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Policy paper by the Commission services ERAC Plenary Meeting

How to improve national Research and Innovation systems of Member States and Associated Countries

Research and Innovation

Policy paper by the Commission services
ERAC Plenary Meeting, Salzburg,
Agenda point 5.1: Strategic debate: how to improve national Research and Innovation systems of Member States and Associated Countries

European Commission

Directorate-General for Research and Innovation
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1. CONTEXT

Research and innovation (R&I) in Europe can not thrive without well functioning, efficient and impactful national R&I systems. ERA Priority 1 recognises this in calling for more effective national research systems and Member States and Associated Countries have over the past years made significant efforts to make their national R&I policy mixes richer and geared towards stronger impact. However, the outcome of the 2018 European Semester cycle shows that further progress needs to be made, with obstacles remaining across Member States in improving the quality of the public science base, knowledge transfer between the public and the private sector or improving the business environment.

As highlighted by the report Science, Research and Innovation Performance of the EU 2018[1], building Europe's foundations of sustained growth will require renewed efforts to sustain investments in R&I and other intangible assets. But it will also require the design, implementation and evaluation of the necessary accompanying reforms to boost the quality, efficiency and institutional capacity in research and innovation.

The European Council in June 2018 concluded that Europe's high-quality research should be developed to create new products, services and business models across the EU, and that access to financing and cooperation between research, innovation and education are essential preconditions[2]. The Renewed European Agenda for Research and Innovation[3] provides a set of concrete actions to deepen Europe's research and innovation capability, and was at the basis for that discussion by Leaders.

The ERAC plenary can now contribute to this timely discussion by making further progress on ERA Priority 1 through strategic policy debates on key R&I policy issues where Member States and Associated Countries continue to face challenges, and where reforms are being pursued in many Member States and countries associated to Horizon 2020. The 2017 Annual Report of ERAC demonstrates a broad range of activities from ERAC and the other ERA-related groups which contribute to a better understanding of R&I policies in various countries. In recent times, however, ERAC faces a discussion deficit in relation to strategic thinking about the right policy-mix in research and innovation on the basis of a substance-driven discussion around the various policy tools.

It is against this backdrop that this policy paper provides background information and analysis to stimulate a debate on two key policy issues for which important evolutions have been noted over the past years: Performance Based Research Funding and R&D tax incentives. The paper draws on information and expertise accumulated in the Commission services through a range of activities and notably:

Commission R&I related reports, and notably the Science, Research and Innovation Performance of the EU 2018, and the European Innovation Scoreboard 2018[4];

The outcomes of Horizon 2020 Policy Support Facility activities, for which the demand has risen steadily, both in terms of country based activities and Mutual Learning Exercises;

Cooperation with other reputed organisations, and notably the OECD;

In-house studies and analysis performed by both DG RTD and JRC.

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[1] The report analyses Europe's performance dynamics in research and innovation and its drivers, globally and with a thorough indicator-based macroeconomic analysis and deep analytical dives into hot policy topics.

[2] http://www.consilium.europa.eu/en/meetings/european-council/2018/06/28-29/

[3] https://ec.europa.eu/commission/publications/european-commissions-contribution-informal-leaders-meeting-sofia-bulgaria-16-may-2018_en

[4] The European Innovation Scoreboard 2018 provides a comparative analysis of innovation performance in EU countries, other European countries, and regional neighbours. It assesses relative strengths and weaknesses of national innovation systems and helps countries identify areas they need to address.

2. REWARDING PERFORMANCE THROUGH PUBLIC RESEARCH FUNDING

2.1 Performance Based Research Funding within the policy mix.

What is the policy context? Science is recognised as the indispensable feedstock of high impact innovation. In terms of overall scientific production, Europe is world leader (with 27% of global scientific publications in 2016), notwithstanding the sharp increase of China (from 2.7% in 2000 to 16.7% in 2016) and ahead also of the United States (with 19.5%). However, in relative terms and looking at the top 10% most cited publications, Europe lags behind the United States and China is quickly catching up (Commission, 2018a). As a result, numerous EU Member States are making efforts to increase the effectiveness and performance of their public sector research systems, including through Performance Based Research Funding Systems (PRFS).

What is a Performance Based Research Funding system (PRFS)? National public research systems are funded for a significant part through institutional funding, i.e. funding provided by the government which can be used at the discretion of the organisation to which it is provided. Traditionally, this institutional funding was allocated through a **"block grant":** a single lump sum essentially allocated without conditions. Governments have, however, over the past decades, started to make increasing use of PRFS to fund their research institutions. PRFS refers to the component of the institutional funding system that is allocated in a competitive or performance based manner as opposed to block funding. A PRFS has two components: an assessment process, which judges the 'goodness' of past research on a range of criteria, and a funding formula, which converts the ratings of each university into money.

