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## The use of behavioural additionality in innovation policy-making

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# The Use of Behavioural Additionality in Innovation Policy-Making

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## Abstract

The overarching aim of this paper is to contribute to a better understanding of how the main target variable of innovation policy – change in behaviour – can be better conceptualised and put into practice in evaluation and policy making. The paper first develops a theoretical framework of the concept of behavioural additionality. On that basis it looks in detail at the way behavioural additionality is operationalised in evaluation practice and how the concept is discussed and applied in the interaction between policy-makers and evaluators. The paper utilises a statistical analysis of 171 innovation policy evaluations, a text analysis of selected behavioural additionality evaluation reports and finally a number of in-depth case studies of evaluations. Based on the theoretical considerations and the empirical findings, the paper identifies three different uses of behavioural additionality in innovation policy evaluations. It concludes that despite the widespread use of the behavioural additionality concept, an improved theoretical basis and serious methodological improvements are needed to realise the full potential of this concept for evaluation and policy practice.

## 1 Introduction

Innovation is the origination or adoption of a novel idea and its transfer into a practical application. Firms develop innovative products and services in order to offer an advantage to their customers compared to the established product or service. Firms, as well as public and third sector organisations, also constantly innovate in their internal processes and organisational set up. To innovate means to do something differently in order to be more efficient and effective in pursuing one's goals. To do things differently, individuals and organisations have to change behaviour, they have to learn, adopt knowledge, develop new skills, practices and routines, and apply all this in their respective contexts (OECD and EUROSTAT, 2006).

Consequently, innovation policy is the set of public measures that tries to enable and incentivise actors to innovate, i.e. to increase their capabilities and willingness to learn and change their behaviour. The basic intervention logic for innovation policy is thus not only market failure (under-investment in research to innovate) and system failure (e.g. lack of cooperation and networking), as the innovation policy literature has it, but also capability and adoption failure (e.g. support to enable change in behaviour) (Bach and Matt, 2005; Bryant, 2001; Dodgson et al., 2010; Georghiou, 1998a; Hall, 2002; Larosse, 2004; Metcalfe and Georghiou, 1998; Schwerin and Werker, 2006; Smith, 2000).

Innovation policy is designed and implemented with a view to tackle all three failures. Almost all innovation policies, explicitly or implicitly, thus aim at a change of capabilities and behaviours to some degree, at individual or organisational level. To design and re-design appropriate policies and to understand their effects and shortcomings, strategic intelligence needs to capture all three failures and at the same time enable us to understand the impact of the policy intervention to tackle those failures.

One major tool to support the design and implementation of innovation policy is evaluation. Evaluation of innovation policy (or its various earlier variants such as technology policy, R&D policy etc.) traditionally looks at what impact policy has on the performance of the target group, both in terms of changes in input, changes in output and changes in the way things are done. During the 1990s, the latter dimension, i.e. changes in the way things are done, has been conceptualised in the academic literature as well as in evaluation practice in order to better understand *how* innovation policy actually can change the way things are done – and how this can be done in a more persistent way, beyond the impulse of the initial intervention (Georghiou and Laredo, 2006).

There have been many different studies within the technology and innovation policy and evaluation literature on the change in behaviour through government action. However, an explicit concept of behavioural additionality (BA) was first coined by Georghiou and his colleagues (Buisseret et al., 1995). In its most general understanding, BA can be defined as the *persistent* change in what the target group agents are doing and how they are doing it, and this change is attributable to the policy action. After its coinage in 1995, the term has gained considerable attention first in scholarly literature and subsequently in evaluation practice in the domain of innovation policy. An OECD project in which a number of member states conducted pilot studies to evaluate BA in their programmes marked another phase for the concept (OECD, 2006). In spite of the increasing uptake of the term both in innovation policy evaluation and – to a lesser extent – in innovation policy design, the term is not yet fully matured as the definition and theorisation of the concept still needs further work (Gök, 2010). The literature presents wildly different and sometimes conflicting perspectives of the concept, which results in further difficulties in its evaluation, and the understanding of policy makers and evaluators alike is, as a consequence, diffuse. This means that there is a real risk that the most important dimension of innovation policy, change of behaviour of actors as a condition for innovation to happen, is not fully understood in policy practice, and as a consequence it is wrongly applied, under-evaluated or mis-used, which ultimately contributes to under investment in innovation through under-appreciation (Aho et al., 2006; Georghiou, 2007).

