of all estimates given in this chapter is relatively low and the actual outcome uncertain due to several spill-over effects and the unpredictable nature of the welfare gains from R&D activities[235]. Since long-run (we define long-run as 10 years) quantitative impact estimations depend greatly on the economic state of the country, the assessment is more accurate in short-run estimates. For long-run impacts, qualitative assessments are more reliable. In order to enhance the reliability of long-run projections we have used economic growth estimates given by The Estonian Ministry of Finance[236].

The short-run state budget impact assessment is based on how much of the tax subsidy will be exploited. We assume that potential users will be made aware of these tax subsidies, which of course, in practise, is hard to achieve. Therefore, maximum impact is assessed. A policy recommendation based on findings by Corchuelo and Ester[237], is that informing SME's of the tax subsidies is more important, than informing large enterprises.

Administration cost assessment used in this analysis is based on a study by Foyn and Lien[238], where administration cost is 2% of the tax subsidy value. This has been given as an additional cost and is not part of the initial state budget impact estimates. Although the cost rate used for different tax subsidies is the same, the tax subsidies are different and qualitative assessment has to be taken under consideration. For a more detailed implementation description of the tax subsidies, see chapter 5.2 and its sub-chapters.

Two approaches have been used to estimate the compliance costs for the tax subsidies. For direct tax subsidies we have used international experience, mainly, studies by Foyn and Lien[239] and de Jong and Verhoeven[240]. They estimate that the compliance costs are 4%-7% of the tax

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[234] Jürgenson, Anne. The impact assessment of R&D financing programs. Praxis working paper no. 36, October 2007, 40 p.

[235] Expert Group on R&D Tax Incentives Evaluation. Comparing Practices in R&D Tax Incentives Evaluation. Final Report. European Commission, Directorate General – Research. Brussels, 2008, 139 p.

[236] The Estonian Ministry of Finance. Projections of macroeconomic indicators 2000-2050. The Estonian Ministry of Finance. 27.08.2009. [http://www.struktuurifondid.ee/public/Pikaajaline_makro_-_27.08.2009.xls]. 06.10.2009.

[237] Corchuelo, M. Beatriz. Martínez-Ros, Ester. The Effects of Fiscal Incentives for R&D in Spain. Universidad Carlos III de Madrid. Working Paper 09-23, Business Economic Series 02, March 2009, 32 p.

[238] Foyn, Frank. Lien, Guro. Assessment of administrative procedures and user-friendliness of the Norwegian tax reduction system for R&D (SkatteFUNN). Subreport in the evaluation of the SkatteFUNN system. Reports 2007/49, Statistics Norway, 2007, 74 p. [http://www.ssb.no/emner/10/02/rapp_200749/rapp_200749.pdf]

[239] *Ibid.*

[240] De Jong, J.P.J., Verhoeven, W.H.J. WBSO Evaluation 2001-2005. Impacts, target group reach and implementation. EIM onderdeel van Panteia, UNU-MERIT, Zoetermeer, March 2007, 85 p. [http://www.worldcat.org/wcpa/oclc/206570082?page=frame&url=http%3A%2F%2Fappz.ez.nl%2Fpublicaties%2Fpdfs%2F07OI35.pdf%26checksum%3Dd306846155e157de440b43d2967a13b5&title=&linktype=digitalObject&detail=]

subsidy value. The estimation methodology for compliance cost to wage tax subsidies is based on studies by The Estonian Ministry of Economic Affairs and Communications[241], Harris and Joannou[242] and Jürgenson[243]. The basic logic here is to comprise a step-by-step list[244] of actions concerning the compliance to the tax subsidy, then giving each of the actions a time cost and then multiplying this with the number of people or enterprises under question and with the wage cost of the person doing the action. This approach is more accurate when using it to assess the compliance costs for wage tax subsidies. It can't be used to assess the compliance costs for direct tax subsidies because of the complicacy of the inner-workings of a business enterprise.

Increase in R&D activity estimations are based on the approach, which is using user-cost elasticity as it has been used by different international researchers like Harris *et al*[245], Koga[246] and others. The estimated value of R&D activity elasticity to R&D user-cost change is based on international studies by Bloom *et al*[247] and Hall and van Reenen[248]. We use projections, where the initial user-cost reduction is 10% of the amount subsidised through the tax subsidy. This means, that if the subsidy is 10 cents for every EEK spent on R&D, the subsidy user will, at first, increase its expenditure by 1 cent. The long-run (10 year) user-cost reduction equals the amount subsidised through the tax subsidy and the elasticity growth is assumed to grow with a linear trend (10% in the first year, 20% in the second and so forth).

Table 5.3.1. The projection method example

Year	1	2	3	4	5
R&D activity	**100**	**100**	**100**	**100**	**100**
Tax subsidy proportion	10%	10%	10%	10%	10%
R&D activity user-cost change elasticity	10%	20%	30%	40%	50%
R&D activity increase	1	2	3	4	5
Tax subsidy	10,1	10,3	10,6	11	11,5
R&D activity with subsidy	**101**	**103**	**106**	**110**	**115**

[241] The Estonian Ministry of Economic Affairs and Communications. Company administration burdon of applying EU structural funds in 2004-2005. Final report. The Estonian Ministry of Economic Affairs and Communications. 2006, 48 p.

[242] Harris, David., Joannou, Androula. Regulatory Impact Assessment For Research And Development (R&D) Tax Credit For Large Companies/ Vaccines Research Relief. Inland Revenue Business Tax Policy. 2002, 7 p.

[243] Expert opinion by Anne Jürgenson (PRAXIS).

[244] Expert opinion by KPMG.

[245] Harris, Richard., Li, Qian Cher., Trainor, Mary. Is a higher rate of R&D tax credit a panacea for low levels of R&D in disadvantaged regions? Elsevier. Research Policy, 38, 2009, pp. 192–205.

[246] Koga, Tadahisa. Firm size and R&D tax incentives. Elsevier. Technovation, 23, 2003, pp. 643–648.

[247] Bloom, Nick., Griffith, Rachel., Reenen, John Van. Do R&D tax credits work? Evidence from a panel of countries 1979–1997. Elsevier. Journal of Public Economics, 85, 2002, pp. 1–31.

[248] Hall, Bronwyn., van Reenen, John. How Effective Are Fiscal Incentives for R&D? A Review of the Evidence. Research Policy 29. 2000, pp. 449-469.

In this example (table 5.3.1. above), R&D activities will grow in the first year by 1 unit and after 5 years will have grown by 15 units. The tax subsidy will cost 53,5 units over the 5 year period.

The projection method used in this assessment uses the long-run predictions of macroeconomic indicators given by The Estonian Ministry of Finance[249]. Also, it is estimated, that R&D activities grow at the rate of 1,5 compared to the whole economy. This estimation is based on historical data on Estonian economic and R&D activity growth rates.

A reduced rate R&D approach is used for R&D employment growth and investment growth estimation. Since the capital-labour structure in the R&D sector is stabile over time (47%-50% of all R&D expenditure are labour costs), it can be used to predict how much of R&D expenditure is invested into labour, and how much into capital. Through the labour growth estimates, a positive impact assessment on the state budget is given. According to Eurostat[250], in 2007, the implicit tax rate for wage costs (all wage tax paid divided by all wage costs) was 33,8%. This tax rate, the employment growth and the predicted average wage cost for R&D employees is used to give these estimates. Also, different wage costs have been used for business sector and non-profit sector R&D employees.

An assessment of future R&D and GDP ratio will be given using the projections[251]. These estimates will show the future state of the ratio and not the additional ratio that the R&D tax subsidy produces. Without the tax subsidy R&D/GDP ratio will grow from 1,35% to 1,5%. It has to be stressed, that the projections don't consider the supply side of R&D activities. It is important to note, that there is no adequate assessment possible for additionality (for example – annual turnover per R&D employee) of an R&D employee. The closest assessment available is the average annual turnover of an employee in the research and development sector, which is 800 000 EEK (2007)[252].

[249] The Estonian Ministry of Finance. Projections of macroeconomic indicators 2000-2050. The Estonian Ministry of Finance. August 2009. [will appear in here - http://www.struktuurifondid.ee/index.php?id=11279].

[250] Eurostat. Implicit tax rates by economic function. [http://epp.eurostat.ec.europa.eu/portal/page/portal/government_finance_statistics/data/database]

[251] R&D activity and GDP have been projected in to the future using the growth projections and then the ratio is calculated.