Besides the institutional funding (which includes block funding and/or PRFS), universities and public research organisations also derive part of their income **from project based funding**. Project based funding is won by the university in a competitive manner from external funders and each project involves a contract whith the external funder. The combined growth in the use of PRFS and project based funding has led **to an increasing competitition among universities** to access funding.

What is the policy challenge addressed by Performance Based funding? The introduction of a PRFS is one of the central mechanisms through which many countries have in recent years tried to **increase the effectiveness and performance of their public research systems**. Yet, interest has grown in using PRFS to also steer the behaviour of research organisations towards achieving **more complex policy objectives**[5]. These include concentrating excellent research in a few institutions (e.g. UK); strengthening research capacity in the weaker parts of the system (e.g. NO), prioritising certain fields of research (e.g. EE), promoting internationalisation (e.g. IT, PT), incentivising excellence (e.g. ES), increasing the societal use and impact of research (e.g. HR, UK) or developing greater interaction with industry (e.g. HR, EE, UK, IT, FI, NO). The need to create incentives to pursue the 'third mission' underpinned some of the recommendations made by the Horizon 2020 Policy Support Facility (PSF) expert panel providing Specific Support to Slovenia[6].

How does PRFS increase the effectiveness and performance of public sector research? PRFS enhances competition for public funding and thereby contributes to enhancing performance. It is also seen as a useful instrument to increase transparency in the allocation of funding, ensure accountability for public investment in research and

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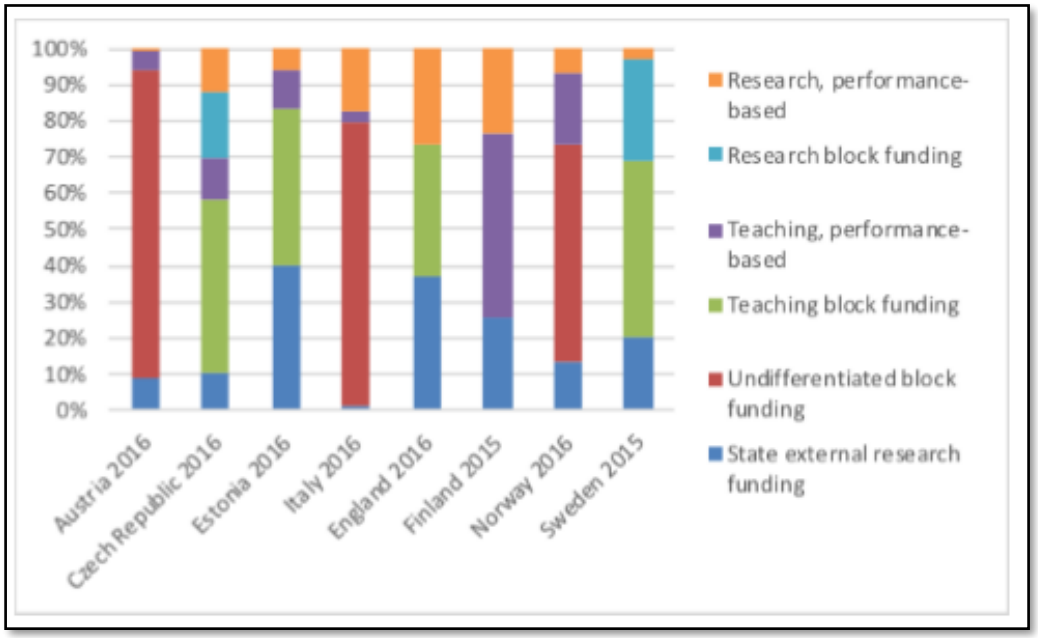
[5] The Horizon 2020 Policy Support Facility MLE on Performance Based Funding of University Research brought together practice and experiences of 14 countries. It delivered a useful handbook for policy makers and PRFS designers. https://rio.jrc.ec.europa.eu/en/policy-support-facility/mle-performance-based-funding-systems

[6] https://rio.jrc.ec.europa.eu/en/policy-support-facility/specific-support-slovenia

increase institutional autonomy (Jonkers and Zacharewicz, 2016). Ultimately, a PRFS provides information for developing a research strategy at institutional and/or national level.