The overarching aim of this paper is to contribute to a better understanding of how the main target variable of innovation policy – change in behaviour – can be better conceptualised and put into practice in evaluation and policy making. By doing so we hope to make the concept of BA better understood and subsequently contribute to improving academic knowledge and concrete design and impact of innovation policy.

In order to achieve this aim, the paper analyses the use of the BA concept in innovation policy practice. Therefore, we focus on evaluations, which are the major means for innovation policy makers to assess and re-design their policy measures. The paper looks in detail at the way BA is conceptualised and operationalised in evaluations and how the concept is discussed and applied in the interaction between policy-makers and evaluators. The study is based on a large scale, systematic analysis of evaluation reports of innovation policy across Europe (Edler et al., 2011) and a set of in-depth case studies.

The paper will start by outlining the origin of the concept in innovation policy and the various academic concepts of BA (Section 2). Section 3 presents the empirical analysis. After outlining the methodology applied (3.1), this section portrays the variety of understandings of the concept in evaluation practice based on a detailed text analysis of 33 evaluation reports (3.2). It then analyses the main characteristics of evaluations that apply to BA approaches based on a broad statistical analysis of 171 evaluation reports (3.3). A final empirical section summarises and discusses five case studies of the application of the BA concept in selected policy measures (3.4). Section 4 then discusses and interprets the various findings while the last section 5 outlines presents implications for further research and for policy making.

## 2 The Concept of BA in the Academic Literature

The concepts of input additionality (i.e. additional inputs that would not have been created without a government intervention) and output additionality (i.e. outputs exclusively attributable to government intervention) are widely considered as the hallmark of the neoclassical policy rationale which ultimately seeks to remedy market failures. If a government action designed to address market failures does not create more inputs and/or outputs that would not have been created without it (e.g. input and/or output additionality), then it is unsuccessful.

On the other hand, BA is considered as the core of the evolutionary / structuralist view which urges policy action to increase cognitive capacities of agents and/or to resolve exploration, exploitation, selection, system, and knowledge processing failures, rather than simply addressing market failures. Thus, a policy is only successful if it increases the capacities of agents that are crucial for innovation activity and performance (cognitive, networking etc.) and by doing so leads to persistent effects. Bach and Matt (2002, 2005) call this ‘cognitive capacity additionality’ while Georghiou and his colleagues (2004, 2007; Georghiou and Clarysse, 2006) refer to it as ‘behavioural additionality’ (Bach and Matt, 2002, 2005; Lipsey, 2002; Lipsey and Carlaw, 1998a, b, 2002; Lipsey et al., 2005).

However, although the concept of BA has gathered considerable attention from a range of scholars, there is still no consensus as to what it means. Similarly, the concept still lacks a comprehensive theoretical basis and a sound, accepted operationalisation. Gök (2010, 2011) classifies these definitions into a set of four categories (see also Table 1).

### A. BA as an Extension of Input Additionality:

There are a number of papers that understand BA as a very simple concept that complements the excessively linear and strict nature of input additionality. For instance, Luukkonen (2000: 713) argues that “input additionality and BA are usually merged together in a question that lists different degrees of additionality, whether the R&D would not have been carried out at all without public support, or alternatively whether the public funding changed the scale and scope of the R&D or R&D

would have been done differently”. Similarly, Hsu and his colleagues use the very same definition in their closely related empirical articles (Hsu et al., 2009; Hsu and Hsueh, 2009).

Some other scholars accept that there might be further effects, although they either put the emphasis on the extensions of input additionality or they find only this definition workable (evaluable). One example here is Falk (2007) who defines BA as a broad category that includes scope and acceleration additionality (i.e. if the measure encourages the firms to conduct their projects in a bigger scope and faster than it would have been) as well as cognitive capacity additionality (i.e. if the cognitive capacity of agents are increased) and uses only the first two in her empirical investigation. Another example is Malik et al. (2006: 206) who accept that BA is a multi-layered concept; all the same, they use and prefer the reduced definition. Finally, Georghiou (2002a: 59) defines BA as the superset of scale, scope and acceleration additionality, while accepting that there might be more permanent effects within the umbrella of BA.

