Policy Support Facility Mutual Learning Exercise: Evaluation of Business R&D Grants Schemes

Capturing Behavioural Change

Thematic Paper No 2

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1   INTRODUCTION

1.1   Context and structure of this paper

Business research and development (R&D) grant schemes are a specific type of instrument to support R&D and/or innovation by companies. These schemes are provided to individual companies, although there can be requirements in terms of collaboration with other companies, universities or research institutes. As such, there can be effects on the beneficiaries and their R&D and innovation partners, value chain partners and regional or technological innovation system. This paper addresses the topic of understanding and measuring behavioural change in firms (and the challenges to capture these) of business R&D grants and, more widely, innovation schemes. It does so from an organisational learning perspective of firm behaviour.

The *ex-post* evaluation of business R&D grant schemes has been the topic of the first cycle of this Mutual Learning Exercise (MLE) that took place in 2016 (see Cunningham et al., 2017). One of the main conclusions after this first cycle regarding evaluation methods was that there is a trend towards the use of econometric analysis in measuring the impact of government interventions and, in particular, its focus on measuring input and output additionality. However, it was also concluded that this trend needs to be balanced by recognising the simultaneous need to understand behavioural effects (i.e. the 'innovation journey of firms') of the use of R&D and innovation grants more fully. In particular, it was concluded that both policy-makers and evaluators need a better understanding of how the use of these schemes affects the ways in which firms deal with R&D and innovation, and, more widely, how they affect organisational capabilities and organisational adaptability.[1]

In the second cycle of this MLE, the importance of understanding and measuring behavioural change was explored during a 2-day site visit to Stockholm (24 to 25 October 2017).[2] An earlier version of this paper was used as a challenge paper. This current paper is an updated version in which the presentation and discussions that took place in Stockholm are incorporated. Boxes are spread throughout the paper, focusing on lessons learned and examples of how behavioural change was addressed and measured in various Member State cases. Most of them are derived from presentations during the Stockholm site visit and therefore contain a clear bias to examples from Sweden.

In the remainder of this introduction, the need for policy-makers and evaluators is addressed to understand the behavioural effects of R&D and innovation schemes. Subsequently, behavioural change and how it relates to the various types of additionalities are briefly conceptualised. Section 2 of this challenge paper will discuss the ambitions of policy-makers with regard to behavioural change. Section 3 looks at how behavioural change can be identified and captured (possibly through the use of indicators) and also by looking at evaluation methodologies that can be used for assessing behavioural change. Section 4 looks into the policy learning and feedback side and closes the policy cycle again.

1.2   The need to better understand behavioural effects

Measuring and understanding behavioural effects (and methods to capture these) were mentioned in the pre-MLE as one of the major challenges in the evaluation of R&D and

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[1] Although our prime focus is the firm directly benefitting from a scheme, other firms and organisations may benefit indirectly as well. These spillovers are not included in most evaluations.

[2] On an earlier site visit (Oslo, September 2017), the opportunities and challenges of big data were addressed. A later site visit (London, January 2018) focused on recent advances in econometrics and more experimental-type approaches and randomised controlled trials (RCTs), as well as their combination with more qualitative methods such as surveys and case studies. All three topics fit within the theme of evaluating business and R&D grant schemes and will also be reported in a synthesis paper in spring 2018.

innovation schemes. It is essential that the community of science, technology and innovation (STI) scholars, STI evaluators and STI policy-makers have a better understanding of why and how policies and schemes work (or not); not only what the short-term and long-term (desired) effects of a particular innovation scheme or programme are, but also the unintended or even undesired behavioural effects and impacts. Some of the fundamental questions regarding the behavioural effects of R&D and innovation policy interventions and their measurement are listed in Box 1 below.[3]

Box 1. Fundamental questions regarding behavioural change due to the use of R&D and innovation instruments and their measurement

1. What changes in firm behaviour are policy-makers after? What kind of behavioural change should be supported, and where and when? [4]

2. What kind of policies best support behavioural change?

3. What (intended and unintended) behavioural effects can be observed in firms benefitting from a particular scheme?

4. Which part of the impact of R&D grants are we missing if behavioural change is not properly addressed in impact assessments?

5. To what extent is the impact of R&D grants sustainable or even cumulative (through processes or organisational learning) due to behavioural change, and therefore possibly bigger than usually considered?

6. To what extent can observed changes in behaviour be attributed to an individual scheme (attribution), especially when firms are benefitting from other schemes as well?

7. How persistent are the changes in behaviour observed?

8. What is the time lag between the receipt of a grant and behavioural change?

9. What is the most appropriate level to observe behavioural effects?[5]

10. Can typical patterns in terms of subsequent use of various schemes be identified?[6]

These types of questions at various levels of analysis cannot be answered easily, and require the willingness and ability to open up the black box of both policy-makers and the schemes' beneficiaries. We need to know from policy-makers what intended behavioural changes they aim for through various schemes, including their interaction. From the schemes' beneficiaries we need to understand in detail how they are benefitting (or not)

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[3] We are indebted to Kimmo Halme who identified some of the questions provided here.

[4] What, one might ask, are the capability failures addressed by a particular scheme or programme? A capability failure is defined as 'inadequacies in potential innovators' ability to act in their own best interest' and is one the system failures as defined by O'Doherty & Arnold (2003, p. 32). For example, firms and their employees might lack the right knowledge, skills, information and contacts to realise innovation, they may lack the capability to identify the actual needs of their clients, they may not be able to articulate their knowledge needs well enough, etc.

[5] The following levels can be identified: the personal level (R&D managers changing their behaviour), the project level (projects starting earlier, with more collaborators or with more resources), the firm level, the value chain or ultimately the socio-technical system level (new technological trajectories emerging, new cross-overs between sectors being realised, how ecosystems have developed over time, etc.).

[6] The issue at stake here is whether firms 'grow' from simpler to more advanced type of schemes developing their capabilities, or do firms typically benefit from a combinations of instruments?

from, in our case, R&D business grants and how it affects their behaviour at various levels. Over their lifetime, innovating firms especially embark on an 'innovation journey' where they need to adapt their strategies, capabilities and innovation efforts according to the stage the firm is in, the type of innovations they are after and the sort of sectoral or technological innovation system(s) they are (or want to be) part of. This implies that R&D and innovation policy-makers need to be explicit in terms of the sort of behavioural change they want to facilitate.

This also requires that policy-makers not only have a good understanding about firm behaviour, but also which combination of schemes are most appropriate for what type of firm. Innovating firms have 'careers' or logical pathways in terms of how they use and benefit from schemes or indeed a combination or mix of schemes. An R&D tax credit scheme can be seen as an instrument to induce firms to perform R&D and preferably more R&D, but is also known to contribute to the institutionalisation of R&D efforts. Typically, an innovation voucher scheme is used to trigger firms to cooperate when innovating and to articulate their knowledge or innovation need, but this may also be the beginning of more sustained cooperation with knowledge institutes and/or other firms. However, schemes aiming to increase STI cooperation or bringing about systemic changes in the wider economy (e.g. contributing to transformation in terms of sustainability, in mobility or how we address other wider societal issues) are typically more complex in terms of the behavioural change that is aimed for. In our view, there is a clear need to be explicit as to how a scheme (or for that matter a policy mix) helps firms and groups of firms wherever they are on their innovation journey.

1.3   Defining behavioural change and behavioural additionality

In this subsection, behavioural change and how it relates to the various types of additionalities discerned in both the literature and policy evaluations are briefly conceptualised. In the literature, the topic of behavioural change in firms caused by the use of business R&D grants and/or innovation schemes is mostly associated with the notion of behavioural additionality. This is mainly to flag that, next to measuring input and output additionality when evaluating schemes (especially using econometric methods), there is a need to measure more precisely how firm behaviour has changed due to the use of a particular scheme. Additionality is an aspect of assessing the impact of R&D and innovation schemes.