How does PRFS fit in the broader policy mix? PRFS helps improve system performance in interaction with other policy instruments, in particular project based funding, and governments need to ensure a good **balance between the use of both instruments.** Even though there is no optimal mix (as shown in Figure 1), interdependence of policy instruments should be carefully considered. The combined effect of growth in the use of PRFS and growth in the proportion of project based funding has led to very diverse research funding systems[7]. For instance, CZ, England and FI have a very large degree of competition in university funding with both project based funding from the government and PRFS funding forming a large proportion of total research income (FI and England together with EE do not provide block funding for research). IT, AT, SE and NO have strong block funding traditions. IT uses quite a strong PRFS with almost no external research funding. In AT, both project based funding from the government and PRFS funding are low. While a lot of use is made of project based funding from the government in SE and NO, the proportion of PRFS funding is low.

Figure 1: Distribution of universities income[8]



PRFS is also complementary to other measures such as fostering international collaboration or pursuing governance reforms in the research-performing institutions. Even though there is a wide recognition that PRFS should be perceived as part of a wider strategy, the general view of the countries participating in the Horizon 2020 PSF mutual learning exercise on Performance Based Funding of University Research, was that PRFS rarely evolved with a systemic view that looks into creating connections and complementarities between different policy instruments.

2.2 Performance Based Research Funding Systems: use and impact

[7] A composite indicator of performance-based funding developed in the context of a pilot study of fourteen countries, shows that performance-based orientation of public funding emerges in countries with low levels of project funding (e.g. AT, IT). Analysis of national public research funding (PREF), JRC Technical Report, Emanuela Reale, 2017

[8] Data collected in the context of the MLE PRFS, 2016 data: AT, CZ, EE, IT, UK and NO, 2015 data: FI and SE

How widespread is the use of PRFS in the EU? A growing number of countries have implemented some form of PRFS (BE, HR, CZ, DK, EE, FIN, FR, IT, LT, PL, PT, SK, SI, SE and UK). Although some countries (e.g. BG, CY, EL, HU, IE, LV, LU, MT or RO) do not use PRFS, some of them are considering it (e.g. LV). Other countries (e.g. ES, HU and DE) have pursued some of the goals of PRFS by awarding centres or units of excellence to universities based on the assessment of proposals . Another group (e.g. AT and NL) base the allocation of institutional funding on performance agreements between the universities and the responsible agency or ministry.

How are PRFS designed across the EU? PRFSs differ widely in terms of the assessment toolbox that they use: peer review evaluation of performance, metrics, or a mixture of the two. Many countries, such as BE, HR, DK, EE, FI, NO or SE use a metrics based system (quantitative assessment of research outputs) to drive the funding allocation. Another set of countries such as UK base their funding formulae on evaluations of research output through peer review. A third group allocates funding using a mix of the two (informed peer review , or mixed peer review and metrics). This group includes countries such as IT, PT, CZ or SI. While early PRFS tended to be wholly based either on peer review or on metrics, a growing number rely on the combination of these approaches to produce higher quality judgement at lower cost. This is the case for instance of CZ that moved from a wholly metric system to one that involves a measure of peer review as well metrics. PT added bibliometric information into its peer review approach in 2014 to improve the basis for peer judgement. IT has moved from a peer review based PRFS to an informed peer review system (for the STEM fields) to decrease the burden and increase the quality of large scale reviewing.

Nonetheless, there is continued discussion about whether peer review or metrics based approaches are best. Key parameters that need to be considered in this respect include the cost (many countries use metrics because of the perceived cost of a peer-review based system), the periodicity (with peer review tending to be done infrequently while metrics approaches can be performed annually), the scale (metrics-based systems can tackle many fields) or the complexity (peer review systems can be simpler than some based on metrics). A number of issues are particular to small countries, such as the difficulty of obtaining foreign peers with the necessary linguistic skills. Other parameters are the scope of the PRFS (scholarly quality or also other dimensions such as innovation or societal impact); the indicators and assessment criteria; the granularity (whether results are reported and funding allocated at the level of research groups, departments, faculties or whole institutions), among others.

What is the impact of PRFS? There is evidence that most countries that use PRFS have seen improvements in their public research performance, though the amount of evaluations that have been carried out in this area is very limited (e.g. evaluation of the Research Assessment Exercise, in UK). International studies tend to associate PRFS with increased productivity and quality (measured as citations). In the context of the Horizon 2020 PSF mutual learning exercise on Performance Based Funding of University Research countries reported that the introduction of PRFS led to improved quality and productivity of research (i.e. NO, UK), the adoption of quality-oriented policies in the universities (i.e. IT), increased transparency, improved prospects for PhD students and young researchers (i.e. PT), changes in the research management for recruitment and promotion purposes (i.e. NO), among others. However, while those countries that adopted PRFS improved their performance, those that did not adopt such systems also improved, so there is no clear relationship between PRFS use and performance (Jonkers & Zacharewicz, 2015). This is the case for instance for the NL, AT, or CH which reach the goals of a PRFS by other means. The PSF expert panel providing support to Slovenia recommended the use of performance agreements instead of a PRFS system, given the lack of real autonomy for the universities.