[252] Statistics Estonia On-Line database last accessed 06.10.09.

5.3.2 Corporate income tax incentives

Corporate income tax incentives analysed in this chapter have the target of reducing the user-cost of an R&D activity. This means reducing the price of R&D activities by reducing the corporate tax base or taxes payable. Which is the better reduction method depends on their respective implementation costs and effects. Also, the aggregated effect of the reductions may not be the same for tax base and tax rate reductions, because firms might have different compliance costs. Especially for SME's, the costs for making them eligible (proving their R&D activities) to make full use of the tax incentives might differ from large companies.[253]

There are three R&D criteria considered for this incentive: the number of R&D employees; R&D expenditure; income on royalty sales.

These three direct tax subsidies only target business enterprise R&D activities (see tables 5.3.2. and 5.3.3. below) since only business enterprises pay corporate income tax. And moreover, they pay this on distributed profits. It has to be noted, that business enterprise R&D and non-profit R&D are different in nature – non-profit R&D is focused on basic and applied research while business enterprise R&D is focused on experimental development (for distribution details see table 5.3.3.).

Table 5.3.2. The distribution of R&D full-time work equivalent employment by institutional sectors, 1998-2007[254]

	Non-profit sectors combined	**Higher education sector**	**Government sector**	**Non-profit private sector**	**Enterprise sector**
1998	**90,4%**	66,9%	23,2%	0,3%	**9,6%**
1999	86,4%	64,0%	22,1%	0,3%	13,6%
2000	88,7%	62,1%	25,6%	1,1%	11,3%
2001	83,3%	61,9%	20,0%	1,3%	16,7%
2002	83,0%	62,1%	19,2%	1,7%	17,0%
2003	82,1%	60,5%	19,4%	2,3%	17,9%
2004	77,1%	58,1%	17,1%	1,9%	22,9%
2005	68,0%	49,9%	16,0%	2,1%	32,0%
2006	65,6%	48,3%	15,1%	2,2%	34,4%
2007	**66,2%**	48,1%	15,6%	2,5%	**33,8%**

[253] Corchuelo, M. Beatriz. Martínez-Ros, Ester. The Effects of Fiscal Incentives for R&D in Spain. Universidad Carlos III de Madrid. Working Paper 09-23, Business Economic Series 02, March 2009, 32 p.

[254] Statistics Estonia, On-line database. Research and development personnel by institutional sector. Authors calculations. 13.08.09.

Table 5.3.3. R&D expenditures and their financing by institutional sector and purpose. 1998 and 2007, overall and distribution[255]

	Overall (thousand EEK)	**Non-profit sectors combined**	**Higher education sector**	**Government sector**	**Non-profit private sector**	**Enterprise sector**
Expenditures						
1998	450 969	80,3%	56,0%	23,8%	0,4%	19,7%
2007	**2 716 982**	**52,8%**	41,8%	8,7%	2,4%	**47,2%**
State funded expenditures						
1998	284 012	97,9%	68,6%	29,0%	0,3%	2,1%
2007	**1 240 113**	**90,4%**	70,1%	17,5%	2,7%	**9,6%**
Expenditures on basic research						
1998	181 007	99,6%	69,4%	30,0%	0,2%	0,4%
2007	**694 324**	**97,0%**	74,6%	19,4%	2,9%	**3,0%**
Expenditures on applied research						
1998	157 321	85,2%	61,2%	23,2%	0,8%	14,8%
2007	**613 367**	**79,6%**	59,6%	13,2%	6,8%	**20,4%**
Expenditures on experimental development						
1998	112 641	42,5%	27,3%	14,8%	0,4%	57,5%
2007	**1 409 291**	**19,5%**	17,9%	1,4%	0,2%	**80,5%**

[255] Statistics Estonia, On-line database. Research and development expenditures and their financing by indicator, year and institutional sector. Authors calculations. 13.08.09.

5.3.2.1 Corporate income tax base reduction by the number of R&D employees

- *A deduction of EEK 300,000 per supplementary R&D employee is allowed as a deduction from the corporate income tax base.*

Since different economic sectors have different capital-labour structures, labour-intensive sectors are better targeted (for example ITC sector). Compared to the tax subsidy based on R&D spending (see below), this criterion requires a simpler R&D definition – only R&D employee has to be defined, not R&D expenditure. A consideration has to be made as figure 5.3.3. illustrates – the sector, which has the largest R&D employment – computers and related – pays very little corporate income tax. So this tax subsidy does not target this sector very efficiently. However, we expect that this tax subsidy will have a certain behavioural effect, mainly, that firms increase their profit distribution. Moreover, since this tax subsidy subsidises R&D growth, growing (and also, new) firms are better targeted. However, it may be that with subsidising growing firms is that these firms will most likely reinvest their profits into firm growth, rather than distribute them.

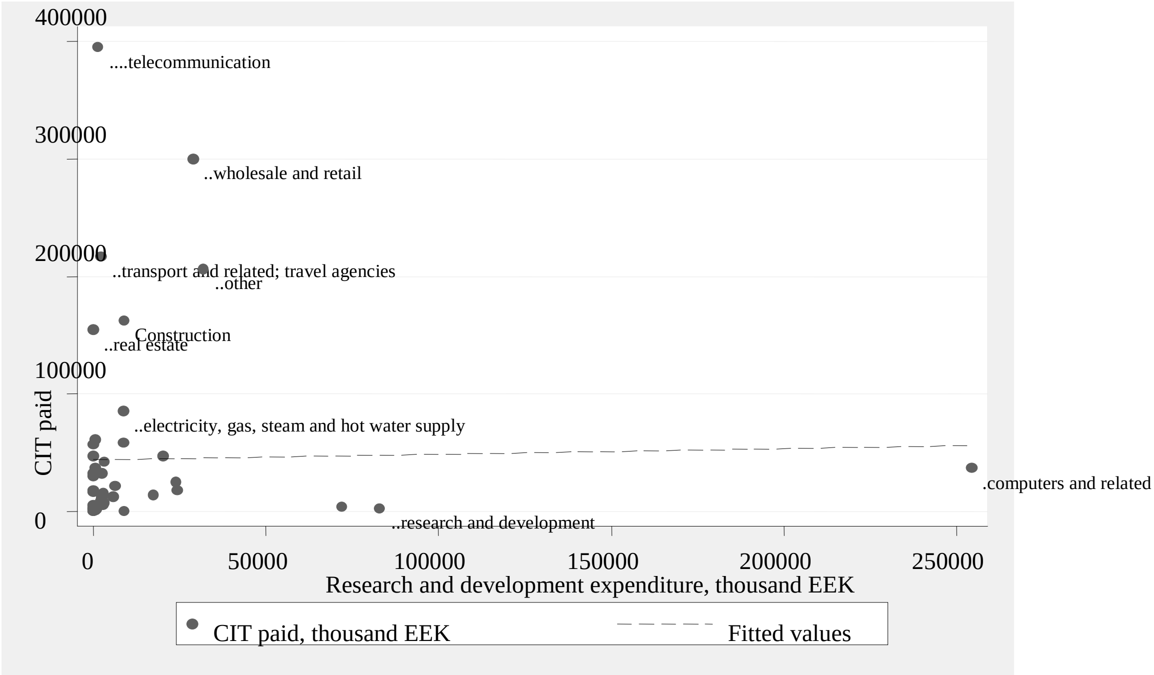
In Belgium, a similar measure was abolished after 2008, because it was perceived to be administratively too burdensome. This, however, might not be the case in Estonia, since R&D employee is defined differently in Belgium (see chapter 3.3.6 for details) than the proposed definition for Estonia (see chapter 5.2.4), but the danger has to considered.

Since this tax subsidy is relatively small in scale, the behavioural effects play a great role and profit distribution in Estonia is very random, the estimates have a relatively low reliability and both underestimation and overestimation are possible.