The types and varieties of 'additionalities' discerned over the years have grown. Basically, the concept of additionality is about the additional or extra R&D or innovation activity that is the result of public support for R&D and innovation. It is based on the neo-classical assumption that individual actors, due to the existence of knowledge spillovers, tend to underinvest in R&D and innovation. The rationale for public support for R&D and innovation is to prevent this underinvestment. The additionality is the additional or extra R&D and innovation activity generated that would otherwise not have been realised without public support. For a long time, additionality was mainly about input additionality and output additionality. According to Roper et al. (2016, p. 8 basing themselves on Falk, 2007):

"Input additionality adopts a resource-based perspective in examining the extent to which firms increase their private investment in R&D in response to public R&D subsidies. Output additionality adopts a results-based perspective in terms of the increase in innovation outputs i.e. patents, products, etc. or innovation outcomes i.e. sales from new or modified products etc. arising from public support for R&D."

Put briefly: input additionality is about the extra R&D and innovation efforts of the firm thanks to public R&D and innovation support,[7] and output additionality is about the extra

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[7] However, it should be noted that input additionality builds upon three additional assumptions that do not necessarily hold for R&D and innovation, namely that (1) there is a clear link between the input and output of

outputs generated by the firms thanks to public R&D and innovation support. Output additionality is harder to measure than input additionality. This is mainly due to the observation that the relation between input and output is complex and related in an unspecified way, hence its observation requires a deep understanding of how firms behave (OECD, 2006).

Since the 1990s more attention has been given to behavioural change as a result of public support for R&D and innovation, especially through the launch of the notion of behavioural additionality next to input and output additionality (see Buisseret et al. 1995). They define behavioural additionality as 'the persistent change in the behaviour of the agents, which is exclusively attributable to the policy action, i.e. what difference a policy makes in those it supports'. A more recent definition where attribution and persistency feature also prominently is the definition of Gök and Edler (2012) namely: 'the persistent change in what the target is doing, how they are doing it and which is attributable to the policy action'. Neicu (2016, p. 101) states that:

"Behavioural additionality refers to permanent changes in firm processes and behaviour, such as newly acquired competences, the entry into new business areas or a change in working procedures, occurring as a result of policy intervention. Such changes may arise due to, among others, learning effects and knowledge spillovers."

The OECD describes behavioural additionality quite briefly as the difference in firm behaviour resulting from a government intervention. In its 2006 project on measuring behavioural additionality, it identified various dimensions of behavioural additionality: (1) knowledge acquisition, (2) human resources; (3) capital investment strategy; (4) market position; (5) strategies for manufacturing; and (6) corporate responsibility and sustainability.

It was observed by the OECD in that same publication that for a long time behavioural additionality has been ignored in econometric studies on the effects of R&D support. Until then these studies typically focused on input additionality or output additionality by estimating additional R&D expenditure and comparing the performance of firms that did not receive public support (OECD, 2006, p. 12-13). However, since then many studies have been published on behavioural additionality.[8] OECD itself shows a renewed interest in the wider theme of impact assessment, evaluation and the role of behavioural additionality therein.[9]

Behavioural additionality as a notion is generally less clear-cut as compared to input and output additionality, as it relates to possibly all factors related to the innovation capabilities of a firm.[10] These factors can be manifold and there is not yet a well-accepted set of

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innovative activities; (2) returns to scale of the innovative activity are constant and indivisible; and (3) there is no difference in the nature of the output generated by public and private funding (OECD, 2006).

[8] For instance: Falk R. (2007). 'Measuring the effects of public support schemes on firms' innovation activities. Survey evidence from Austria', *Research Policy* 36, pp. 665-679; Clarysse, B., Wright, M. and Mustar, P. (2009). 'Behavioural additionality of R&D subsidies: a learning perspective', *Research Policy* 38 (10), pp. 1517-1533; Antonioli, D. and Marzucchi, A. (2012). 'Evaluating the additionality of innovation policy. A review focused on the behavioural dimension', *World Review of Science, Technology and Sustainable Development* 9 (2/3/4). pp. 124-148. Marzucchi, A. and Montresor, S. (2015). 'The multi-dimensional additionality of innovation policies. A multi-level application to Italy and Spain'. In: Crespi, Francesco and Quatraro, Francesco (Eds.) *The economics of knowledge, innovation and systemic technology policy*. Routledge Studies in Global Competition. Routledge.

[9] See for example Caroline Paunov (2017). 'Evaluating impacts of innovation grants: where are we? What should come next?' Presentation Workshop on Capturing Behavioural Change, Stockholm, 24 to 25 October 2017.

[10] Gök and Edler (2012) are quite critical and concluded earlier that 'although the concept of behavioural additionality is recognised and the concept appears to be applied more often, it is ill conceived or only used in a limited way. The methods used are not appropriate and the multiple dimensions of behaviour and the cascade effects of changes in behaviour on innovation performance and management more generally are not

indicators available for measuring behavioural additionality quantitatively (although it can be assessed using more qualitative methods as well). This variety in possible factors is reflected in the various typologies of behavioural additionality that arise. Wanzenböck et al. (2013, see Box 2 below) for example makes a distinction between project additionality, scale additionality and cooperation additionality. Other dimensions of additionality – not captured in the classification of Wanzenböck et al. – are for example more deliberate and planned R&D efforts, change in management attitude towards R&D and innovation, increased propensity to experiment, a willingness to consider societal challenges as a starting point for innovation, etc.

Box 2. Different dimensions of behavioural additionality[11]

Project additionality:[12]

- R&D and innovation projects that are started earlier than the firm's original planning.

- projects that are performed faster (speeding up the innovation process).

- reflectiveness regarding innovation projects (that is learning from earlier experiences).

Scale additionality:

- more ambitious projects.

Cooperation additionality:

- an increased willingness to perform innovation in a more collaborative way.

- joint agenda-setting with (new) collaboration partners.

- increased inclination to involve (potential) users of the new product or service in innovation processes.

- willingness to participate in government programs.

More recently Roper et al. (2016, p. 12-17) differentiates between three types of behavioural additionality (BA) using an organisational learning perspective and also assessed them quantitatively, i.e.:

1. congenital additionality: the change in collection of competences that resides in an organisation due to public support for R&D and innovation and which is mostly assessed through the sum of employees' education and experience;

2. inter-organisational additionality: broadened or deepened innovation linkages of the organisation thanks to public subsidies for R&D and innovation;

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conceptualized' (p. 316). Similarly, Roper at al. (2016, p. 6) observe that 'recognising that assessment of the different mechanisms through which behavioural additionality occurs are not well developed and tested'.

[11] Wanzenböck et al. (2013, pp. 6-7)

[12] As we have defined behavioural additionality earlier as persistent or permanent change in the behaviour of firms due to funding, one can question whether project additionality (especially the first two bullets below) fully comply with this definition.

3. experiential additionality: the change in the ability to reconfigure routines and processes thanks to public support for R&D and innovation.

Interestingly, Roper et al. (2016) not only assesses these three types of behavioural additionality, but also explicitly points at two complicating factors that may lead to an underestimation of additionality. A first complicating factor is that it is not always clear to what extent the endurance or legacy effects of public R&D and innovation support are taken on board. This is especially key (but not necessarily limited!) to behavioural additionality, as here the focus is not on one-off project-related decisions to invest more in R&D and innovation for example (input additionality), but on how firms learn over time, improve their innovation routines and capabilities, and eventually adapt to a changing context in which they operate. These behavioural changes are long-term effects that last longer than the duration of, for example, an R&D or innovation project for which a firm receives a grant. A second complicating factor is that the benefits of R&D and innovation support will not be restricted to only the beneficiaries of R&D and innovation schemes. Results of the supported firm will most likely also benefit non-supported firms, typically through 'knowledge spill-overs, technology diffusion, and knowledge exchanges within communities of firms' (Autio et al. 2008, p. 59 quoted in Roper et al., 2016, p. 8).[13]

Methods for capturing behavioural additionality can be qualitative (fully understanding the motives, context and other details, e.g. via case studies, interviews of all sorts and surveys) as well as quantitative 'bang for the buck' approaches at both the macro and micro level. There are many examples of evaluations where combinations of methods are used to not only gather the regular input and output additionality, but also the behavioural additionality that is induced by a scheme (or not). When reporting results of evaluations, it is important to not only communicate the bang-for-buck type of results (i.e. focusing on input and output additionality). It is key to also report the quantitative attempts to measure behavioural additionality (which in general is more experimental) in combination with detailed and more qualitative narratives of how schemes are used in practice and do impact on firm behaviour.[14] We think these insights into behavioural effects are also needed to see how R&D and innovation schemes impact on their beneficiaries.