However, this type of BA is not really concerned with or taking into account the persistence of the changes induced by the measure, and thus evaluations capture behavioural changes at only one point in time during the project. There is no particular emphasis on spill-over and endurance beyond the support period. Further, in this category, BA is perceived as confined to R&D and innovation activities of the firm and it has a limited temporal breadth.

#### **B. BA as a one-off change in the behaviour related to R&D and innovation activities:**

The second group of articles that define BA see the concept as capturing the change in behaviour of the agents. This change, contrary to Category A, is beyond an extension of input and output additionality. It not only includes scale, scope, and acceleration additionality for the concept of behavioural change, but also the way the project is undertaken.

The original definition of the concept is the prime example. Buisseret et al. (1995:590) coined BA as “the change in a company’s way of undertaking R&D which can be attributed to policy actions”. Later, Georghiou (2002b:59) has elaborated on their definition by arguing that when defining BA, what they were inspired by was not the change in the “stop-go decision by the firm in respect of the project but [...] rather the way in which the project was carried out.” Similarly, Georghiou (2004:7) defines it as “the difference in firm behaviour resulting from the intervention”. Clarysse et al. (2006) and Steurs et al. (2006:6) endorse this and use it as a reinforcement of the use of the black-box analogy – BA is what is inside the black-box of the firm, beyond input and output additionality. Finally, Hall and Maffioli (2008: 173) use this definition in their empirical investigation.

Similar to the definition category A, the studies in category B do not particularly stress the issue of persistency. They do not analyse if the change in behaviour is sustained beyond the project or its immediate vicinity. Clarysse et al. (2006) and Steurs et al. (2006:6) hint at the persistence but, as will be discussed later on, their temporal understanding is still more short-term-like than the definition categories C and D below. In a similar vein, Georghiou (1998b: 39) and Davenport et al. (1998: 56) accept that BA is “the most durable” amongst the three types of additionality, but fall short of analysing persistence systematically compared to the next two categories. Furthermore, this category is also confined to the behaviour related to R&D and innovation activities.

#### **C. BA as the change in the persistent behaviour related to R&D and innovation activities:**

The third category of definitions of the concept of BA is very similar to the second one, with the main difference that now we have a more explicit and systematic capture of persistence. Aslesen et al. (2001:5-6) define it as the “permanent change”, Licht (2003) as the change “permanent in character”, and OECD (2006:187-189) as the “more sustained effects”. Fier et al. (Fier et al., 2006: 127) prefer to use “long-term behaviour”. Busom and Fernandez-Ribas (2008) define it as the change

in the propensity to exhibit a particular behaviour. In all these definitions and related evaluations, persistence is the key point; these effects endure beyond the support period.

#### D. BA as the **persistent change in the general conduct of the firm:**

The first feature in this category is that the change is not necessarily confined to R&D and innovation related activities, but BA is defined as the induced change in the general conduct of the firm. Secondly, BA is defined in its widest temporal breadth - it endures long after the support. Most importantly, the definitions of BA include more structural changes as they refer to the change in the individual building blocks of behaviour. The most explicit attempt to do this is by Georghiou and Clarysse (2006:12-13) who employed the resource based view of the firm and implied that BA refers to changes in the dynamic capabilities. Another attempt is by Bach and Matt (2005:37) who defined a new category of *cognitive* capacity additionality. This extension, however, is meanwhile integrated into a broader concept of BA. As a matter of fact, Hyvarinen and Rautiainen (2007: 206) later adopted this approach by defining BA as “how public R&D funding affects the firm’s behaviour, cognitive capacity and learning”, whereby they extended those effects beyond the R&D and innovation activities of the firms. Similarly, some other scholars define BA as the change in organisational routines more generally (Georghiou, 2007; Georghiou and Keenan, 2006) but do not articulate their definitions. Finally, Clarysse and his colleagues utilise the concept of learning to define BA (Clarysse et al., 2009). However, they do not extend this broader concept into their empirical analysis where they stick to traditional indicators.