2.3 Performance Based Research Funding Systems: key considerations

What are the key considerations to take into account when designing and implementing a PRFS? A PRFS needs to be **consistent with the wider set of incentives in the policy mix**. A strong PRFS in the absence of significant incentives for teaching quality or performing the third mission may introduce distortions, making teaching a second-class activity, discouraging interaction with society and industry or deterring structural upwards shifts in institutional culture, e.g. towards more gender balanced policies in staff selection (Jonkers and Zacharewicz, 2016). In the UK, for instance, the higher education funding councils introduced a 'Teaching Excellence Framework' to counterbalance some of the negative effects of the 'Research Excellence Framework' and its predecessors. The former Australian PRFS incentivised increased production of research outputs without offering an incentive to maintain or increase quality. The result was an increased volume of publications but reduction in average citation impact (Butler, 2003).

A PRFS needs to have clear policy objectives to avoid unintended or undesired behavioural changes in the system. Equally important is **not to overload the system** with multiple policy objectives trying to create incentives for all tasks assigned to universities. The risk of defining too many policy goals is that the PRFS becomes so complex that it misses its purpose, in practice creating no, or at best very unclear and conflicting, incentives that researchers cannot satisfy.

There seems to be **no evidence to suggest the existence of an optimal share of institutional research funding** to be allocated through PRFS. The amount of institutional funding allocated through PRFS should be sufficiently large to trigger behavioural and organisational changes, but at the same time not be so large as to generate instability. In Europe, countries such as UK and FI allocate respectively 43% and 31% of total institutional funding for research through a PRFS. There is nonetheless evidence that other countries that only drive a small part of institutional funding such as SE (with 3% of PRFS) and NO (with 7% of PRFS) are effective at changing behaviour and performance. **The ratio of project based funding to institutional funding should also be carefully considered** in a context where project based funding is on the rise. This is a problem in systems such as in LV and BG where austerity considerations have led to a substitution of national public research funding with project based funding through the EU Structural Funds. The PSF expert panels providing specific support to LV and BG recommended that block funding should cover a sufficient part of the institutional cost of research.

It may be **premature for countries** (such as GE, LV and BG) **that suffer from institutional fragmentation** to introduce a PRFS. In the case of BG and LV, the PSF expert panels recommended to first address fragmentation as a pre-condition for an effective implementation of a PRFS.

What are the potential unintended consequences of PRFS? While there is little literature about the effects of PRFS, there is an ongoing debate regarding their potential unexpected or undesired effects (some of them already highlighted above). Countries participating in the Horizon 2020 PSF mutual learning exercise on Performance Based Funding of University Research shared some of them. These include: discouraging interdisciplinarity, 'blue skies and 'transformative' research, promoting orthodox rather than heterodox theory and methods, undervaluing applied research, reducing researcher and institutional autonomy, undermining the non-research functions of a university, under-valuing research not published in English, discouraging performance of the third mission and the popularisation of science. In addition, existing literature highlights that ill-designed PRFS strategies, e.g. those placing excessive weight on output indicators, may incentivise that researchers slice their results in order to publish them in various journals (Jonkers and Zacharewicz, 2016). They can as well generate citation biases, including self-referencing, and favour areas that are more prone to generate multiple-author peer-reviewed publications -such as the life and medical sciences- to the detriment of social sciences and humanities (Hazelkorn, 2010). It should be noted that evidence on those effects remains to a large extent anecdotal and that PRFS does not necessarily foster all these effects in isolation or simultaneously. -–Whether PRFS strategies do so or not will eventually depend upon the specificities of their design and the interaction between the PRFS and other

incentive systems. It will also depende on the nature of the underlying national science system and its framework conditions for public research organisations and universities.