Some definitions have behavioural additionality mostly associated with the scale, scope, level of risk and speed of R&D and innovation projects (i.e. a rather small interpretation of behavioural additionality) rather than organisational learning, changes in routines and capabilities over time (the broader interpretation of behavioural additionality). We also do not like to rule out endurance and the wider spillover effects of R&D and innovation schemes, so we prefer to use the phrase 'behavioural change' rather than 'behavioural additionality' in this paper.[15] Another reason for this is that innovation networks, clusters, triple helix- (industries-governments-universities) type combinations of actors or complete sectoral innovation systems change their collective behaviour as well This could be, for example, ways in which R&D and innovation priorities are set or ways in which sustainability (or other societal goals) are addressed through the R&D and innovation efforts taking place in an innovation system. More systemic policy tools steer towards the network or system level and at this level it is also necessary to identify what behavioural change policy-makers are looking for and what sort of behavioural change is actually realised in practice. The sheer impossibility of discussing behavioural additionality at the systems level is another reason to prefer the phrase 'behavioural change'.

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[13] We cannot discuss the results of the Roper et al. study (2016) in detail here but he tested the five different types of additionality as well as the endurance effect of these for both subsidies for R&D and New Product Development, using panel data on the innovation activities of Irish manufacturing firms. They found some legacy and some additionality (including behavioural additionality) effects for some combinations.

[14] It is important to note here that the impact of R&D grants and innovation schemes on a firm's strategies and behaviour have been studied and assessed more widely for a longer time and, importantly, not only linked to the notion of behavioural additionality.

[15] Although scholars like Gök and Edler acknowledge the need to include spillovers and endurance beyond the support period (Gök and Edler, 2012, p. 308).

2   POLICYMAKING AND BEHAVIOURAL CHANGE

2.1   Introduction

In this section, we focus on the question of whether the design of policy mixes and programmes intend to bring about behavioural change. At this point, we are confronted with two challenges. First, there is no guarantee that insights from the evaluation community about the importance of behavioural change reach policy-makers. Secondly, policy-makers are often inclined to choose policy objectives that are (easily) measurable. We already noticed that behavioural change is, just like other forms of additionality, hard to measure, and is in fact probably the most difficult.

2.2   Policy-maker's ambitions with regard to behavioural change

We may discuss what behavioural change policy-makers are after in the first place. To what extent is it obvious what 'failures' (be it market, system or transformational failures), R&D grants and wider innovation schemes are addressing? What types of behavioural change are policy-makers after? To what extent is behavioural change identified as part of the programme logic (and unwanted or 'perverse' behavioural change foreseen and controlled for)? Is there an effort to discuss behavioural change before implementing a particular scheme? Are policy-makers wiling to fully understand how firms use and benefit from these schemes?

One important challenge is that the attention given to behavioural change in the scientific and evaluation community is not automatically followed up or supported by policy-makers in all countries. The attention for behavioural change in policymaking is growing, but goals regarding economic performance as a result of an R&D or innovation grant still dominate in most countries. These policy-makers tend to prefer policy goals that match economic objectives and limit additionality to input and output additionality (more R&D, more innovation, more revenues, more profits, more employment) rather than objectives related to firm behaviour (attitude towards innovation, more ambitious projects, joint agenda-setting). At the same time, an increasing number of policy-makers realise that the impact of an R&D grant on a firm's output will often be small and short-term. For the long term, it is important that firms act more strategically towards R&D and innovation (and consequently adapt their behaviour and underlying capabilities). In Boxes 3 and 4 below, examples from Sweden are given to illustrate how this development towards assessing and evaluating behavioural change (BC) more broadly at firm level is progressing. An R&D grant might be the seed to change that behaviour. Therefore, the concept of behavioural 'additionality', according to the OECD (2006), offers policy-makers a useful vocabulary for explaining the effects of policy interventions on firms and differentiating among types of effects. These distinctions can help in designing effective policy instruments and selecting from among different approaches for financing business R&D (OECD, 2006, p. 7).[16]

Such an approach poses new challenges as it asks for a better and deeper understanding of the evolution of organisational routines by government actions, but it must take into account the entire process and its dynamics by capturing the origination, adaptation and retention phases of evolutionary changes in organisational routines (Gök & Edler, 2012). This interpretation confirms the fact that the behavioural change goals that are formulated mainly focus on the firm level. Evaluation practitioners may have to stimulate policy-makers to pay more attention to a broader concept of behavioural change, for example by setting goals at the level of an innovation system or of a specific sector (see Boxes 5 and 6 in section 3.2. on the Dutch Topsector and the Swedish CDI and SIP programmes).

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[16] Remarkably, the policy attention raised for behavioural additionality is, to our knowledge, not that visible in recent R&D and innovation policy documents.

Vinnova presented its approach and the lessons learned regarding funding innovative small and medium-sized enterprises (SMEs) and the actual policy goals in terms of BC. It was highlighted that much more insight is needed into how the various schemes used develop the firm's innovation capability and capacity, which was flagged as a key attribute of BC. The sheets below give an impression of the policy goals, the traditional approach to assessing behaviour (i.e. R&D behaviour), and the dimensions for assessing and evaluating BC more broadly at firm level.

Box 4. Lessons from the Swedish Almi programme[18]

Professor Anna Öhrwall Rönnbäck (Luleå University of Technology & Linköping University) presented the results of an evaluation of the Almi programme, which aimed at improving growth in established SMEs. The programme, which goes back to the IEM programme at Linköping University (LiU), is run by Almi, a government-owned company that provides advisory services, loans and venture capital to SMEs, which operates close to its customers (there are 40 offices spread across Sweden).

The programme is very much about peer-learning networks, entrepreneurs teaching entrepreneurs and the use of real-life cases (as used for executive management education). Participants are mostly owner-managed firms, mainly in manufacturing industries.

MSc students provide business consultancy services (together with experienced advisors) and the programme itself is a combination of open seminars on growth, a series of 8 to 10 meetings at the participating firms, as well as coaching individual

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[17] Kjell-Håkan Närfelt (2017). 'Vinnova's funding of innovative small and medium sized enterprises'. Presentation Workshop on Capturing Behavioural Change, Stockholm, 24 to 25 October 2017.

[18] Professor Anna Öhrwall Rönnbäck (2017). 'Government Initiative: A programme to improve growth in established SME', Presentation Workshop on Capturing Behavioural Change, Stockholm, 24 to 25 October 2017.

> firms. Additional experts from different areas, from sales and marketing to business growth and process efficiency, are engaged as well.
>
> It was explained that a difference is made in the programme between business innovation and technology innovation. The programme is mostly about business innovation – although this term is not used – and this is where most growth is coming from. The programme triggered the behavioural change of individual entrepreneurs, especially in the way they deal with business innovation. Most entrepreneurs had to learn and experiment with business innovation because, so far, they have perceived innovation mostly in terms of technological innovation. The 48 firms that participated in the (regional) evaluation showed, on average, a 40 % growth in employment and a high (12 %) return on assets. And this effect is continuing for most of the companies. Also remarkable is that most of the personal relations between the group members continued after the project.

Another challenge – strongly related to what has already been mentioned – is that a change in behaviour is often not included as an explicit policy objective. Despite this blind spot, policy-makers are willing to accept a behavioural change as a policy outcome after econometric analysis proved that there is no significant effect on the firm's performance resulting from an R&D grant. In other words, the evaluation does not confirm that an R&D grant has a positive impact on the firm's economic performance, but the evaluation does confirm, for example, that participating firms increased their focus on innovation, collaboration and creativity. In this case, behavioural additionality becomes a legitimate objective afterwards.