The main characteristics of this tax incentive are the following:

- *Target – R&D employment growth in business enterprise sector; growing and labour-intensive firms and firms who pay corporate income tax (i.e. distribute dividends)*
- *Scale – small, less than 100 firms*
- *Behavioural effects – short-run R&D employment growth*
- *Estimation accuracy – both overestimation and underestimation possible*
- *Positive – growth targeting*
- *Negative – danger of high administration costs*

Figure 5.3.3. Scatterplot of sectors by R&D expenditure and corporate income tax paid, all firms in all sectors, 2006, thousand EEK[256]



5.3.2.1.1. State budget and administration costs

Based on the average annual growth of business enterprise R&D personnel (full-time equivalent), a growth of 139 employees is observed. A linear trend is used. This is the baseline for our estimates. But considering what the tax subsidy subsidises, there might be an upward shift in the trend. However, this increased growth can't be sustainable, so the growth will decrease in the long-run. To our best assessment, the linear trend should therefore be sufficiently adequate.

When the deducted amount is 300 000 EEK, the estimated initial CIT base reduction would be 42m EEK[257]. But in fact, not all R&D enterprises pay income tax, the estimated correlation between R&D expenditure and paid corporate income tax is 0,3811.[258]

When considering this correlation between company R&D expenditure and whether the company pays corporate income tax, an effective CIT base reduction of 16m EEK is estimated accordingly. The overall estimated initial annual impact on the state budget (tax rate is 21%) of these tax subsidies will be 3,3m EEK. Based on the projection, in the long-run (10 years), the tax subsidies cumulative cost is 44m EEK, with the tax subsidy taking from the state budget 6,5m EEK in the last assessment year.

The administration cost for this tax subsidy is 2% (60 000 – 70 000 EEK annually, over the 10-year period, this figure will double).

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256 Authors calculatons based on data from Statistics Estonia On-Line database, last accessed 13.08.09.

257 0,3m EEK multiplied by 139 employees.

258 Authors calculations based on microdata from The Business Registry and Community Innovation Survey 2004-2006 (CIS4).

5.3.2.1.2. R&D activity, employment, investments and value added

The short-run effect is increased R&D activities by 1/10 of the initial state budget impact (0,3m EEK). R&D activities have risen after 10 years by 26m EEK, based on the projection. The annual compliance cost for this tax subsidy is estimated at 4%-7% of the tax subsidy value (0,13-0,23m EEK).

Considering the long-term trends of R&D employment in Estonia (see table 5.3.2.), the business enterprise R&D employment is growing steadily, non-profit R&D employment is decreasing roughly at the same pace. There is little reason to expect an accelerated R&D employment growth in the long-run[259], although, some behavioural effects might play a role in the short-run. Based on the labour demand elasticity and taking into account the business enterprise R&D capital-labour structure, up to **5** additional R&D employees is estimated. Based on the projections, in the long-run – up to **23** new R&D employees have been added by this tax subsidy.

Based on the employment growth, a positive impact on the state budget from 0,5m EEK to 5m EEK is estimated.

In the short-run, 0,3m EEK additional investments is estimated. Based on the projection, in the long-run (10 years), investment level is 26m EEK higher than without the tax subsidy.

We estimate a 0,08% additional increase in intramural business enterprise R&D/GDP ratio in the long-run (from 0,64% to 0,72% of GDP).

[259] The full-time work equivalent R&D employment has grown from 4600 to 5000 people in the period of 1998-2007.

5.3.2.2 Tax credit by R&D expenditure

- *Tax credit 1 – 10% of tax credit available of intramural business enterprise R&D and subcontracted R&D to non-profit organizations (e.g. universities) expenditure with the maximum ceiling at 30% of corporate income tax payable (the credited amount cannot be more than 30% of the total corporate income tax payable on dividends). The expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies are excluded.*
- *Tax credit 2 - 10% of tax credit available of total business enterprise R&D expenditure (including subcontracted R&D) with the maximum ceiling at 30% of corporate income tax payable (the credited amount cannot be more than 30% of the total corporate income tax payable on dividends). The expenses made by the company at the expense of government grants (e.g. EAS grants) or other public subsidies are excluded.*

These incentives will work in the same way as CIT rate reduction would work as well as CIT base reduction by a certain % of R&D expenditure, so we find that there is no need to make calculations for these measures separately. However, since the behavioural effects play a great role and profit distribution in Estonia is very random, the estimates have a relatively low reliability and both underestimation and overestimation are possible.

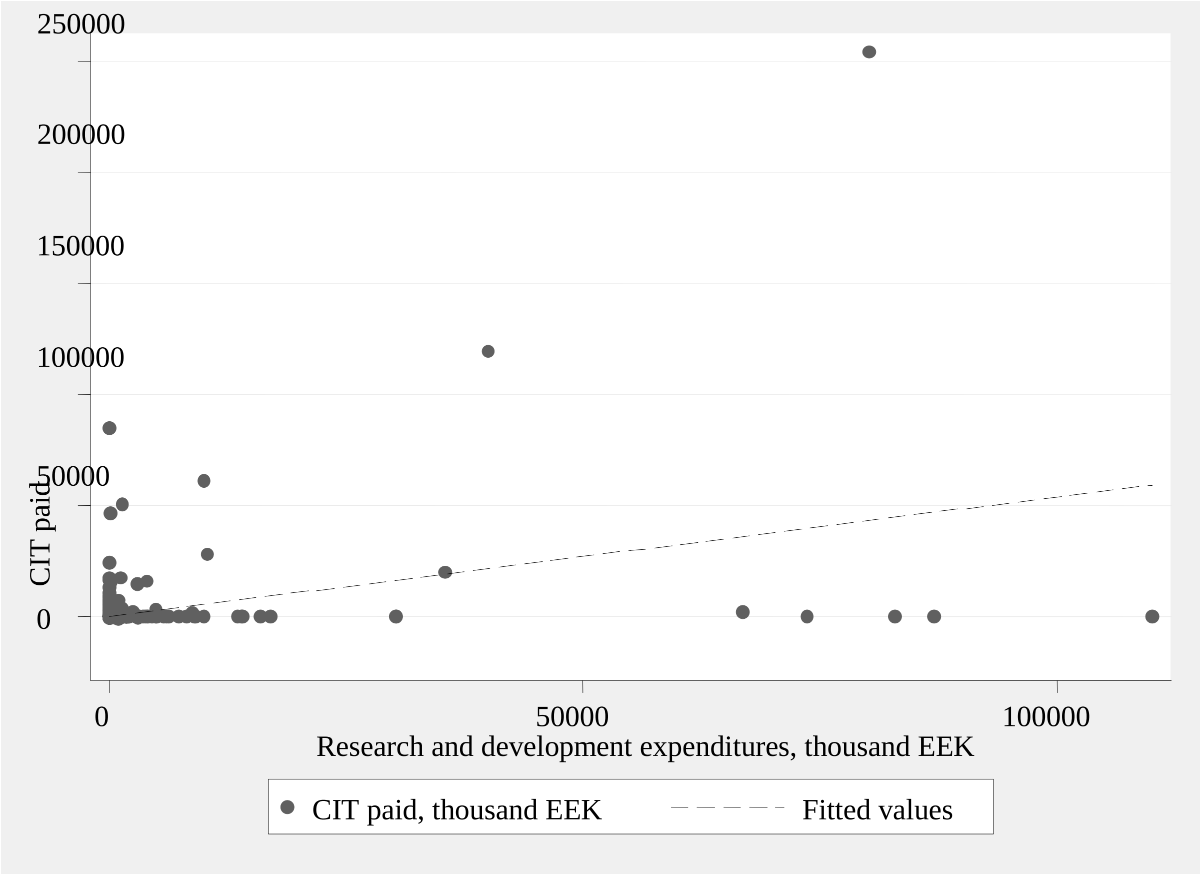
This criterion has the best targeting of the three direct tax measures because in terms of aggregated positive effects, employees have different additionality, but a firm’s R&D activity, when measured by expenditure should give a much more objective assessment of additionality. This means, that both labour-intensive and capital-intensive firms can gain from this tax subsidy.

While tax credit in general is one of the simplest tax subsidies available, using it with R&D expenditures has its dangers. Mainly, that the firms might have large compliance costs. All extramural R&D expenditure has to be verified to go to non-profit sectors. There is also a danger of efficiency loss for the tax subsidy, in the case of double subsidisation.