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3. R&D TAX INCENTIVES

3.1 R&D tax incentives within the policy mix

Context. Despite positive developments, reported by the 2018 edition of the European Innovation Scoreboard, which highlights that the EU's innovation performance is improving and that the outlook is positive, the gap in business R&D intensity between the EU and some of its main competitors has been a point of concern for many years and it remains so. Business R&D intensity in the EU amounted to 1.32% GDP in 2016 (compared to 1.99% in US, 2.58% in Japan and 3.28 % in South Korea). Over 2012-2016, business R&D intensity growth slowed down in the EU to 0.9 % per annum, well below the growth rate in China, the US, Japan and South Korea (European Commission, 2018a). Although Europe holds a world leading position in industrial sectors such as pharmaceuticals, chemicals, mechanical engineering and fashion, and is strong in supporting Key Enabling Technologies, such as photonics and biotechnology, its companies spend less on innovation than their competitors and venture capital remains underdeveloped, resulting in some firms moving to ecosystems where they have better chances to grow fast (European Commission, 2018c). The policy response across the EU to tackle this deficit in business R&D investment has been a substantial **increase in public support for business R&D** from 0.13 % of GDP in 2006 to 0.19% of GDP in 2015. Much of this support came through **indirect public support** via the provision of R&D tax incentives.

What are R&D tax incentives? R&D tax incentive schemes provide **tax relief** to businesses, organisations and individuals who engage in R&D activities. Depending on the specific objectives sought, governments can use and combine different provisions when designing and implementing R&D tax schemes. These provisions determine the type and levels of support (or 'generosity'[9]) of the tax incentives. For instance, if governments aim at supporting innovative young companies, which can often be loss-making, allowing these companies to carry the tax credit into a different period against future or past taxable income/liabilities (**carry forward/back**) or get **refunds** (i.e. tax credit resulting in payments being made to a taxpayer even if no other taxes are left for the credit to offset) is important. Also, **incremental-based** tax incentives may be more effective in encouraging businesses to continuously increase their level of R&D expenditure over time, whilst **volume-based** provisions apply to all qualified R&D expenditures. Similarly, tax relief on wage and social security contributions can support the employment of (young) R&D personnel.

What is the policy challenge addressed by R&D tax incentives schemes? EU and other OECD countries are increasingly using R&D tax incentives to boost R&D activities performed by the private sector, and thus increase productivity and economic growth. In particular, R&D tax incentives schemes aim at **increasing business R&D expenditure** (BERD[10]). Besides supporting business R&D, R&D tax incentives can also be used to enhance public-private R&D cooperation (e.g. FR), encourage the employment of researchers (e.g. BE, FR, HU, ES) or support SMEs' innovation potential (e.g. FR).

How do R&D tax incentives support private R&D? By lowering the price of doing R&D, R&D tax incentives stimulate businesses to undertake (more) R&D activities with potential spill over effects to other companies in the same industry, in different industries and even across countries. According to the market failure theory and given the characteristics of R&D, businesses may not engage sufficiently in R&D activities as costs may outweigh benefits[11]. As a result, businesses 'underinvest' in R&D from a societal point of view. The rationale for public intervention therefore stems from the need to **decrease the cost of doing R&D** incurred by businesses.

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9 The level of generosity of a scheme or tax subsidy rate is calculated as 1 minus the B-index, a measure of the before-tax income needed to break even on USD 1 of R&D outlays.

10 Business R&D (BERD) is an indicator of expenditures on R&D performed by the private sector.

11 The returns on investments in R&D are difficult to fully appropriate by firms as some of the resulting knowledge will leak out or 'spill over' to other firms, to the benefit of society and the economy.

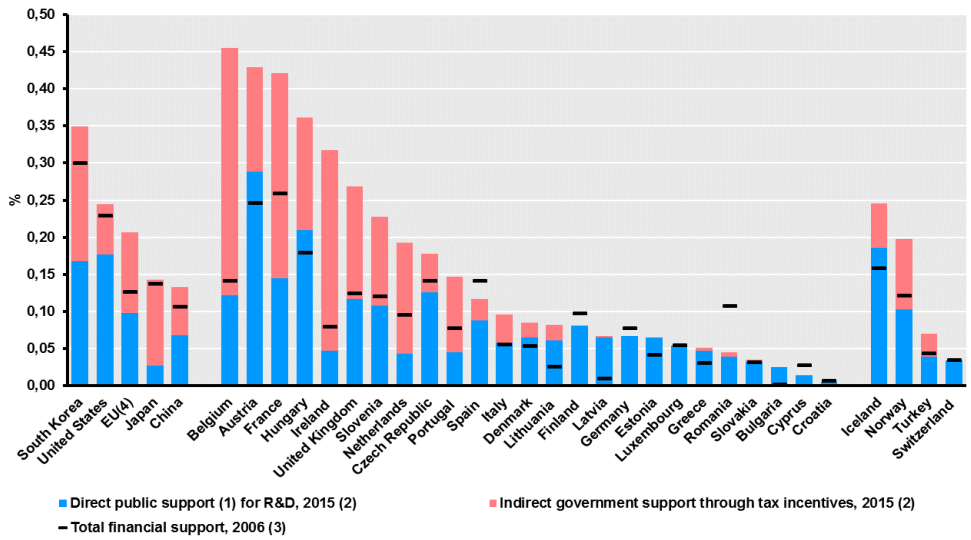
How do R&D tax incentives fit in the broader policy mix? Governments provide financial support for BERD through **direct** (grants, loans) **and indirect measures** (public procurement and tax relief on R&D expenditures). Although both types of measures aim at supporting private R&D, their specific objectives and operating modes differ. R&D tax incentives have advantages and limitations when compared to direct government support measures. Overall, R&D tax incentives have a lower administrative burden (for businesses and public authorities), whilst grants or subsidies, which provide support to targeted R&D projects, are more often discretionary and cumbersome to implement. However, grants give a certain 'directionality' to R&D and thus this type of measures may prove more effective in supporting certain R&D outcomes (e.g. break-through innovations). Overall, tax incentives and grants are complementary measures to stimulate business R&D. A detailed comparison of the advantages and limitations of R&D tax incentives vs. direct support to business R&D is provided in Ognyanova (2017).