This does not mean that behavioural change is never an explicit policy goal. Our small questionnaire among participating countries in this MLE indicates that the attention given to behavioural change in policy-making is growing, but that it is not yet broadly institutionalised.[19] Where behavioural change is an accepted policy goal, it is mainly focused on firms (rather than systems and individuals). In Germany and Slovenia (and other countries), for example, more emphasis is put on extending long-term collaboration between businesses and universities (a form of desired behaviour) via R&D and innovation grants. In addition, policy-makers are seeking to create other forms of behavioural changes, both quantitatively and qualitatively. Policy-makers address topics such as strategic planning, enhancing innovation cultures within firms, linking technological innovation with commercial aspects, supporting collaboration and networking, and taking into account societal goals. The next section provides an overview of the methods that policy-makers and researchers can use to measure these indicators related to behavioural additionality.

It remains, however, a challenge to make policy-makers aware that an important key to success regarding innovation and, in the end, economic performance lies in the internal management and organisation of firms, and the willingness of firms to change behaviour and to participate in innovation schemes. It also asks for patience as the economic results of changed behaviour take a long time to incubate. This raises the problem of timing: when is it reasonable to expect the results of such changes to become identifiable and measurable?

Behavioural change is not only reserved for firms. It also applies to innovation systems, industrial and service sectors, and value chains. From a methodological perspective, the firm probably provides a more useful or practical unit of analysis rather than a system or sector, but that does not mean that behavioural change only occurs at the level of the

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[19] The questionnaire was only sent to the Member States of this MLE. Eventually seven Member States responded: Austria, Belgium (Brussels Region), Germany, Lithuania, Slovenia, Spain and the United Kingdom.

firm.[20] In policy evaluations, there is a tendency to measure indicators that are available instead of measuring indicators that actually map the change. A similar risk exists in the application of methods. We might choose those methods that are most applicable rather the ones that result in the best answers to our research questions.

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[20] In the London presentations about Catapults, for example, we heard that one objective for the initiatives is to influence strategic-level thinking and attitudes in the wider Catapult sector communities.

3   IDENTIFYING AND CAPTURING BEHAVIOURAL CHANGE

3.1   Introduction

This section investigates how behavioural change can be identified and captured, possibly by using indicators but also by looking at some relevant evaluation methodologies that can be used for assessing behavioural change.

3.2   First inventory of our knowledge about behavioural change

In this section, we conduct a limited stocktake of what we know of the behavioural change (intended and unintended) brought about by business R&D grants and to what degree these changes are regarded at the firm and system levels. What examples of indicators of persistent behavioural change at the various levels (individual, firm, value chain) are available and how have these been derived? What qualitative and quantitative methods for assessing behavioural change are available? What data should be collected from the beginning of the intervention to measure behavioural additionality properly and to what extent is this possible? What new options do large linked datasets, big data, the use of non-traditional or altmetrics and other more qualitative approaches (storytelling) offer? How does triangulation take place?

The body of evaluations of behavioural change is relatively small compared to the number of input and output evaluations. In theory there are proper indicators, but in practice their measurement is still in its infancy. As a result, the first inventory of knowledge about behavioural change (questionnaire) is limited as well. Examples of (new) insights about the behaviour of firms with regard to R&D and innovation that were mentioned by the respondents in our small survey include:

- learning processes within firms, especially SMEs, with regard to R&D and innovation;

- new forms of collaboration between firms and between firms and knowledge institutes and universities, all aimed at enhancing R&D and innovation;

- customising internal R&D and innovation management and processes;

- a growing focus on the knowledge transfers from universities to businesses (within universities) and the uptake of discussion about the commercialisation of new products and services (within firms).

These examples are in line with the dimensions of behavioural change mentioned by the OECD (2006), namely (1) knowledge acquisition, (2) human resources, (3) capital investment strategy, (4) market position, (5) strategies for manufacturing and (6) corporate responsibility and sustainability. Numerous indicators can be derived from these and other dimensions, but this is not an easy task. The collection of indicators in the questionnaires results in few indicators (most at the firm level) that relate strongly to input and output additionality (e.g. R&D expenditure, R&D intensity or the share of companies that have introduced new products). The search for indicators that capture behavioural additionality remains a challenge. But there are good examples of indicators that highlight changes in the firm's behaviour as a result of government grants. Examples are creating new partnerships, appointing innovation managers, setting up an innovation strategy, training staff and applying for patents and other R&D and innovation grants. Another issue that adds to the complexity is that we are looking for indicators that measure organisational and human behaviour, and these indicators often do have a more qualitative nature.

At the firm level we are looking for indicators that measure direct changes in the way a firm handles R&D and innovation. For example:

- Development of an internal R&D and innovation strategy;

- Formalisation of R&D and innovation (R&D department, R&D managers, R&D procedures);

- Collaboration with other firms and research institutes to conduct joint R&D and innovations (exchange of staff, letters of intention, contract research);

- Investments in 'human capital' (innovation management capabilities, upgrade of commercial, technical and organisational skills) and R&D facilities (laboratories, equipment, ICT);

- Increased participation in networks of organisations (public and private) that fulfil all kinds of functions in (technological) innovation systems;

- Growing application for R&D and innovation grants (or other innovation instruments).

We need to take into account the special position of small start-ups and spin-offs. These are mostly innovative companies, but are generally less inclined to formulate and formalise their innovation strategies and processes. The lesson we need to draw from this is that every indicator must be considered in its context.

Boxes 5 and 6 below provide examples of evaluative approaches to policy programmes in which behavioural additionality plays a considerable role (at the sectoral or technological innovation systems level), showing that we should also look for more qualitative indicators, e.g. organisational capacity.

Box 5. Evaluation of the Dutch Topsector policy approach[21]

The Dutch Topsector policy identified nine so-called top sectors that play a central role in (specific) innovation and science policy. These top sectors are platforms in which policy-makers, science representatives and captains of industry from key sectors determine together which efforts should be taken to shape (sectoral) ecosystems from which promising new technical trajectories can emerge, e.g. by launching ambitious pubic private partnership research programmes, adapting education curricula, altering legislation. Although the jointly developed holistic roadmaps are ultimately focused on improving competiveness – preferably while solving societal challenges – it is acknowledged that standard indicators of labour productivity and export rates are, at most, loosely connected to the actual policy inputs that are being provided.

Without a counterfactual analysis for this coherent and interacting set of interventions, there is no obvious method to assess whether the Topsector approach consists of a policy mix that addresses real constraints, truly alleviates them, and is not crowding out efforts that would have been taken anyway. Janssen et al. (2017) evaluated this Topsector approach using two qualitative evaluation frameworks, and in doing so assessed the behavioural change at the systems level. A first set of design principles was distilled from the new industrial policy literature and helped to assess policy organisation as well as the policy orientation of the Topsector approach. A second, impact framework derived from the technological innovation system or TIS approach was used to assess the extent to which a multi-instrumental policy approach is effective, decisive and targeted at the system functions that are the most relevant for advancing a TIS.

From the evaluation is was evident among others that the Topsector approach has proven useful in creating mass and jointly generating the momentum to tackle urgent issues. This has led to collective priorities and action agendas. It also generated overview, especially in heavily fragmented domains. In its application, the approach has been valuable in engaging various stakeholders in the implementation of innovation directions that the market aims to develop. A particularly prominent impact is that the approach has resulted in the more demand-oriented programming of research at Dutch knowledge institutes, maintaining

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[21] Based on Janssen (2018) and Janssen et al. (2017).

applied research infrastructures and setting up some long-term public-private partnership (PPP) programmes for basic research.

Due to the publication of the evaluation, a discourse emerged as to the degree to which a Topsector approach was appropriate to deal with future societal challenges. The recently installed Dutch Government decided to continue with the Topsector policy approach. The major change is that these sectoral systems of innovation will be more clearly linked to and address societal challenges.