**Table 1: Comparison of Different Definitions of BA**

	Category A	Category B	Category C	Category D
Definition	An extension of input additionality covering scale, scope and acceleration additionality and like	The <b>one off</b> change in the behaviour related to R&D and innovation activities	The change in the persistent behaviour related to R&D and innovation activities	The change in of the general conduct of the firm Substantial reference to building blocks of behaviour
Coverage	Only R&D and innovation	Only R&D and innovation	Only R&D and innovation	Beyond R&D and innovation
Persistence	One-off, no persistence	One-off, no persistence OR Rather mid-term than long-term and rather less persistent	Persistent OR Rather long-term than short-term and rather more persistent	Persistent

A more recent, and more holistic approach to conceptualise BA (Georghiou and Gok, 2011; Gok, 2010, 2011) argues that all these four broad categories of definitions of the concept of BA summarised in Table 1 share two common problems. Firstly, the concept lacks a proper *unit of analysis*. BA studies and the literature in general criticise the input-output approach by claiming that it treats the firm as a black-box where certain measureable inputs create some outputs, neglecting the process within which this happens. However, the very same approach is mostly repeated in the current conception of BA because the literature successfully opens the black-box of the firm and discovers smaller black-boxes of behaviour. Consequently, these smaller boxes of behaviour are analysed in terms of their inputs and outputs, but not opened and properly analysed within. For instance, collaboration behaviour is evaluated in terms of the money spent on collaboration (i.e. input to collaboration behaviour) or the amount of collaboration (i.e. output of collaboration behaviour) but not the building blocks of collaboration. Therefore, as ‘*behaviour*’ per se is not a unit of analysis, this approach suggests utilising the concept of ‘*organisational routines*’ to study the change in the firm behaviour.

Secondly, BA needs a better *framework of analysis*. As opposed to input and output additionality which are seen as main criteria for neoclassical innovation policy rationale, BA is arguably the hallmark of the evolutionary/structuralist perspective of innovation policy. If BA is to capture the logic and rationale of the evolutionary innovation paradigm, then it has to embrace the dynamic framework of analysis. In contrast, the various current measurement approaches of BA summarised above employ a comparative static framework of analysis in which input/output of behaviour prior to policy support is compared with the input/output of that behaviour once the firm is supported, by holding all other variables constant. Due to this *ceteris paribus* assumption, the change (i.e. the observed difference between these two static points) can be attributed to the government intervention and, hence, BA can be estimated. This view not only limits the full potential of the concept but also hinders its compatibility within evolutionary thinking as the focus of the evolutionary/structuralist view to innovation policy-making is not the end-result of the change but the actual process of change.

To overcome those two fundamental problems, Gok and Georghiou (Georghiou and Gok, 2011; Gok, 2010, 2011) suggest a new understanding of BA based on two pillars. First, the evolution of organisational routines by government action must be conceptualised, operationalised and analysed at three levels. The micro level refers to the evolution of particular organisational routines in particular firms by government action, the meso level refers to the evolution of particular organisational routines within a population of firms and, finally, the macro level refers to the evolution of social technologies (widely practiced and institutionalised organisational routines) *à la Nelson (1991, 2005, 2009a, b)* within the economy. Secondly, a thorough analysis of BA needs to take into account the entire process and its dynamics by capturing the origination, adaption, and retention phases of evolutionary change in organisational routines.

The next section will now turn to the actual use of the BA concept in concrete evaluations of policy measures in innovation policy.