The main characteristics of this tax incentive are the following:

- *Target – R&D expenditure growth in business enterprise sector, firms who pay corporate income tax*
- *Scale – medium, less than 500 firms*
- *Behavioural effects – increased profit distribution, increased R&D expenditure*
- *Estimation accuracy – both overestimation and underestimation possible*
- *Positive – tax credit is simple in nature*
- *Negative – might inhibit growth*

Figure 5.3.4. All firms, 2006, thousand EEK, scatterplot of firms by R&D expenditure and corporate income tax paid.[260]



As figure 5.3.4. illustrates, only a few companies have both high R&D expenditure and high amount of corporate income tax paid. Also, the proposed ceiling (30% of CIT) has only a marginal effect, the R&D expenditure has to be three times larger than the payable corporate income tax in order for the ceiling to have any effect.

5.3.2.2.1. State budget and administration costs

Tax credit 1 (intramural) - the initial annual maximum impact on the state budget is 26m EEK. The cumulative 10 year impact on the state budget is estimated at 350m EEK with the tax subsidy costing 53m EEK in the last assessment year (based on the projection).

The administration cost for this tax subsidy is 2% (520 000 EEK, over the 10-year period, this figure will be 1,1m EEK)

Tax credit 2 (total) - the initial annual maximum impact on the state budget is 30m EEK. The cumulative 10 year impact on the state budget is estimated at 400m EEK with the tax subsidy costing 60m EEK in the last assessment year (based on the projection).

The administration cost for this tax subsidy is 2% (0,6m EEK, over the 10-year period, this figure will be 1,2m EEK)

[260] Authors calculatons based on microdata from The Business Registry and Community Innovation Survey 2004-2006 (CIS4).

5.3.2.2.2. R&D activity, employment, investments and value added

Tax credit 1 (intramural) - short-run effect is that R&D activities will rise by 0,2% of current intramural business enterprise R&D expenditure (2,6m EEK, 0,09% of all current R&D expenditure). The long-run effect is that R&D activities have risen by 8,6% of estimated intramural business enterprise R&D (210m, 4,0% of all estimated R&D expenditure).

Tax credit 2 (total) - short-run effect is that R&D activities will rise by 0,2% of current total business enterprise R&D expenditure (3m EEK, 0,11% of all current R&D expenditure). The long-run effect is that R&D activities have risen by 8,6% of estimated total business enterprise R&D (240m, 4,6% of all estimated R&D expenditure).

Initial compliance cost for these tax subsidies is 4-7% of the tax subsidy value (1-2m EEK initially, over the 10-year period, this figure will roughly double).

From 50 and up to 200-225 additional R&D employees have been added in the long-run by these tax subsidies. Based on the employment growth, a positive impact on the state budget from 6m EEK to 45m EEK is estimated.

Tax credit 1 (intramural) - in the short-run, 1,3m EEK additional investments is estimated. Based on the projection, in the long-run (10 years), investment level is 105m EEK higher than without the tax subsidy.

We estimate a 0,14% additional increase in intramural business enterprise R&D/GDP ratio in the long-run (from 0,63% to 0,77% of GDP).

Tax credit 2 (total) - in the short-run, 1,5m EEK additional investments is estimated. Based on the projection, in the long-run (10 years), investment level is 120m EEK higher than without the tax subsidy.

We estimate a 0,15% additional increase in total business enterprise R&D/GDP ratio in the long-run (from 0,73% to 0,88% of GDP).

5.3.2.3 Corporate income tax exemption of income on royalty sales

- *80% of royalty income from patents is exempt from income tax on dividends.*

This instrument is well targeted because it reduces the user-cost of intellectual property transfers. Also, its implementation and administration costs are relatively low, but so is the overall impact. This instrument has to be considered as an additional instrument.

Since the Estonian Tax and Customs board does not differentiate between income from royalty sales and income from rent, there is no adequate assessment available for any impact analysis on this tax subsidy. There is no statistics available about how many royalty transactions are being made, and what is their value.

Around 300m EEK of income tax is paid annually to the Estonian Tax and Customs Board on income from royalty sales and income from rent by all firms combined. First, rent income has almost certainly the larger value of the two. And second, since not many firms sell royalties, and out of these firms, on average, only 10% pay corporate income tax, the impact is estimated to be smaller than other tax subsidies' impact.. The correlation between turnover and corporate income tax paid over all firms is 0,26 [261], this means that larger firms pay more income tax. The correlation between net profit and corporate income tax paid over all firms is 0,33 [262], this means that more profitable firms pay more income tax. So, this tax subsidy targets larger and more profitable firms.

As quantitative assessment of this subsidy is not possible for statistical reasons, qualitative assessment and international experience should be considered. However, according to our knowledge there is currently no evaluation studies carried out in the countries using intellectual property tax incentives. The Belgian government has explicitly chosen to implement a straightforward and easily computable tax incentive, meant to attract and encourage R&D activities and the ownership of patents.[263] Van Stappen *et al* estimate that the use of the new tax regime for patent income, together with the notional interest deduction and other R&D incentives available, makes Belgium a very attractive place for innovative patent-generating companies, intangible property centres and central entrepreneurial entities. [264].

It is our understanding that this incentive could have similar effects in Estonia. However, since the effects of this incentive are perceived to be relative low (because of low patenting activity in Estonia) we would recommend implementing this incentive as an additional incentive. If implemented together with R&D tax credit this incentive would probably attract the attention of foreign R&D companies. Favourable results could also be achieved if this incentive is implemented together with one of the wage tax incentives. However, in these cases the co-effects of the incentives would have to be carefully analysed.

One way of weighing the positive and negative effects of this tax subsidy is to conduct a scenario analysis. As was discussed, the negative effects are marginal since the Estonian intellectual property activity is very small in scale.

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[261] Authors calculatons based on microdata from The Business Registry and Community Innovation Survey 2004-2006 (CIS4).

[262] *Ibid.*

263 http://www.kpmg.be/dbfetch/52616e646f6d495685b3104a1080cf80eb6855291cdfa6b4ab217e8ff0deb2a8/new_patent_taxation_regime_-_september_2007.pdf

[264] ibid

For the positive effects, some assumptions must be made. First, we must assume, that the tax subsidy attracts a number of multinational companies here. The number of companies might be, for instance, 5. We must also assume the number of employees, that these companies employ, for instance, 100 employees per company. In such a case, the main channel for Estonia benefitting from this, is through the wages that these companies pay their employees. Since intellectual property transfers is what attracted these companies, we can then assume, that the wages in these companies are relatively high. If the wages are 2 or 3 times higher than the average Estonian wages, it would mean that the labour costs for these employees would range from 170m - 260m EEK annually, combined. A third of this would go directly to the state budget, 60m – 90m EEK annually. The rest would in large part be spent also in Estonia, so some additional revenue for the state budget through the VAT tax system is expected. And of course, since the companies were attracted here by the tax subsidy, an additional 5% of all intellectual property transfers will end up in the state budget. Also spillovers might have some additional positive effects.

The positive effects definitely outweigh the negative effects, but it has to be stressed, that the positive side is only assumed. There is no way of guaranteeing, that this tax incentive will attract foreign companies.

The main characteristics of this tax incentive are the following:

- *Target – intellectual property transfer in business enterprise sector, firms who pay corporate income tax*
- *Scale – very small, a few firms*
- *Behavioural effects – foreign direct investment growth*
- *Positive – low implementation and administrative costs, possibility of attracting foreign firms*
- *Negative – small impact*

5.3.3 Wage tax incentives

The target of wage tax incentives is to decrease the R&D user-cost, as with corporate income tax incentives. And in this case by directly reducing labour costs.

Four tax subsidies are considered: reduction of withholding income tax on wages for R&D employees; reduced rate of social security tax for R&D employees; ceiling on social tax for all R&D employees; social tax ceiling for imported R&D employees. Also, an additional tax subsidy is analysed – ceiling on social tax for all employees.

With wage tax subsidies not only the business enterprise R&D is targeted, but also, non-profit R&D. However, since business enterprise R&D employees have higher wages, wage tax subsidies target this sector more efficiently. It has to be noted, that if the state considers non-profit sector subsidisation to be deadweight loss, it can significantly decrease these losses by reducing the budget for the wages for non-profit sector R&D employees. The vast majority of the non-profit sector R&D employees are directly paid by the state.

Also, wage tax subsidies will efficiently subsidise firms that are not making profit or the companies that have decided to reinvest their profits instead of distributing them. These incentives mainly concern start-up firms and firms in their growth phase.