Box 6. Some lessons learned from evaluating the Swedish Challenge Driven Innovation (CDI) and Strategic Innovation programmes (SIP)[22]

Sweden has various broad policy programmes such as the Strategic Innovation and Challenges Driven Innovation programmes for which it is developing broader evaluation frameworks. During the Stockholm workshop, VINNOVA shared some of its thinking on how to evaluate these programmes. What was striking is the attention – including when evaluating – given to measuring attributes of innovation capability and the innovation itself, as well as the long time frames over which evaluations are taking place. These point to the need for assessing *ex ante* the desired BC or policy goals as well as the period needed for behavioural change to materialise. Information provided on the challenges for the SIP shows that in order to measure this wider policy programme, both innovation ambitions (which are about societal transformation) and thus evaluation efforts go well beyond the programme itself.
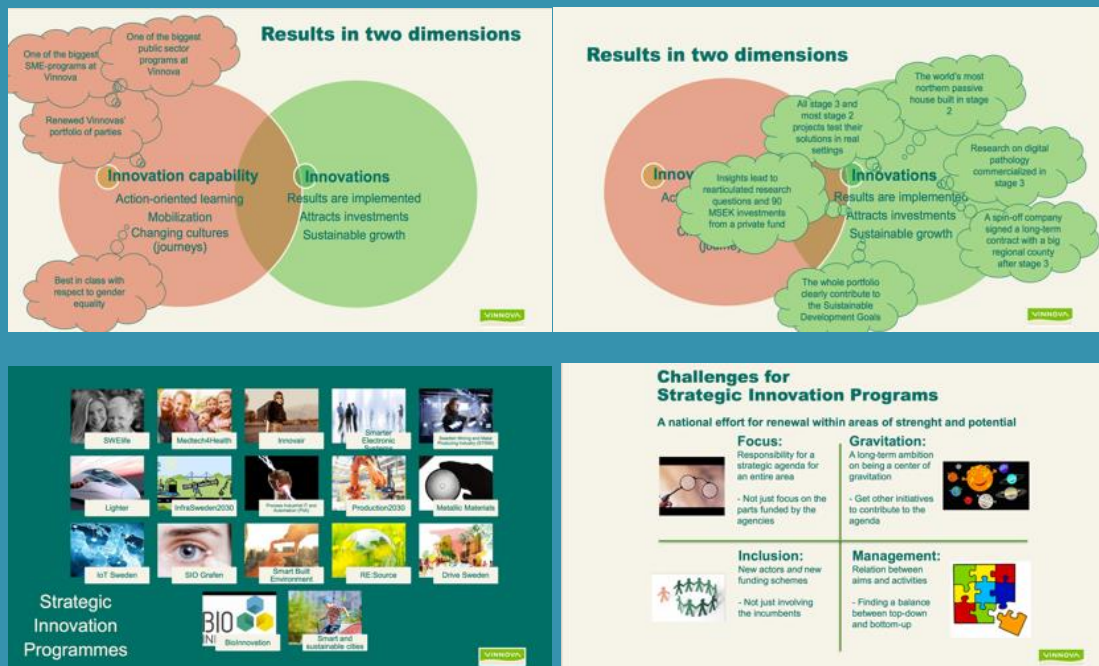
[22] Goran Marklund (2017). 'Swedish Innovation Policy and Evaluation Practices'. Presentation Workshop on Capturing Behavioural Change, Stockholm, 24 to 25 October 2017.

3.3 Available methods

A resulting question is: which research methods are at our disposal to measure and capture behavioural additionality? How can policy impact and in particular behavioural effects (at both firm and system level) be attributed to individual schemes? How can we check the persistency of effects, i.e. raising the issue as to how long a firm should be allowed to benefit from a particular scheme? To what degree is the system ecology affected by a certain business R&D grant? Are there combinations of types of schemes and types of behavioural change? What do we know about the 'innovation policy careers' of individual firms, i.e. is there a certain order in which various types of schemes are being used one after another or in combination? In particular, the issue of persistence raises a question regarding the temporary or permanent nature of R&D business grants. During the Stockholm site visit, we learned with others about differentiating between direct, spillover and system effects (see Box 7).

We will describe a few useful methods:

- **Questionnaires:** Firms can be surveyed and asked how they assess the impact of an R&D or innovation grant on their internal operations and external performance. One can also ask if firms developed an innovation strategy or if they have appointed an innovation manager. For the best results, the questionnaire should be distributed among a group of firms that are a beneficiary of an R&D grant programme and to firms that are part of a control group. Various strategies and methods exist for the construction of control groups, and the firms in these two groups should be as similar as possible.[23]

- **Network analysis:** Use administrative data (joint patents, joint publications, contracts) to map the network of the firm (clients, partners, suppliers) and analyse changes in this network before and after the intervention. This type of analysis not only provides insight into the development of collaborations but also into financial relations, staff mobility, etc. This network analysis is also applicable at the level of R&D and innovation programmes. Such an analysis can, for example, highlight which firms participate in one or more programmes.

- **Interviews:** Conversations with stakeholders are an excellent source for capturing any behavioural change that results from participation in an R&D and innovation scheme. One can ask in-depth questions to see if changes did occur and if these changes resulted in receiving a grant. An example of the use of interviews next to econometric analysis to gain additional insights is the evaluation of the Dutch SBIR (see Box 8 below). The same kind of interviews can be carried out with firms that did not receive any grant at all or any other control group of firms. The disadvantage of using firms that were unsuccessful in applying for a grant might be that the act of applying for a grant can result in a positive change in the firm's attitude and behaviour towards R&D and innovation, leading to an underestimation of the possible effect on a firm's behaviour towards a scheme. Another methodological problem associated with interview approaches (as well as questionnaires) to the determination of BC and BA is that of asking suggestive questions. In other words, when framing questions about induced changes, it is difficult to avoid suggesting the range of potential changes that could have occurred, which can lead respondents to identify or exaggerate effects that did not occur, or which occurred to a minor degree. Similarly, in framing such questions, it is difficult to identify unanticipated effects *a priori* as these tend to lie outside the original programme logic. Thus, when looking for BC/BA effects, it is desirable to find a neutral non-suggestive approach.

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[23] These were discussed, among others, during the third site visit (London workshop).

Professor Åsa Lindholm-Dahlstrand (CIRCLE, University of Lund) began her presentation by indicating that a (technological) innovation system without vibrant experimentation will stagnate. Experimentation is a key function of such a system. She discussed the symbiosis of large established firms, universities and new and innovative and technology-based firms ('two batteries tied together'), and most importantly differentiated between the types of impact: direct effects, system effects and spillover effects – the latter two being probably more important than the first. She also emphasised that it is key to take more time to really assess the impacts of schemes.

Prof. Lindholm-Dahlstrand shared the first results of a small experimental evaluation study. This study included a small telephone survey among 60 SMEs that had participated in the Vinnova SME programme and received support for at least two projects: a one-on-one and at least one of the Vinnova collaborative programmes (consortia). The survey assessed the direct effects (products, patents, sales, etc.) and spillover effects (influence on their project partners and other actors, such as employment and economic growth at suppliers and other business partners). SME respondents assessed themselves on the effects on their companies and their partners and other actors. The telephone survey also included questions about spin-offs that benefited from the two types of Vinnova support. She also provided case studies of highly innovative SMEs, selected in collaboration with Vinnova.

The preliminary results and others seem to indicate that the direct effects on the firms (such as growth) are relatively limited, whereas the positive spillover effects (such as the influence on customers and universities, spin offs, etc.) and especially the effects on various system functions are considerable. A substantial number of SMEs reported a positive effect on two or three functions of the innovation system, including experimentation (entrepreneurial experimentation breeds entrepreneurial experimentation). The overall message was that we should consider the wider spillover and system effects of schemes as well as the direct effects.

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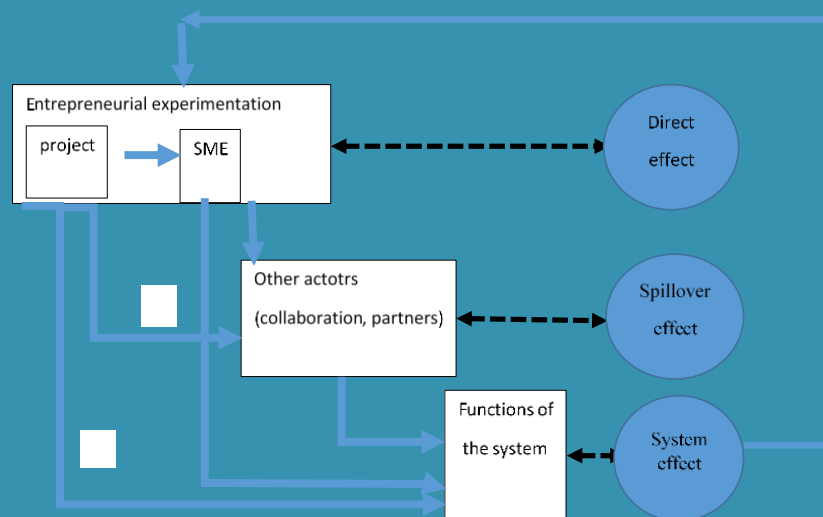
[24] Professor Åsa Lindholm-Dahlstrand (2017). 'Spillover and system effects of VINNOVA-funded R&D and innovation projects in SMES'. Presentation Workshop on Capturing Behavioural Change, Stockholm, 24 to 25 October 2017.