Since the outset of the financial and economic crisis, R&D tax incentives have become a major tool for supporting BERD. Across the OECD, the **share of tax relief** in total public support for business R&D increased on average **from 36% in 2006 to 46% in 2015** (OECD). The next section provides a more detailed analysis of the use and impact of tax incentives schemes in the EU.

3.2 R&D tax incentives: use and impact

How widespread is the use of R&D tax incentives in the EU? The majority of OECD and EU Member States are using R&D tax incentives to support private R&D. In the EU as a whole, tax incentives for R&D account for 53 % of all public support for business R&D (European Commission, 2018a). As of 2018, **only five EU Member States**[12] do not provide R&D tax incentives, whilst the introduction of such a scheme has been frequently discussed in Germany. In most EU Member States, R&D tax incentives have increased both in relative and absolute terms. In several Member States (e.g. DK, EL, FR, IE, BE, NL, PT, SI, UK), the policy mix is now **primarily dominated by R&D tax incentives**, which amounted to more than half of total (direct and indirect) public support for business R&D in 2015[13] (European Commission, 2018a) (see Figure 2 below). It should be noted that there is a much higher rate of increase in the use of tax incentives for R&D in Europe than in the United States, Japan, China and South Korea (European Commission, 2018a).

Figure 2: Direct and indirect public support for business R&D as a percentage of GDP, 2006 and 2015



Source: EC, Data: OECD, Eurostat

[12] These are BG, DE, EE, CY, FI.

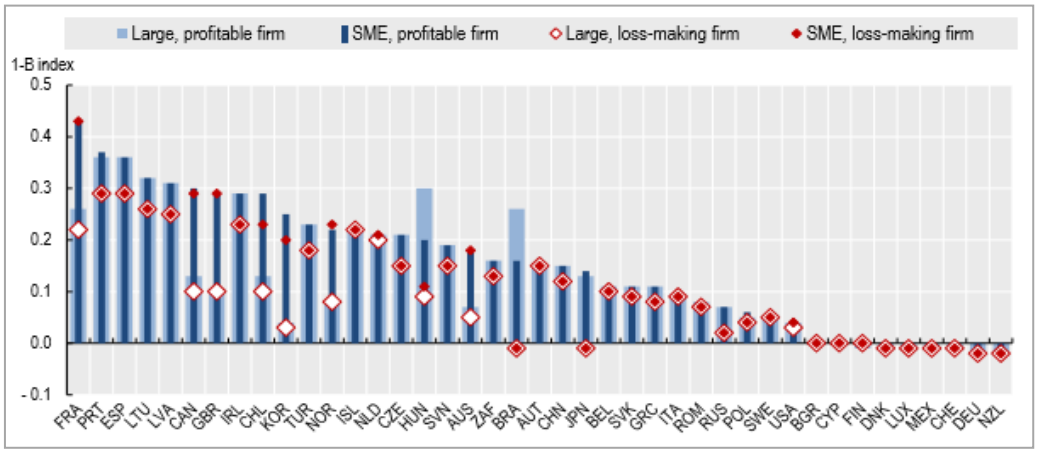
[13] The share of tax incentives is as follows: Netherlands (87 %), Ireland (82 %), Belgium (71 %), Portugal (69 %), France (66 %), Denmark (55 %), the UK (54 %), Slovenia (53 %) and Greece (51 %).