5.3.3.1 Reduction of withholding income tax on wages

- *Income tax for R&D employees reduced to 10% (11% decrease from 21%).*

With this tax subsidy, contribution based social benefits are not affected. There are two ways suggested of how this tax subsidy should be implemented. First, the R&D employee will have a reduced tax rate and keep the amount that is reduced. Second, the company will keep the amount that is reduced. The differences between the two are only short-term. In long-term, the company will have the full benefits of the tax subsidy by reducing or not increasing the employees' wages. Also, it might be argued, that wages in Estonia have risen too fast when compared to productivity, considering this, the employers' interest for this tax subsidy should be considerable.

The reduced personal income tax rate will have an impact also on the local government budgets as 11.4% of the personal income tax collected by the tax authorities is transferred to the local governments based on the registered domicile of the individual taxpayers. Thus, depending on the location of the R&D employees' activity, some local governments will be more effected than others.

The main characteristics of this tax incentive are the following:

- *Target – R&D labour costs in all sectors*
- *Scale – large, up to 10,000 employees*
- *Behavioural effects – increased R&D employment*
- *Estimation accuracy – overestimation possible*
- *Positive – labour cost reduction*
- *Negative – impact on local government revenues*

5.3.3.1.1. State budget and administration costs

Table 5.3.4. Estimated initial annual maximum[265] impact on the state budget, EEK[266]

R&D labour costs, aggregate, Business enterprise sector, 2007	**R&D labour costs, aggregate, Non-profit sector, 2007, estimate**
582 594 000	652 988 565,0
Minus 33%	Minus 33%
438 040 601,5	490 968 845,9
11%	11%
48 184 466,2	**54 006 573,0**
Full-time work equivalents	Full-time work equivalents

[265] This estimate doesn't take into account the personal income tax free minimum.

[266] Source: authors calculations.

1 689,0	3 313
Tax reduction per full-time work equivalent	Tax reduction per full-time work equivalent
28 528,4	**16 301,4**

The initial annual maximum impact on the state budget is 102m EEK (see table 5.3.4.). The combined 10 year impact on the state budget is estimated at 1,4b EEK with the tax subsidy costing 230m EEK in the last assessment year (based on the projection).

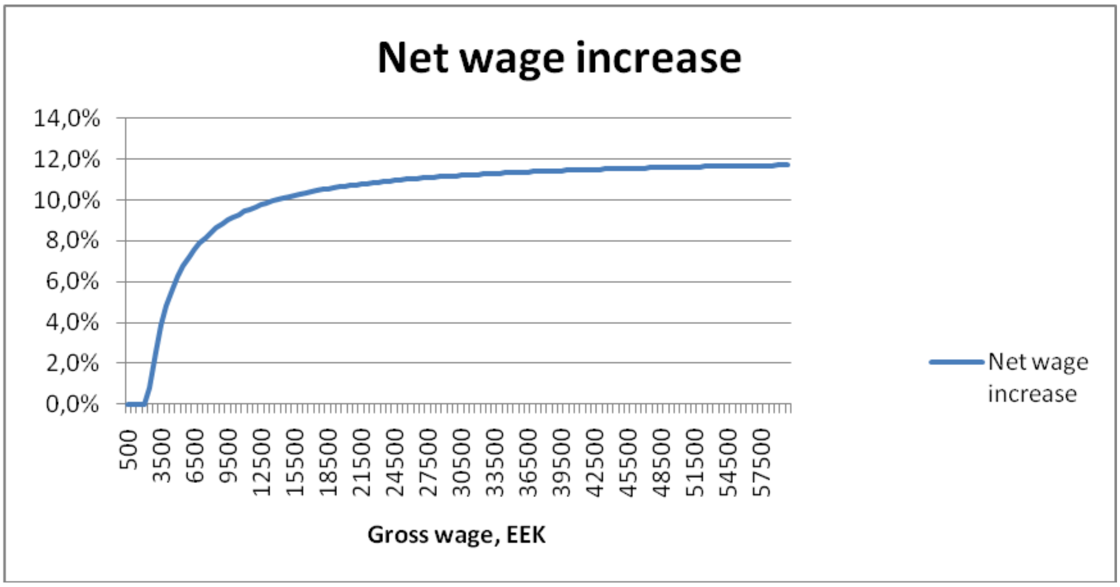
The annual administration cost for this tax subsidy is 2%[267] (2m EEK, over the 10 year period, it will grow to 4,2m EEK)

5.3.3.1.2. R&D activity, employment, investments and value added

Short-run effect is that R&D activities will rise by 0,4% of all current R&D expenditure (10m EEK). The long-run effect is that R&D activities have risen by 16,5% of all estimated R&D expenditure (850m EEK).

The initial annual compliance cost for this tax subsidy is estimated at 2,1m EEK[268].

Chart 5.3.5. Net wage increase with income tax for R&D employees reduced to 10%.[269]



The average R&D employee gross wage in business enterprise sector R&D is 21 500 EEK (2007). In the non-profit sector, the average R&D gross wage is smaller, 12 500 EEK (estimated, 2007). An average net wage increase of 10% (102m EEK) in long-run will translate into company wage cost reduction, the companies will delay wage increases, R&D employee user-cost will decrease, which will translate into increase in demand for R&D.[270]

267 We use the same estimate, as with the direct tax subsidies.

268 So high compliance cost is due to the fact, that there are much more R&D employees than there are full-time work equivalent employees. Each one of them has to keep track of their work-load. However, although the overall compliance cost is high, for an individual, the cost is marginal, so it shouldn't affect the effectiveness of the tax subsidy.

269 Authors calculations.

270 Harris, Richard., Li, Qian Cher., Trainor, Mary. Is a higher rate of R&D tax credit a panacea for low levels of R&D in disadvantaged regions? Elsevier. Research Policy, 38, 2009, pp. 192–205.

There is no exact estimate for labour demand elasticity of Estonian employees[271]. Various estimates range about 0,2 – 0,9 [272]. Labour demand elasticity for high-skilled labour, including RD workers, is lower. In our calculations we take it to be 0,2. Based on this, the estimated long-run R&D employment increase is up to 2%[273] (100 full-time work equivalent employees).

The second employment increase estimate, based on the projection, gives a figure of 700 additional R&D employees. This over-estimates the number of additional R&D employees, because the projection is based on the demand of these employees. However, this figure is not impossible if the supply side (unemployed high-qualification employees in Estonia and high-qualification employees from other countries) will sufficiently catch up.

Based on the employment growth, a positive impact on the state budget from 9m EEK to 105m EEK is estimated.

Based on the capital-labour structure of R&D activities, in the short-run, around 0,2% (5m EEK) additional investments is estimated, in the long-run (10 years), investment level is 17% (430m EEK) higher than without the tax subsidy.

We estimate a 0,4% additional increase in R&D/GDP ratio in the long-run (from 1,35% to 1,75% of GDP estimates).

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[271] The estimates change with time and different industries.

[272] Krillo, Kerly. Labour demand substitution elasticity. Bank of Estonia, Department of economic studies. 2004, 65p.

Järve, Janno. Labour cost impact on labour demand in the Estonian industry. Policy analysis 2002/1. Praxis - Centre For Policy Studies. 2002, 15p.

[273] 10% wage cost decrease multiplied by 0,2.

5.3.3.2 Reduced rate of social security tax

- *The social tax reduced to 15% for all R&D employees.*

Contribution based social benefits are affected. These might have to be compensated to R&D employees. So an additional negative impact on the state budget has to be considered.

The main characteristics of this tax incentive are the following:

- *Target – R&D labour costs in all sectors*
- *Scale – large, up to 10,000 employees*
- *Behavioural effects – increased R&D employment*
- *Estimation accuracy – both overestimation and underestimation possible*
- *Positive – labour cost reduction*
- *Negative – implementation is difficult since social benefits are affected*

5.3.3.2.1. State budget and administration costs

Table 5.3.5. Estimated initial annual maximum impact on the state budget, EEK[274]

R&D labour costs, aggregate, Business enterprise, 2007	**R&D labour costs, aggregate, Non-profit sector, 2007, estimate**
582 594 000	652 988 565,0
Wage cost reduction (social tax 15%)	Wage cost reduction (social tax 15%)
80 106 675,0	**89 785 927,7**
Full-time work equivalents	Full-time work equivalents
1 689,0	3 313
Wage cost reduction per full-time work equivalent	Wage cost reduction per full-time work equivalent
47 428,5	**27 101,1**

The impact at the current level of R&D expenditures on the state budget will be 170m EEK (see table 5.3.5). The cumulative 10 year impact on the state budget is estimated at 2,5b EEK with the tax subsidy costing 420m EEK in the last assessment year (based on the projection).