SBIR is a pre-commercial form of public procurement of R&D services. This research-funding mechanism aims to facilitate innovative solutions (or gain insight to the solutions) for societal issues. If successful, the procuring authority can purchase a new type of product. SBIR, which is based on the concept that various parties compete to develop an innovative solution, is conducted in several ways:

(1) Firms are invited to tender for a knowledge question from the government. Ministries or other government agencies collaborate with the Dutch Enterprise Agency to convert a societal or procurement issue into an SBIR call.

(2) Academic start-ups aim to transfer knowledge generated by the (university) knowledge infrastructure.

Although SBIR cannot be considered an R&D or innovation grant, the evaluation addressed behavioural additionality as it was also part of the policy programme. The evaluation concluded after an econometric analysis that there is no evidence of an impact of both types of SBIR on the participants' R&D efforts. However, in-depth interviews with SBIR applicants and participants revealed significant evidence of behavioural change that were impossible to be observed by the econometric analysis. SBIR stimulated companies to think about other solutions, to explore the risks and to learn how to prepare a business plan. They were also challenged to consider the potential market opportunities of an innovative solution. Applicants prepared a proposal, provided explanations and received feedback from experts.

Behavioural change was observed following not only successful but also rejected tenders, for example tightening up a tender bid or acquiring funding from elsewhere for their proposal.

- **Administrative data:** Administrative data, as well as big data, provide all kinds of opportunities to gain insight into behavioural change. These data can be collected at tax and statistics offices, chambers of commerce, but also from internal management systems (HRM, accounting) or project reports,[25] subject to reasons of confidentiality. Despite the fact that these data are not registered with the aim to evaluate a firm's behaviour and performance, these can provide valuable input. What kind of new staff were appointed? What kind of training courses were attended? Did the firm start new business activities or establish new spin-offs? Did collaboration with universities or Research and Technology Organisations (RTOs) increase? In which R&D and innovation programmes does the firm participate?

- **Observation:** Observation is an important sociological research method where the evaluator visits a firm and observes how the firm and its employees deal with R&D and innovation (meeting attendance, etc.). The challenge here is that the evaluator does not influence this behaviour intentionally or unintentionally. Observation can easily be combined with other methods such as interviews. There are specific moments where observation provides additional insight into changing behaviour, for example when a grant application is being discussed or when a board decides on R&D and innovation issues. One of the most important advantages of this method is that it enables the evaluator to capture information that is not recorded in databases, questionnaires or meeting minutes.

- **Case studies/narratives:** The use of different resources to describe the impact of the R&D or innovation grant on the firm's R&D and innovation activities. The advantage of this approach is that it captures the entire process – from applying for a grant to the

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[25] Text mining of data contained in final project reports might offer a neutral way to determine behavioural effects, including unanticipated outcomes.

implementation of an innovation. In a case study, it is also possible to highlight a specific topic, for example what is the impact of the government intervention of the firm's R&D and innovation behaviour.

- **Monitoring:** One of the challenges in R&D and innovation policies is to change the behaviour of a firm permanently. However, a shortcoming of many evaluation studies is that these are often conducted during or directly after (i.e. a few months) the firm receives an R&D grant or participates in an innovation scheme. One way to overcome this problem is to start a monitoring process that lasts a few years and enables the registration and analysis of indicators that measure changes in behaviour. However, this will never be the only solution, as it does not allow us to attribute a change to a specific intervention. The length of a grant scheme is not necessarily adapted to the length for a proper monitoring and evaluation. Some grant schemes are only ad-hoc or run only for one legislation period and are then discontinued.

Ideally these research methods are applied within a context that provides a broad and full insight into the behavioural change in the short term and the long term. To obtain an even better understanding of the impact these methods should be applied in treatment and control groups, i.e. firms that did receive an R&D or innovation grant and others that did not. The methods should also be able to measure the long-term impact. Policy-makers will be more satisfied if policy instruments are able to change behaviour permanently, but this creates a paradox in evaluation research as this is often conducted during or directly after the end of a policy programme.

Another challenge is that policy programmes are not tailored to the needs of an evaluation study. It is often not possible (or desirable) to exclude a group of firms from an R&D or innovation grant with the argument that they should be part of a control group (an exception is the introduction of a lottery in which every applicant has the same chance to receive a grant). This does not dismiss policy-makers and government agencies from preparing the collection of data needed to perform an evaluation later on. In evaluation research, we too often encounter incomplete datasets or evaluation requests that are impossible to carry out due to a shortage of data. There are many ways to involve firms more intensively in order to assess their behavioural change. One could, for example, agree that firms who receive a grant are willing to participate in a more extensive evaluation research.

There are various research methods to measure and capture behavioural additionality. However, the success of these methods depends heavily on the programme design (can we identify a control group when using quantitative methods?) and the collection of data from the start of a programme (can we guarantee these data are complete?). Furthermore, the cooperation of the firms is important (how can we involve them without harming their competitiveness by sharing information about their innovation strategy and success?) as well as the timing of the evaluation (to measure permanent behavioural change you need permanent monitoring). Last but not least, the opportunities policy-makers are willing to provide to carry out evaluations of behavioural change are essential because these can provide valuable lessons for improving policymaking in the fields of R&D and innovation.

4   POLICY LEARNING

4.1 Introduction

Section 4 looks at the policy learning and feedback side and closes the policy cycle again. What do policymakers understand about the behaviour of companies (and other recipients) and what types of levers are available for them to effect change in the user population?

4.2 The impact of insights in behavioural change on (future) policymaking

In this section, we discuss how insights into behavioural change (both positive and negative) can be fed back to the entire policy cycle. In describing the concept of 'policy learning' we refer to the notion of the political scientist John that:

"Policy-makers are not automatons driven by electorates or institutional routines but respond to the changing contexts of policy. They are capable of learning from the implementation of policy, and policy changes as a result." (John, 2005, p. 151).

In addition, we conclude that policy learning refers to all stages of the policy cycle and that policy learning is not restricted to just policy-makers. Other stakeholders, e.g. beneficiaries from an R&D scheme, can also learn from the implementation.[26] From this perspective we can raise questions regarding policymaking. Does policy learning take place and do policy schemes and policy mixes change as a result of new insights into the behavioural change induced by evaluations of R&D business grants/innovation schemes? Essentially this is about the 'act of evaluation' itself and the way in which the knowledge of behavioural changes derived from individual evaluations are not only communicated/disseminated, but also fed back to the policy cycle.

The measurement of the impact of an innovation scheme's R&D can be considered an example of how applied scientific knowledge feeds into the policymaking process. This so-called evidence-based policymaking is a rewarding perspective, but it is not the whole story. Policy-makers also use other sources to develop and adjust policy programmes. These other sources can be intuition, experience, power, political preferences and influence. We however conclude that evaluation is becoming increasingly embedded in policy processes, for example, because more and more laws and policy programmes have an obligation to be evaluated. In addition, more and more mid-term evaluations are being conducted to adjust policy.

In line with OECD (2014) it can be concluded that for more complex policy interventions, the challenges are great.

There may still be some scope for the use of experimental methods and for an iterative approach to evaluation, but there also needs to be realism about what can be achieved and about the difficulties of establishing counterfactuals and undertaking impact evaluations. Use of structured hypothesis testing, the intelligent use of carefully selected indicators and creative attempts to extrapolate from diverse sources of evidence might be the best that can be achieved.