As part of the **Common Consolidated Corporate Tax Base (CCCTB)**[14] proposal (currently under negotiation in the Council), the European Commission proposed to further support R&D tax incentives in the form of an enhanced allowance (super-deduction) for R&D expenditure, which is most generous for start-up companies with R&D expenditure up to a certain threshold.

How are R&D tax incentives schemes designed across the EU? The Horizon 2020 Policy Support Facility Mutual Leaning Exercise on Administration and Monitoring of R&D tax incentives[15] carried out in 2017 (Uhlíř, Straathof, Hambro) showed that although the use of R&D tax incentives is widespread across the EU, their design (in terms of provisions) and implementation vary substantially across Member States. R&D tax credits are the most popular type of incentive and in a majority of countries they have a volume-based approach[16] (or hybrid[17]), whilst incremental tax incentives are less common (e.g. IT). Also, the vast majority of tax incentives are based on corporate income taxes, whilst some countries have (additional) incentives applying to social security contributions or wage taxes (e.g. BE, FR, HU, NL, ES). In several Member States (e.g. BE, FR, NL, PT, ES) special tax incentive provisions are available for young innovative firms, start-ups and innovative SMEs, as a subgroup of the SME population. Given the different provisions and their combination, the level of 'generosity' of national R&D tax incentives schemes (or implied tax subsidy rate on R&D expenditure) also varies. As shown in Figure 3 below, France has the most generous scheme overall, followed by Portugal, Spain, Lithuania, Latvia, UK and the Czech Republic. The French scheme is also amongst the most generous vis-à-vis (profit/loss-making) SMEs. The Portuguese, Spanish, Lithuanian and Latvia schemes also provide generous support to (profit/loss-making) SMEs.

What is the impact of R&D tax incentives? Considering the increasing importance of R&D tax incentive schemes in Member States' policy mixes, the issue of their effectiveness and overall impact has become more central in recent policy debates. The literature review (OECD, 2018b, Ognyanova, 2017) shows that R&D tax incentives (i.e. expenditure-based tax incentives) can directly **increase private R&D expenditure** ('input additionality'), however variations exist across countries and firms. Moreover, there is a lag between the introduction of an R&D tax incentive and an increase in R&D spending, that is contingent on how the incentive is designed and implemented, as well as on the structure of the economy in which it is implemented (European Commission, 2018a). Wider innovation and economic impacts of these schemes (e.g. in terms of patents, new products/processes, productivity and employment growth) are found to be of a **more indirect nature** or cannot be adequately assessed.

Figure 3: Implied tax subsidy rates on R&D expenditure by firm size and profit scenario, 2017



Source: OECD

[14] The CCCTB will not fully replace national R&D tax incentives schemes. It will be mandatory for the large companies (groups) in the EU, while it remains optional for the rest of the companies. Source: https://ec.europa.eu/taxation_customs/business/company-tax/common-consolidated-corporate-tax-base-ccctb_en

[15] The PSF MLE was carried out within the framework of the EU Horizon 2020 Policy Support Facility.

[16] This is the case in AT, BE, FR, LV, LT, EL, HU, RO, SI, UK. Source: OECD

[17] Mix of volume-based and incremental. This is the case in CZ, PT, SK and ES. Source: OECD

Recent discussions with Member States at EU level have shown that in the countries where these schemes have been evaluated, impacts on private R&D expenditure differ. The **additionality** of these scheme varies between ca. 1 to over 2 (e.g. IE). In Belgium, existing evidence shows that when businesses combine the different schemes available (e.g. R&D tax incentives combined with subsidies), this decreases their additionality (Dumont, 2017). Recent evaluations also show that cost-benefit analyses are less able to capture spill-over effects and the wider economic impacts. The fact that most R&D tax incentives schemes are relatively new (a decade or so) means that evaluating their long-term impacts (notably on innovation and economic growth) is not (yet) possible. Overall, the design and implementation of these schemes as well as their level of 'complementarity' with other forms of direct public support for business R&D are crucial elements for their effectiveness. Exercises at EU level such as the Horizon 2020 Policy Support Facility Mutual Leaning Exercise on R&D tax incentives have helped Member States identify best practices for designing and implementing these schemes, in order to maximise their impact. Similarly, the on-going joint EC-OECD work[18] on the impact of public support to private R&D aims at providing a first of its kind cross-country analysis of the impact of R&D tax incentives.