### 3 The Understanding and Use of BA in Innovation Policy-making and Evaluation

#### 3.1 Data Basis and Methodology

The empirical analysis presented in this paper rests on three pillars: a statistical analysis, a text analysis of evaluation reports, and a set of case studies of evaluations. The original data is drawn from the INNO-Appraisal database which contains evaluation reports of a whole range of different innovation policy measures of EU25 countries that are covered in the European INNO-Policy Trendchart Database. The period covered is 2002 and 2007. The INNO-Appraisal database<sup>1</sup> includes full characterisations of each evaluation including their purpose, timing, methods, impacts cover, quality, usefulness, consequences, dissemination etc. The evaluation reports were characterised by a study team (more detail see Edler et al 2010). For some of the characterisation issues, i.e. the usefulness of the evaluation, judgements of policy makers were captured through interviews. The overall number of characterisation of evaluation reports is 216, 171 of which include policy maker verification and judgment. Those two samples are used for the *statistical analysis*, depending on which variables are analysed.

For the *text analysis* we selected 33 reports that employed the concept of BA and that did so within evaluations that the project team had assessed as being of sufficient quality in terms of methods

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<sup>1</sup> More information about the INNO-Appraisal database including data collection procedure can be found at [www.proinno-europe.eu/appraisal](http://www.proinno-europe.eu/appraisal)

employed and data used. We also limited the selection to reports in the sample that were in English or German as the nuanced understanding of the text is crucial for the text analysis. The number 33 is sufficient for an explorative – rather than a representative – case by case analysis of different BA understandings.

The selection of the *cases* built upon the text analysis of our 33 reports. The basic idea of these cases is to learn from good but varied applications. The first selection filter was: did the concept play a prominent role in the evaluation, implicitly (without naming it BA) or explicitly. The second criterion was: was the application of the concept thorough and promising to yield some meaningful insights? A third filter then was to make sure different variants of the concept were included, ranging from a simple understanding of BA as an increase in collaboration (which then, within this limitation was conducted carefully and in a sensible way), to complex differentiations of various building blocks of behaviour. And finally, the selection made sure that different kinds of policy measures were covered. The exploratory case analysis builds on a thorough investigation of the evaluation reports and the logic of the underlying policy measure, an analysis of the respective template that was filled in by policy makers, and subsequent semi-structured telephone interviews with the lead evaluators and – in most cases – the responsible policy maker.

### 3.2 The Different Understandings of BA in Evaluation Practice

In section 2 we have outlined the different and sometimes conflicting understandings of BA in the scholarly literature. Against this background, our first empirical question is: How is BA conceptualised and defined in actual evaluation reports? To answer this question allows us to see if and how BA is understood in an applied real-life context. This can serve as a starting point to improve the application of the concept, and to arrive at a generally shared understanding that is rooted in academic literature.

The text analysis of the 33 reports covering BA investigated the following important dimensions that were featured in the analysis of scholarly literature discussed in the previous section:

- Was BA explicitly mentioned or used implicitly?
- What was the definition of BA?
- Did the implicit or explicit definition of BA include the elements of persistency (as persistency is at the core of BA as a consequence of learning and change processes)?
- Was the implicit or explicit definition of BA confined to R&D behaviour only or to collaboration behaviour only?
- Were there any references to the individual building blocks of behaviour (or was the concept not differentiated into such building blocks)?

To start with, not all of those reports explicitly used the term BA; some reports applied the idea of the concept without referring to it explicitly. This is in a way a first finding: it is often intuitively obvious to analyse change in behaviour, but this is often done without an explicit conceptual basis.

The further results of the analysis are summarised in Table 2 below. It reveals that the typology of the literature is replicated in evaluation practice, with a few minor differences. First of all, the two distinct categories of approaches to BA, i.e. “the extension for input and output additionality” (category A) and “the change in the non-persistent behaviour related to R&D and innovation activities” (category B) form a single category in practice (category A+B) as it was not possible to distinguish category A from Category B in most of the cases. This means that there is one category of understanding that does not differentiate and sees BA as a residual category. All kinds of changes not attributed to input or output additionality are labelled as BA, with no linkages to persistency of that change. Evaluations in this group (category A+B) form around one-third of the all BA evaluations

analysed. In this category, BA is most often used implicitly, without mentioning the term. Almost one third of the evaluations in this category focus exclusively on the issue of collaboration.