Despite these methods and other issues, there are many examples of evaluation studies that played a pivotal role in political and social debates, and which have led to the cancellation, adjustment or proliferation of existing policies. One can even argue that improving the quality of evaluation research, for example by focusing on behavioural

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[26] One could expect that some beneficiaries (e.g. firms) prefer the concept of 'organisational learning' over 'policy learning' as their firm learned, for example, to pay more attention to R&D and innovation as a result of participating in a public policy scheme.

change, can help to improve the impact, along with the involvement of stakeholders, maintaining a link with the decision-making process, planning good communications, management's response and building good knowledge management systems (OECD, 2014). And even if evaluation research only adds to the conceptual knowledge and utilisation of policy-makers, there is still policy learning.

The evaluation of behavioural change:

- Can lead to a better understanding of organisational routines, and therefore add to the knowledge on whether government interventions will be more of less productive with regard to stimulating R&D and innovation. Government interventions preferably take into account the characteristics of the target group. In the case of small innovative companies, other forms of behaviour may need to be stimulated more than in mature firms. The same applies to firms that have already made a far-reaching innovation journey or firms that are just starting to innovate. This will help to enable R&D and innovation instruments to become more effective.

- Can help policy-makers to formulate more specific R&D and innovation goals. These goals will not only include input and output objectives (the 'usual suspects' such as more R&D expenditure or an increasing number of patents), but also include goals that explicitly relate to the firm's behaviour (collaborations, new and adapted internal R&D and innovation processes, investments in skills). The questionnaire made clear that some governments changed their policies as a result of these types of evaluations.

- Can encourage policy-makers to develop a more comprehensive perspective on R&D and innovation. Behaviour is an individual as well as a social process, and a social process involves, by default, other actors. The involvement of other actors (other firms, research institutes, governments) implies that behaviour should also be studied at 'higher' levels, such as an industrial or service sector.

- Can invite governments to reflect on their own behaviour as well as R&D, and innovation is not restricted to firms. Governments can set an example by developing behaviour that supports innovation as well (innovation of internal processes, appointing innovation managers) or by adjusting behaviour to the innovation instrument to be implemented (e.g. if the government wants to be a launching customer, it should act as a launching customer; if the government wants to change a firm's behaviour it should first learn about existing behaviour).

- Can help policy-makers to develop policy programmes that fit the ambitions related to change behaviour. If the ambition is to constantly change behaviour it is necessary use an instrument that supports this long-term goal. This will maybe result in a mix of instruments, for example a grant for the short term and advice and support for the long term, or a simultaneous use of tax and grants by firms.[27] Neicu (2016) concluded that:

"Firms that obtain R&D subsidies are more likely to further adjust their approach to R&D using funds made available through tax credits than when they benefit from tax credits alone. The combination causes firms to speed up their research projects, but also orient their R&D proportionally more towards research (versus development) activities."

- Can support policy-makers in the design of (new) policy programmes aimed at stimulating R&D and innovation (and possibly a greater distinction between the two). This design should pay attention to questions such as:

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[27] This opens the debate about the underlying purposes of policy schemes. Perhaps they need to become more focused in this regard, i.e. grants to lead to the development of new products and to overcome bottlenecks, support for more generic collaboration, and softer measures to entice entire sectors to adopt more innovation-friendly behaviours?

- Which behavioural changes should the programme stimulate and how can these changes be measured properly?

- How should the programme be designed to enable the measurement of behavioural change?

- How should the programme be designed in order to be able to attribute a behavioural change to a specific government intervention?

- Is it possible to establish a treatment and control group (when using quantitative methods)?

- What data/information needs to be collected at the start/during and after the finalisation (with a decent time lag) of the programme in order to measure the impact on behaviour properly?

- How can firms (or other actors) be encouraged not only to participate in the programme but also in the evaluation of the programme (as this is not mandatory in most countries)?

- What budget is available for monitoring and evaluation (including measuring behavioural additionality)?

During the Stockholm site visit, many of the lessons learned at the national or regional level were exchanged (see Box 9 below). It was clear that participating countries not only got a very fine introduction to the Swedish innovation system, several of the Swedish schemes and the current thinking on behavioural additionality and behavioural change, but also shared many insights. It was concluded that countries are at different stages of measuring behavioural additionality/behavioural change, but that there are numerous good studies and indicators around that could help in assessing these more explicitly. It was further concluded that it is necessary to combine and complement the various methods. It was also mentioned that it is essential that behavioural additionality/behavioural change be explicitly addressed when designing policy schemes: what sort of change in behaviour is required? It was also made clear that both policy-makers and evaluators should be aware of the possible negative outcomes of schemes in terms of behavioural additionality and behavioural change. A subsequent key message was that thinking about and measurement of behavioural additionality/behavioural change should be further inspired by key insights from innovation studies, including notions such as organisational learning. Finally, it was agreed that both direct and more indirect (spillover and system-level) effects exist that can be measured at various levels. A fine conceptual framework (such as the one shown in Box 7) would be very helpful here, together with ensuring that some international comparisons can be made.

During the Stockholm site visit participants from various member countries exchanged experiences regarding behavioural change and its evaluation. Below is a (non-exhaustive) listing of some of the lessons learned at country level that were exchanged. For more details, we refer you to the minutes of the site visit.[28]

"A relevant example from Germany is the evaluation of an innovation programme for regional economic growth (Innovative Regional Growth). The programme contains R&D grants for companies but also support for research organisations and cluster organisations. The emphasis is on the eastern part of the re-united Germany. An evaluation was done 10 years after the introduction of the programme. This allowed for asking questions about the persistence of collaborations, R&D investments by firms and spin-offs created by research organisations, and analysing the extent to which start-ups continue to exist, grow, be acquired, etc. The evaluation combined surveys and case studies. The evaluation budget was provided by the Ministry of Economic Affairs. Overall, the results were positive." -- Jan Wessels, VDI/VDE, Germany

"The opportunities of the European Structural Funds and the process of developing a Smart Specialisation Strategy meant that we pay more attention to SMEs and entrepreneurship. The first evaluation of business R&D grant schemes – for SMEs and others – indicated that SMEs had negative experiences when collaborating with universities, research organisations and large firms. Among other things, there was a lack of trust, especially regarding IPR [international property rights]. As such, this blocked the type of new behaviour the government was aiming for. So Croatia is now supporting networks and clusters, so actors get to know each other, develop trust, discuss shared problems. The original scheme is still ongoing. In 2018 there will be an evaluation of the effect of the scheme(s) on new, effective and persistent collaboration between actors, including collaboration between SMEs and other types of actors." – Bruno Grubesic, Ministry of Economy, Entrepreneurship and Crafts, Croatia

"The additionality of public support and behavioural change are at the heart of a pilot evaluation of a Brussels region programme for industrial doctorates (conducting PhD research in companies). The objectives of the programme are knowledge transfer and sustainable collaboration between (large) firms, universities and individual researchers. Public support accounts for 100 % of the PhD wage, which is paid via the university. The evaluation shows additionality. The collaborations would not have existed otherwise. In terms of behaviour: companies are becoming more pro-active in doing research, are developing innovation strategies and are partnering. PhD researchers get familiar with the perspective and benefits of industrial research. Several PhD students were hired by the companies. The evaluation of the scheme was based on case studies, including interviews." -- Arianne Wautelet, Brussels Capital Region, Belgium.

"France also assessed the role of PhD students as a mechanism for knowledge transfer. Support is provided, for example, via a tax credit scheme. In short, companies receive more tax credits if they hire and pay a PhD student. This partly solves the problem of Engineering Schools and other Graduate Schools (and their students) that are not always used to conducting research and that have few resources to fund PhD trajectories. Similar to the Brussels and UK cases, evaluations looked from the company and researcher perspective, e.g. using surveys to assess whether students continue working in industry. Another method used to capture behavioural change is network analysis, e.g. looking at new and persistent collaboration as a result of cluster

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[28] Meeting Report (2017). Behavioural change: Towards a better understanding of innovation journeys of beneficiaries of R&D and innovation grants, Mutual Learning Exercise on Evaluation of Business R&D Grant Schemes under the Horizon 2020 Policy Support Facility (PSF), Second Workshop, 26 to 27 October 2017, Stockholm.

programmes (pôle de compétitivité)." - Rémi Lallement, Departement Economie, France Strategie, Services du Premier Ministre, France.