The annual administration cost for this tax subsidy is 2%[275] (3,4m EEK, over the 10 year period, it will grow to 8m EEK).

[274] Source: authors calculations.

[275] We use the same estimate, as with the direct tax subsidies.

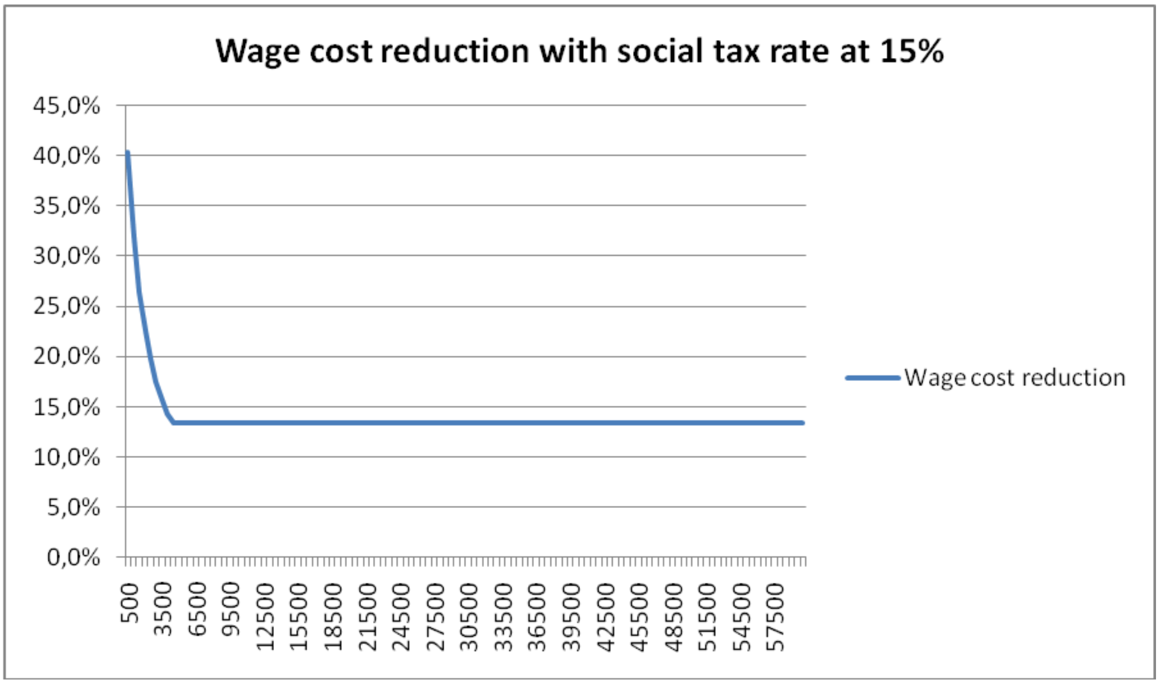
5.3.3.2.2. R&D activity, employment, investments and value added

Short-run effect is that R&D activities will rise by 0,63% of all current R&D expenditure (17m EEK). The long-run effect is that R&D activities have risen by 28,8% of all estimated R&D expenditure (1,5b EEK).

The initial compliance cost for this tax subsidy is estimated at 2,1m EEK[276].

A reduction in wage costs is estimated at 13,4% (see chart 5.3.6. below), which will additionally increase R&D employment by up to 3% (up to 150 full-time work equivalent employees), based on the labour demand elasticity of 0,2.

Figure 5.3.6. Wage cost reduction with different employee wage costs.[277]



The second employment increase estimate, based on the projection, gives a figure of 1300 additional R&D employees. This over-estimates the number of additional R&D employees, because the projection is based on the demand of these employees. However, this figure is not impossible if the supply side (unemployed high-qualification employees in Estonia and high-qualification employees from other countries) will sufficiently catch up.

Based on the employment growth, a positive impact on the state budget from 13m EEK to 200m EEK is estimated.

Based on the capital-labour structure of R&D activities, in the short-run, around 0,3% (8m EEK) additional investments is estimated, in the long-run (10 years), investment level is 29% (750m EEK) higher than without the tax subsidy.

276 So high compliance cost is due to the fact, that there are much more R&D employees than there are full-time work equivalent employees. Each one of them has to keep track of their work-load. However, although the overall compliance cost is high, for an individual, the cost is marginal, so it shouldn't affect the effectiveness of the tax subsidy.

277 Authors calculations.

We estimate a 0,6% additional increase in R&D/GDP ratio in the long-run (from 1,35% to 1,93% of GDP estimates).

5.3.3.3 Ceiling on social security tax

- *Social security tax ceiling for all R&D employees. Three different monthly ceilings are assessed: €500, €400 and €300 (EEK 7800, EEK 6300, EEK 4700 accordingly).*

This tax subsidy has many positive additional effects mainly that it is an incentive for high-qualification job creation, which makes the Estonian job market attractive for old EU member country residents, who are accustomed to considerably larger wages. Also high-qualification employees have higher additionality to the economy. Since business enterprise R&D employees have higher wages, this tax subsidy targets business R&D more efficiently.

As with the previous tax subsidy (see above), contribution based social benefits are affected. These might have to be compensated to R&D employees. So an additional negative impact on the state budget has to be considered.

The main characteristics of this tax incentive are the following:

- *Target – high-income R&D labour costs in all sectors, R&D labour costs in business enterprise sector*
- *Scale – medium to large (depending on the ceiling value), 1,000-4,000 employees*
- *Behavioural effects – high-income R&D employment growth*
- *Estimation accuracy – overestimation possible*
- *Positive – targets high-income employees*
- *Negative – implementation is difficult since social benefits are affected*

5.3.3.3.1. State budget and administration costs

The estimates in table 5.3.6. are based on the projection and the wage distribution of R&D employees.

Table 5.3.6. Initial annual impact on the state budget of the tax subsidy with different ceilings. EEK.[278]

Ceiling	€ 500	€ 400	€ 300
Initial maximum impact on the state budget	**21m**	**42m**	**96m**
Cumulative 10 year impact	**283m**	**570m**	**1,34b**
Impact in the last year	**41m**	**86m**	**211m**
Administration cost (first year)	**0,42m**	**0,84m**	**2m**
Administration cost (last year)	**0,84m**	**1,7m**	**4m**

[278] Source: authors calculations.

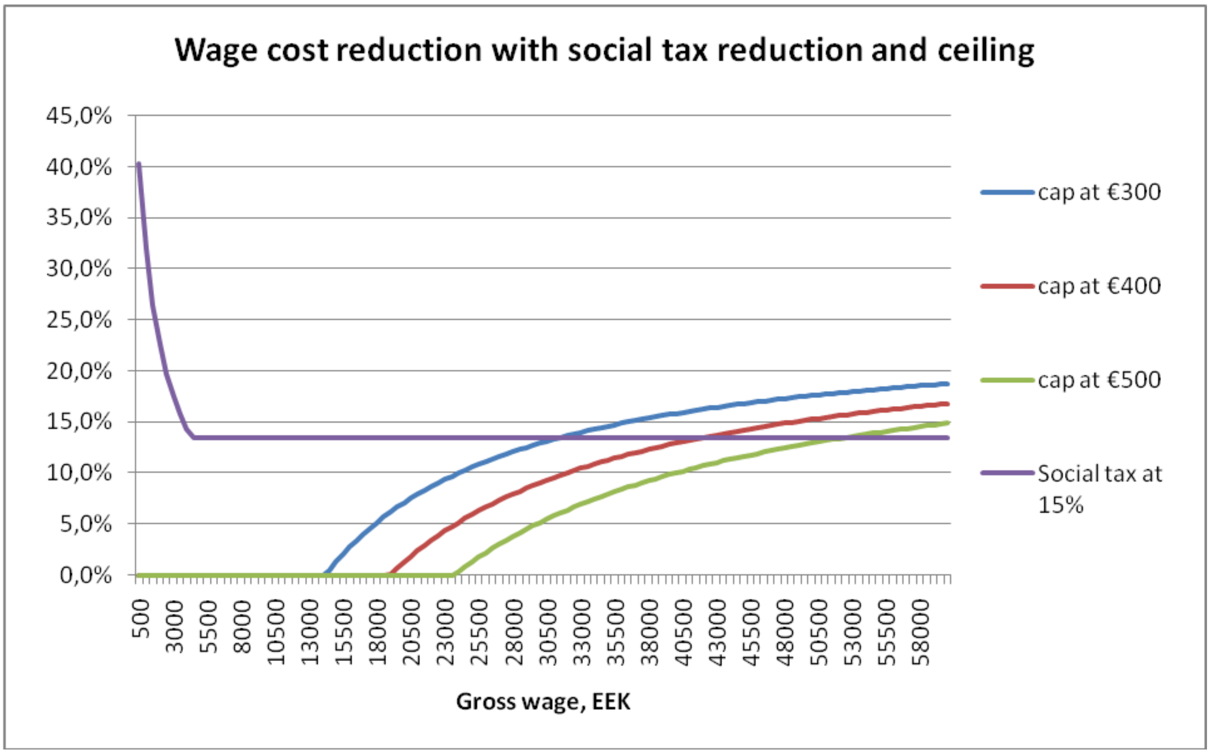
5.3.3.3.2. R&D activity, employment, investments and value added