In contrast, category C in the literature (“the change in the persistent behaviour related to R&D and innovation activities”) is slightly more differentiated in practice and thus can be split into two categories, those that look at BA as one distinct phenomenon (Category C1), and those that differentiate it into various building blocks (category C2). This means that there are evaluations that look at persistent change in R&D and innovation related behaviour, but do not differentiate, do not dig deeper as to what the different elements are that characterise that change. Furthermore, there are those that do the latter, but still do not enlarge the concept to the conduct of the firm more broadly (which would be category D). The evaluations we find in category D define BA as change in the general conduct of the firm with strong references to building blocks of behaviour.

The analysis showed that those four categories are more or less evenly distributed among the 33 evaluations. There is, in other words, no dominant understanding of BA. While some evaluators define it extremely narrow or not at all, others have a differentiated concept that defines and operationalises building blocks and looks beyond R&D and innovation activities. There is a clear link between the scope of the behaviour they investigate and the definition category. For instance, while category A+B evaluations are mostly limited to collaboration behaviour, Category D evaluations have a much wider scope in terms of the type of behaviour they evaluate.

**Table 2: Classification of Definitions of BA in as Applied in Practice**

	Category A + B	Category C1	Category C2	Category D	Other
<b>Definition</b>	The non-persistent extension of input additionality OR the change in the non-persistent behaviour	change in the persistent behaviour	change in the persistent behaviour with minor references to building blocks	change in the general conduct of the firm, reference to building blocks of behaviour	Inconsistent OR not possible to analyse
<b>Coverage</b>	Only R&D and innovation	Only R&D and innovation	Only R&D and innovation	(Some of Them) Beyond R&D and innovation	
<b>Persistence</b>	One-off, no persistence OR Rather mid-term than long-term and rather less persistent	Persistent OR Rather long-term than short-term and rather more persistent	Persistent	Persistent	
<b>Observations</b>	<ul style="list-style-type: none"> <li>• 30% of the all evaluations</li> <li>• Around one-third of this category looks at only collaboration</li> <li>• BA mostly implicit</li> </ul>	<ul style="list-style-type: none"> <li>• 15% of the all evaluations</li> <li>• Around half of this category looks at only collaboration</li> <li>• BA mostly implicit</li> </ul>	<ul style="list-style-type: none"> <li>• 20% of the all evaluations</li> <li>• Almost all evaluations in this category looks at only collaboration</li> <li>• BA mostly implicit</li> </ul>	<ul style="list-style-type: none"> <li>• 15% of the all evaluations</li> <li>• Almost all evaluations in this category looks at collaboration as well as other issues</li> <li>• BA is more explicit than other categories</li> </ul>	20% of the all evaluations

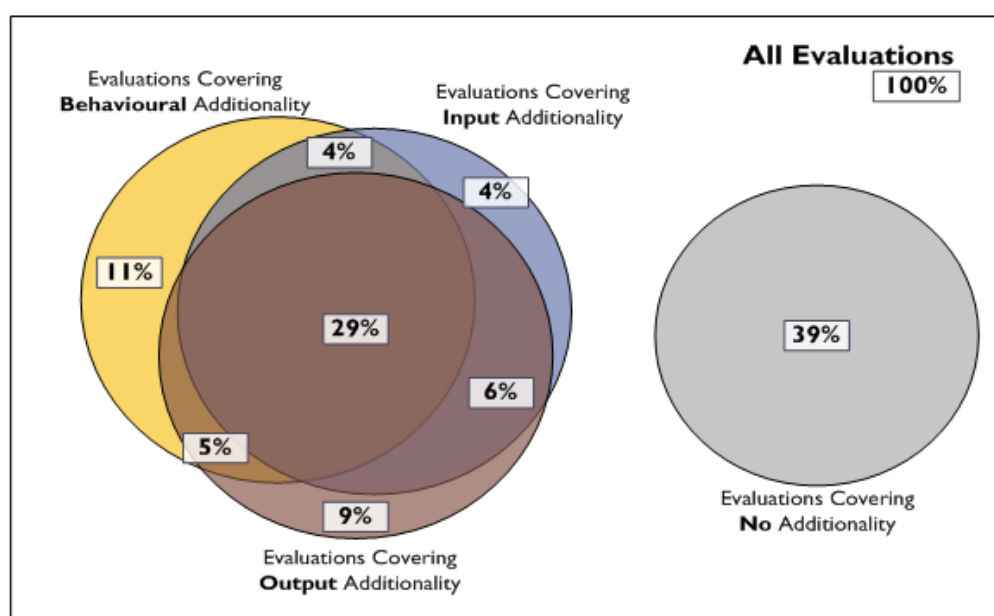
### 3.3 The Broader Practice of Using BA in Evaluations – A Statistical Analysis