"In Norway, evaluations are still very output-oriented, but Innovation Norway tries to address behavioural change. One example concerns a support programme for the seafood industry, including support for companies (per employee) for taking a 6-month course at a business school. The topic is business development and marketing, because this could increase the market orientation of companies in the seafood industry. After 6 years, when the support stopped, companies continued to send their employees to this type of business course; and business schools had become experienced in providing these courses and continued to do so. Our evaluation – including case studies and surveys – also found that companies that have sent a substantial number of their (middle) managers to business courses improved their market orientation. At the level of individuals, the courses were appreciated, but some people decided to move to another type of function (or company)." -- Knut Senneseth, Innovation Norway, Norway.

"Evaluation of Innovate UK's Smart Programme included a survey among beneficiaries. The effects are, among others, speeding up innovation, actually doing a project (instead of just considering it), more innovation (e.g. develop new products) and reducing time-to-market. Another programme looked at innovation/commercialisation at universities. The programme targets young PhD students and postdocs and provides them information and skills related to commercialisation of their ideas (entrepreneurship, licensing, etc.). So far, the survey results and impact modelling of the evaluation indicate a GBP 4 return for every pound invested by Innovate UK." -- David Legg, Innovate UK, United Kingdom.

"Case studies have shown to be powerful ways of understanding how schemes affect behavioural additionality/behavioural change of firms, e.g. how they contribute to the creation of new R&D departments (10 % of beneficiaries); recruitment of new R&D personnel or learning about how to manage R&D projects. Surveys done immediately and again 2 years after the finalisation of loans/projects have also helped to increase behavioural insights. It has helped to confirm or reject programme managers' intuition as to the behavioural effects, thanks to participation in R&D schemes. Almost all questions in these surveys are actually on behavioural additionality." -- Ascension Barajas Inigo, CDTI, Spain.

"All we do (as innovation agencies/policy-makers) is about behavioural additionality and change, including scaling up and speeding up. It is a necessary condition, otherwise there would be no additionality at all. You have to capture what behavioural effects you are after and what you realised. Because of the design of the instruments, you have to understand the behavioural effects and be explicit about the behavioural effects that a scheme is intended to trigger. There are various examples of behavioural insights that are being fed back to the policy design (closing the policy cycle again) such as in schemes aimed at SME business grants where it proved important to look at business groups instead of single firms (as firms merge, they are being taken over and become part of a wider group of firms). The evaluation of programmes aimed at innovation in public organisations showed that applicants with some form of innovation management skills are more successful. Further it was noted that extensive monitoring on an almost real-time basis is important to capture behavioural change and requires serious investment in expertise at Vinnova." -- Goran Marklund, Vinnova, Sweden.

"In PPPs, it is really important to get to know the persistency of the created cooperation over time. This means following beneficiaries over longer periods of time. Like in Spain, Germany is investing in follow-up surveys after 2 and sometimes even 5 years after finalisation of R&D support (and firms have to commit to this kind of monitoring up front). Some of the lessons learned are that SMEs have to learn to see knowledge institutes (RTOs/Higher Education Institutions) more as relevant partners. A success criterion for these knowledge institutes is the degree to which they really manage to

work with SMEs. Another example of measuring behavioural effects is the degree to which end-users are included in R&D projects." -- Tim Grebe, BMBF, Germany.

"In Lithuania, mobility schemes that bring researchers to firms are seen as important mechanisms to change the behaviour of SMEs (and researchers). Although the initial scheme met with some resistance from both the researcher and the SME, the Lithuanian Government insists on making the scheme more popular. This can only be done by understanding how researchers and SMEs perceive the scheme and the change in behaviour requested. In Lithuania, there have been a wide variety of initiatives to increase the appetite for 'soft measures' aimed at, for instance, increasing start-ups, joint R&D projects and procurement policies. They all require more detailed understanding of how (potential) beneficiaries perceive such schemes and thus insight into behavioural effects of schemes." -- Daine Denisoviene, Office of the President, Lithuania.

"We performed a study where four countries (Poland, Croatia, Spain, Portugal) were compared on additionality (using micro-aggregated CIS-data). Input, output and behavioural additionality were assessed. The latter was divided into two slots: training and cooperation. For Poland, some input additionality for some sectors, no output additionality and behavioural additionality on cooperation was found. Other countries showed a somewhat different picture. For Spain and Portugal input additionality was confirmed; behavioural additionality was confirmed for Spain only in the case of training and cooperation. Output additionality was there as well. So, results do tend to differ between countries. If we want to have some sort of result, we will really need to design it into the policy scheme. Design should match the expected results. Currently we use indicators that do not always measure the phenomenon/goal we are after." -- Marzenna Weresa, Warsaw School of Economics, Poland (Chair of the MLE).

4.3 Main takeaway messages

All in all, the key takeaways from the Stockholm site visit can be summarised as follows:

1. It is essential that the community of STI scholars, STI evaluators and STI policy-makers acknowledge more fully the importance of measuring and capturing behavioural change through STI schemes. There is a need to understand in detail why these schemes work (or not) and what their short-term and long-term (desired, undesired and even unintended) behavioural effects are. We think these insights into behavioural effects are needed to see how R&D and innovation schemes are impacting their beneficiaries, and in particular how they affect the organisational capabilities and organisational adaptability of beneficiaries.

2. Behavioural additionality as a notion is generally less clear-cut as compared to input and output additionality, as it relates to possibly all the factors associated with the competences and innovation capabilities of a firm. These factors can be manifold and there is not yet a well-accepted set of indicators available for measuring these quantitatively.

3. However, although countries differ in where they stand when it comes to measuring behavioural effects, there are numerous good and inspiring studies and indicators around that could help in assessing these effects more explicitly. Their exchange needs to be supported.

4. Attempts to measure behavioural additionality and, more widely, behavioural change due to the use of R&D grants and innovation schemes should be stepped up.

5. When assessing behavioural effects of R&D grants and innovation schemes a mixed-method approach is preferred. It is key to report both quantitative attempts to measure the behavioural effects of R&D grants and innovation schemes, and detailed and more qualitative narratives of how schemes are used in practice and their impact on firm behaviour.

6. The economic results of changed behaviour take a long time to incubate. Therefore, evaluations are needed with a longer time horizon so that changes become identifiable and measurable.

7. The wider spillover and system effects of schemes next to the direct effects at firm level need to be considered more fully. A fine conceptual framework (such as the one shown in Box 7) would be very helpful here, as well as ensuring that some international comparisons can be made.

8. The thinking on and measurement of behavioural additionality/behavioural change should be inspired more by, and benefit from, key insights from innovation studies (including notions such as organisational learning).

9. Despite the difficulty in designing a policy scheme that also fits the needs for an evaluation, there are many ways to involve beneficiaries further in order to assess their behavioural change. One could, for example, agree that beneficiaries are willing to share more information about their behaviour (and not just filling out a questionnaire).

10. Behavioural effects can only be measured and included in evaluations and impact studies more fully when there is sufficient administrative and political support, with regard to budget, data availability and the willingness to learn and adapt.

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This thematic report has been prepared for the Mutual Learning Exercise (MLE) on the evaluation of business research and development (R&D) grant schemes in European countries. It addresses the topic of understanding and measuring the behavioural change in firms through these schemes and challenges to capture these. It is essential that the community of STI scholars, STI evaluators and STI policy-makers acknowledge more fully the importance of measuring and capturing behavioural change through R&D and innovation schemes. There is a need to understand better why these schemes work (or not) and what are their short-term and long-term (desired, undesired and even unintended) behavioural effects, in particular how they do affect organisational capabilities and organisational adaptability of beneficiaries. Although there are various good and inspiring studies and indicators around (which need to be exchanged more often), it is a.o. concluded that evaluations are required with a longer time horizon so that changes become better identifiable and measurable. Evaluations do also need to consider more fully the broader spillover and system effects of schemes next to the direct effects at firm-level.

Studies and reports