3.3 R&D tax incentives: key considerations

What are the enabling factors for effective R&D tax incentives schemes? First and foremost, the **design of R&D tax incentives schemes** is crucial as their specific provisions will determine their level of 'generosity', notably vis-à-vis key target groups (e.g. young innovative companies). In particular, policy-makers need to have a clear understanding of the type of businesses who most need (and will benefit from) this type of public support. Granting preferential treatment to SMEs may discourage companies from growing, whilst tax incentives targeting young innovative companies have a stronger impact (Ognyanova, 2017). Avoiding frequent changes of the R&D tax incentives scheme and ensuring a **stable and predictable framework** over time have also been highlighted as crucial elements by several Member States (e.g. IT, FR). Going beyond, one can note that **stable and clear fiscal systems** are a pre-requisite for the effective implementation and use of R&D tax incentives. Anecdotal evidence shows that in some Member States, tax incentives may be underused by businesses due to uncertainties or administrative burden linked to the fiscal system (e.g. RO). The **economic and firm structure** of a country may also explain the limited (or lack of) effectiveness of these schemes. In countries with a low share of medium and high-tech sectors, the impact of tax incentives is likely to remain limited, as very few firms actually invest in R&D activities. Similarly, services-oriented economies (as opposed to manufacturing-oriented economies) are known to be less BERD intensive and hence the impact of tax incentives may also remain marginal.

What are the important caveats to keep in mind when supporting private R&D through R&D tax incentives schemes? As shown in the academic literature, no public support measure, whether direct or indirect, is effective in isolation. As a result, policy-makers need to carefully design a **balanced R&D policy mix**, where R&D tax incentives are one of the possible support measures available to public authorities. The effectiveness of tax incentives depends not only on their specific design and implementation, but also on contextual factors (e.g. economic structure of a country) upon which policy-makers have little or no influence in the short term. In practice, this means that implementing tax incentives in economies with very low levels of BERD may be questionable. In some Member States, which need to increase the quality and performance of their public science base, indirect public support to private R&D via tax incentives **should not come at the expense of public support to the public science base**. In more mature economies, R&D tax incentives may play a role in **tax competition** and can influence the location decisions of multinational enterprises investing in R&D.

How is the impact of R&D tax incentives monitored? The **budgetary impact of R&D tax incentives** is expected to feature more prominently in the EU Semester related discussions between the European Commission and Member States. Given the amount of tax revenues foregone due to R&D tax incentives and the potential negative impact on public budgets, questions have arisen as to whether some Member States may have

[18] MicroBERD module within the Horizon 2020 funded Tax4INNO project.

reached a **tipping point** in terms of public support for business R&D (European Commission, 2018b).

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4. QUESTIONS FOR DISCUSSION

PRFS

- Given the elements outlined in this paper, what is (are) the element(s) of your country's PRFS that would need to be improved?

- Does your country see PRFS as a positive development to raise its research performance or do you think that it can induce "undesired" effects (making teaching a second-class activity or discouraging science-business links)? Why?

- *R&D tax incentives*

- Given the significant increase in the use of R&D tax incentives over the past decade, to what extent do you consider that your country has a balanced mix between direct and indirect support to business R&D in your country?

- Do you think that your country has the necessary toolbox to adequately assess the impact of the R&D tax incentives that are in place?

- *Strategic policy debates at ERAC*

- Should this type of strategic debate on national policies become an integral part of ERAC's mission and how can it be organised most efficiently, taking into account existing processes such as the European Semester and the European Research Area?

- How can ERAC best organise its work in order to make operational progress and exchange practice further on policy issues such as PRFS and tax incentives?

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The Directorate-General for Research & Innovation (DG RTD) of the European Commission regularly carries out policy-oriented in-house analyses. This paper provides background information and analysis to stimulate a policy debate on two key policy issues for which important evolutions have been noted over the past years: Performance Based Research Funding and R&D tax incentives.

The introduction of a Performance Based Research Funding is one of the central mechanisms through which many countries have in recent years tried to increase the effectiveness and performance of their public research systems. While Performance Based Research Funding helps improve system performance in interaction with other policy instruments, they differ widely among countries and there is an ongoing debate regarding their potential unexpected or undesired effects.

In parallel, the majority of OECD and EU Member States are using R&D tax incentives as a policy response to tackle the deficit in business R&D investment. While in most EU Member States R&D tax incentives have increased both in relative and absolute terms and there is evidence that they directly increase private R&D expenditure, the wider innovation and economic impacts of these schemes cannot be adequately assessed.

The paper draws on information and expertise accumulated in the Commission services through a range of activities and notably the report Science, Research and Innovation Performance of the EU 2018 and the outcomes of several Horizon 2020 Policy Support Facility activities, among others.

The policy paper was drafted in view of a strategic policy debate on how to improve national Research and Innovation systems of Member States and Associated Countries that took place in the European Research Area Committee plenary on 17-18 September 2018in Salzburg, Austria.

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