Table 5.3.7. R&D activity increase based on the projections, different ceilings. EEK.[279]

Ceiling	€ 500	€ 400	€ 300
Short-run increase in R&D activities (% of current level)	**0,08%** (2,1m)	**0,16%** (4,2m)	**0,35%** (9,6m)
R&D activity rise in 10 years (% of estimated level)	**3,3%** (170m)	**6,6%** (340m)	**15,4%** (800m)
Compliance cost (initial)	**0,25m**	**0,4m**	**0,85m**

[279] Source: authors calculations.

Figure 5.3.7. Wage cost reduction with different social tax ceilings and social tax reduction.[280]



The gross wage at which wage costs will be reduced are 14 500 EEK, 19 500 EEK, 24 000 EEK, accordingly to the caps (€300, €400, €500).

32% of R&D employees have gross wages higher than the average gross wage (estimated, monthly gross wage is 16 000 EEK).

12% of R&D employees earn more than 24 000 EEK. Their combined wage costs are 23% of all wage costs. An additional increase of R&D personnel by 0,4% is estimated (20 employees). The projection gives a figure of 150 additional R&D employees.

Based on this employment growth, a positive impact on the state budget from 4m EEK to 24m EEK is estimated.

20% of R&D employees earn more than 19 500 EEK. Their combined wage costs are 36% of all wage costs. An additional increase of R&D personnel by 0,7% is estimated (35 employees). The projection gives a figure of 300 additional R&D employees.

Based on this employment growth, a positive impact on the state budget from 6m EEK to 45m EEK is estimated.

42% of R&D employees earn more than 14 500 EEK. Their combined wage costs are 62% of all wage costs. An additional increase of R&D personnel by 1,6% is estimated (80 employees). The projection gives a figure of 700 additional R&D employees.

Based on this employment growth, a positive impact on the state budget from 9m EEK to 105m EEK is estimated.

[280] Source: authors calculations.

Table 5.3.8. R&D investment increase based on the projections, different ceilings. EEK.[281]

Ceiling	€ 500	€ 400	€ 300
Short-run investment growth	**0,08%** (1m)	**0,16%** (2m)	**0,35%** (5m)
Investments increased in 10 years	**3,3%** (85m)	**6,6%** (170m)	**15,4%** (400m)

We estimate up to a 0,2%-0,4% additional increase in R&D/GDP ratio in the long-run (from 1,35% to 1,55%-1,74% of estimated GDP).

281 Source: authors calculations.

5.3.3.4 Ceiling on social security tax for imported workers

- *Tax ceiling 1 - Imported R&D employees, up to 3 years in Estonia, working on R&D (based on occupational classification), social tax capped at EUR 1,000 absolute value (meaning EUR 3000 salary with 33% social tax rate). After 3 years social tax will be 33%.*
- *Tax ceiling 2 - Imported R&D and innovation employees, up to 3 years in Estonia, working on R&D or innovation (based on occupational classification), social tax capped at EUR 1000 absolute value. After 3 years social tax will be 33%.*

These tax subsidies target imported high-income R&D and innovation employees. These are employees with the largest additionality to the economy. So these tax subsidies have an excellent target. Since business enterprise R&D employees have higher wages, theses tax subsidies target business R&D more efficiently.

As with the previous two tax subsidies (see above), contribution based social benefits are affected. These might have to be compensated to R&D employees. So an additional negative impact on the state budget has to be considered.

There is a similar subsidy in use by the EAS which aims for the same target by reducing the labour costs of R&D employees. The instrument is called „development employee involvement support“[282] and it can be used by every firm in Estonia, but the employee who is imported, has to meet certain criteria[283]:

• has at least 5 years of field experience in a foreign country

• comes from a firm or a research institution from another country

• has worked there for at least two years

• is working there till the day of the support application

• has at least a BA degree

• is not a replacement employee, but is hired for a new assignment

The problem with such a long list of criteria, is that not many firms are applicable and the macroeconomic effect will be just above marginal at best. This subsidy has an effective wage cost subsidisation rate of 50%. In order to achieve this kind of subsidisation rate, the tax subsidy should exempt the person from all tax obligation and then add some additional subsidy.

However, the idea of an imported employee social security tax ceiling is still an excellent one. Since imported employees are usually imported for only a relatively short time period, they can’t make the full use of Estonian contribution based social benefits, so burdening them with too much of the social security tax might be de-motivating for the employee and also the employer.

Currently, there is no reliable assessment possible for the number of imported R&D employees or imported innovation employees. So, a quantitative assessment of effects is more or less impossible. However, the short-run fiscal impact of the first subsidy (for R&D employees) is deemed small[284], even when adding imported innovation employees[285], the expected short-run

[282] Arendustöötaja kaasamise toetus

[283] Source: EAS (Enterprise Estonia) homepage - http://www.eas.ee/index.php/ettevotjale/eksport/arendustoeoetaja-kaasamise-toetus/ueldist.

[284] In chapter 5.3.3.3. there are estimates for a ceiling, that applies to all R&D employees, and which is half the value (€500).

fiscal effect is smaller, than most other tax incentives analysed. Long-run effects depend on how well these tax subsidies will attract employers to import R&D employees, and for this assessment, international experience and qualitative analysis, should be used.

A suggestion at this point, is that a survey should be conducted to assess the number of imported R&D employees. It has been suggested, that knowledge importation has a vital part in the success of a country's innovation activity[286]. This is because the innovation systems are opened and are crossing country borders, it is much more efficient to import the knowledge and experience temporarily, than to try and create it from scratch. So, this tax subsidy might have the best targeting capabilities of all the tax subsidies analysed in this report. However, without a full analysis of the current situation, no reliable policy recommendations can be given as to what the best social security tax ceiling should be (the social security ceiling should fall between €500 and €1000) or what are the fiscal effects.

The main characteristics of this tax incentive are the following:

- *Target – knowledge importation, high-income R&D labour costs in all sectors, R&D labour costs in business enterprise sector*
- *Scale – small, less than 100 firms*
- *Behavioural effects – imported R&D employment growth*
- *Positive – excellent targeting*
- *Negative – needs further research*

[285] The defining of an innovation employee might be tricky.

[286] Source: de Jong, J.P.J. *et al*. Policies for Open Innovation; Theory, Framework and Cases. VISION Era-Net, Helsinki, July 2008, 172 p. [http://www.praxis.ee/fileadmin/tarmo/Projektid/Innovatsiooni_poliitika/Avatud_innovatsioonipoliitika_hindamise_raamistik/OIPAF_final_report.pdf]

5.3.3.5 Social tax ceiling for all employees

This is a tax subsidy that is not directly related to R&D user-cost reduction. It is, however, a subsidy for reducing the user-cost of all high-income employees.

- *The proposed social tax ceiling is on two average wages.*

Table 5.3.9. Impact estimates for social tax ceiling for all employees[287].

		Affected people		Annual reduction in social tax revenues		Change in labour cost (for those affected)
Ceiling	Monthly Gross wage[288] (EEK)	Persons	Ratio	Million EEK	Ratio	Ratio
2x Average monthly gross wage (ESA[289])	22 672	43 264	**5,8%**	**2 257**	**8,4%**	**-9,1%**

The estimates given in table 5.3.9. (above) take into account the social tax actually paid by self-employed, social tax declared by employers (not necessarily paid), and social tax paid by the state (or The Estonian Unemployment Insurance Fund) on behalf of some social groups (e.g. unemployed, parents on parental leave). The estimation method used is applying the ceiling on social tax, and then calculating the impact change in revenues.

For this tax subsidy impact analysis on R&D activities, see chapter 5.3.3.3, it has a social tax ceiling of €480, so the estimated results are comparable to the social tax ceiling of €500 analysed in that chapter.

With this tax subsidy, over 40,000 people are affected, which makes this considerably larger by impact than other subsidies analysed in this report. The labour cost reduction of 9,1%, when using labour demand elasticity of 0,2, will increase the demand for high-income[290] employees by 2%, which is 800 people. Based on the employment growth, a positive impact on the state budget from 70m EEK to 600m EEK is estimated.

The main characteristics of this tax incentive are the following:

- *Target – high-income employees in all sectors*
- *Scale – very large, over 40,000 employees*
- *Behavioural effects – high-income employment growth*
- *Estimation accuracy – slight overestimation and underestimation possible*
- *Positive – high-income employment growth*
- *Negative – not targeted for R&D*

[287] Calculations based on microdata from Estonian National Social Insurance Board on annual social tax in 2007.

[288] 2007.

[289] Statistics Estonia.

[290] Those people that the social tax ceiling affects.

5.3.4 Summary of qualitative and quantitative analysis

Table 5.3.10. Summary of the main positive and negative qualitative effects.

Aim: Increase R&D activity in Estonia		
	Positive effects	**Negative effects**
Intermediate aim: To reduce capital cost of R&D activities by reducing corporate income tax liability	• Attractive investment climate • Increase in foreign direct investments • Increase in R&D expenditure	• Incentive does not favour start-ups and non-profit organizations
Option 1A: By the number of R&D employees	• R&D employment growth in labour intensive firms	• High administration costs • Small effects • Does not influence capital intensive firms
Option 1B: By R&D expenditure	• Well targeted • Influences both capital and labour intensive firms • Cooperation between R&D companies may increase	• High compliance costs • Risk of double subsidisation
Option 1C: By income from royalties	• Intellectual property transfer growth • Attractive for foreign companies • Low administrative costs	• May not benefit Estonian firms • Benefits will be enjoyed with a time-lag • Low overall impact
Intermediate aim: To reduce labour cost of R&D activity	• R&D employment growth • Benefits also start-ups and non-profit sector • Positive effect on companies' cash flows • Balance of R&D activity will not be distorted	• Large negative influence on the state budget • Does not influence capital intensive R&D activity
Option 2A: Reduction of income tax on R&D employees' salaries	• R&D employment growth • Large impact	• Negative impact on state and /or local government budget
Option 2B: Reduced rate of social tax on R&D employees' salaries	• R&D employment growth • Large impact	• Negative impact on social benefits
Option 2C: Ceiling on social tax on R&D employees' salaries	• Well targeted (creation of high-income jobs) • Estonian labour market may be attractive • Medium to large effect	• Negative impact on social benefits
Option 2D: Ceiling on social tax for "imported" R&D (and innovation) employees' salaries	• Excellent targeting (imported high-income employees) • Import of knowledge	• Fiscal effects are more or less impossible to assess
Option 2E: Ceiling on social tax for all employees	• High-income employment growth	• Not targeted for R&D

Table 5.3.11. Summary of quantitative effects, million EEK (except employment growth and R&D/GDP ratio growth).

Short-run – implementation year, Mid-run – 3rd year Long-run – 10th year	CIT base reduction by the number of R&D employees (300 000 EEK)	Tax credit by intramural R&D expenditure	Tax credit by total R&D expenditure	Income tax reduction to 10%	Social tax reduction to 15%	Social tax ceiling for R&D employees (€300)	Social tax ceiling for R&D employees (€400)	Social tax ceiling for R&D employees (€500)	Social tax ceiling for all employees (2x average wage)
Negative state budget impact (short-run)	3,3	26	30	102	170	96	42	21	2257
Negative state budget impact (mid-run)	3,3	25	29	101	170	95	42	21	2227
Negative state budget impact (long-run)	6,4	53	60	230	420	211	86	41	3500
Administration cost (short-run)	0,06	0,52	0,6	2	3,4	2	0,8	0,4	NA
Administration cost (long-run)	0,13	1,1	1,2	4,2	8	4	1,7	0,8	NA
R&D activity level increase (short-run)	0,3	2,6	3	10	17	9,6	4,2	2,1	2
R&D activity level increase (mid-run)	1	7,5	8,5	30	50	28	12	6,2	6
R&D activity level increase (long-run)	26	210	240	850	1500	800	340	170	170
Compliance cost (short-run)	0,2	1 - 1,8	1,2 - 2	2,1	2,1	0,9	0,4	0,3	90 - 160
R&D investment level growth (short-run)	0,16	1,3	1,5	5	8	5	2	1	1
R&D investment level growth (long-run)	13	105	120	430	750	400	170	85	85
R&D employment growth (long-run) (persons)	5 - 23	50 - 200	50 - 225	100 - 700	150 - 1300	100 - 700	70 - 300	40 - 150	800 - 4000
Annual positive impact on the state budget (based on R&D employment growth)	0,5 - 5	6 - 40	6-45	9 - 105	13 - 200	9 - 105	6 - 45	4 - 23	70 - 600
R&D/GDP ratio change (percentage points)	0,08	0,14	0,15	0,4	0,6	0,4	0,3	0,2	0,2

There are currently (2007) around 5000 full-time work equivalent R&D employees in Estonia, of these, 1700 are in business enterprise sector and 3300 in non-profit sectors (higher education, private non-profit and government). See table 5.3.2 for more detail.

The estimated (2010) R&D/GDP ratios are as follows – all R&D expenditure makes up 1,35% of GDP, business enterprise R&D expenditure 0,73% of GDP, and intramural business enterprise R&D expenditure 0,64% of GDP. For example, with the lowered rate of the social security tax, the expected R&D/GDP ratio after 10 years, is 1,95% (1,35+0,6). As mentioned before, without any tax subsidy, the R&D/GDP ratio is estimated to grow to 1,5%.

The overall pure fiscal cost-effectiveness to R&D is almost the same for all tax subsidies (except for social security tax ceiling for all employees), and it is estimated at 160%[291] for the 10-year period. This, however, does not encompass the spillover effects to the economy. An additional 10-20% will be added to the cost-effectiveness by tax returns to the state budget by the growing R&D activity.

When considering the impact size, the tax subsidy with the largest impact is the lowered social security tax rate for all R&D employees. Also, the lowered income tax rate for R&D employees and social security tax ceiling of €300 are not far behind. Due to simplicity and the question of future social security compensation, the tax subsidy of choice out of these three, is the lowered income tax rate for all R&D employees.

When targeting is considered, three tax subsidies stand out – social security tax ceiling for imported employees, tax credit by R&D expenditure and tax base reduction by the number of supplementary R&D employees. The first subsidy is important for knowledge importation, the second for pure user-cost reduction of the business enterprise sector R&D and the third as an incentive for R&D employment growth.

For those R&D tax measures that require companies to be profitable in order to benefit from the R&D tax incentive, we propose that these should be complemented by R&D grants. In general, R&D grants should be the driving factor for R&D growth in the initial years of the company's existence.

For those measures that do not require the companies to be profitable (wage tax incentives) the direct subsidies (EAS grants) could be complementary but should be very well targeted towards specific objectives that the tax incentive is unable to provide, e.g. the purchase of machinery and equipment. In any case, we propose that the selected R&D tax measure will be coordinated with the EAS grants available to avoid the overlapping in terms of targeting objectives as R&D grants and R&D tax incentives are generally substitutes.

As it is more difficult to keep track of foregone tax revenue than it is to keep track of "out of pocket" expenses, we find that tax audits during the first years of R&D tax incentive application are essential to be carried out.

Our analysis showed that several tax incentives can be implemented in the Estonian income tax system to encourage research and development. The short term costs as well as impact of different incentives vary. Which R&D tax incentive to implement eventually has to be carefully contemplated considering how much resources the government is willing to invest in R&D and which costs or objectives are the priorities.

[291] This percentage shows that if the state pays for 1 EEK of R&D activity, firms will add to that, on average, 60 cents of R&D expenditure in the 10-year period.