Against the background of a fuzzy understanding of the concept of BA in evaluation practice, we now turn to the key question how BA is actually taken up and analysed in evaluation studies. To do so, we

analyse the INNO-Appraisal data statistically and show if and how evaluations differ that apply the concept of BA from those that do not. For the first time this allows us to acquire a systematic picture of the nature of BA in practice.

The data analysis shows that BA is a well-established concept in evaluations: 50% of all reports in the database employ it, explicitly or implicitly. The concept is more often used for policy measures that foster networking and technology transfer, which is consistent with the need for learning, networking and cooperation in those programmes. Further, Figure 1 shows the relationship between the evaluations covering the three types of additionality and also the remaining evaluations that do not cover any type of additionality. Two-thirds of the innovation policy measure evaluations in the database cover at least one form of additionality, and one-third of evaluations cover all three types of additionality. Those covering BA *exclusively*, without any other form of additionality, constitute only one-fifth of all BA evaluations. This picture, therefore, suggests that the three types of additionality are used extensively in evaluations and they are predominantly used together.

Figure 1: Euler Diagram of the Coverage of Types of Additionality in Combination



BA is also closely linked with the other topics concerning projects more than the programme, such as “quality of outputs” and “project implementation efficiency”. This is consistent with the conceptual expectations as BA is especially linked with the micro level, the firm or even project level, and the way a project is conducted or actions and routines are changed, and with the immediate difference this makes for the output (quality). However, evaluations that cover BA are less likely to look at the social and environmental impact, but much more at the scientific and technological impact than the whole sample, while there are no significant differences for economic impact. This means that BA evaluations are often concerned with the concrete project and its outcome rather than the wider impact.

While there is no difference between evaluations that are sponsored by the programme owners themselves or by other bodies, we observe that the concept is slightly less often applied in evaluations that are done internally and not by external evaluators. The application needs specific expertise and in-depth qualitative approaches, which seem to be best conducted by external evaluators. Interestingly, however, this does not imply that evaluators are keener to apply it than policy makers: The concept is more often applied in those evaluations that specify the methodology in the terms of reference and thus express a clear demand for BA approaches. This will be further

discussed in the next section, as our in-depth case studies indeed confirm that both evaluators and policy makers can be the source for the application of the concept, it is not entirely evaluator driven (see section 3.4 below).

In terms of data collection and methods of analysis, BA evaluations are not very different from other evaluations; therefore, they are not method biased. However, there are a number of minor differences worth noting. For instance, the share of BA evaluations that apply qualitative methods is by and large slightly higher than the share in our population of reports. Interestingly, however, BA evaluations also use surveys slightly more often. Those surveys very often limit themselves to the collaboration aspect of BA, operationalising the concept as change in cooperation behaviour. Existing data and monitoring data, in contrast, is not more often used in those evaluations. It appears that monitoring data is not fit for purpose when it comes to understand and assess change in behaviour.

The idea of BA is that it should support the learning process of programme managers as well as the target group itself, and thus the concept is associated with a focus on interaction and learning and the need to re-adjust programme and implementation. Thus, we would expect that the BA concept is more often used in evaluations that accompany a policy measure. However, our analysis shows that the concept is not much more common in accompanying evaluations than other forms of additionality. In the total dataset 14% of all evaluations are accompanying; in the sample that applies the BA concept the share is 19% and thus only slightly higher. Further, while the concept is also used in evaluations that are predominantly formative in nature, the difference is not as strong as one might think. BA, in other words, is also an essential part of summative evaluations that assess the performance (see Edler et al. (2011) for a broader discussion).

This is consistent with our last finding that compared to evaluations that do not look at BA, BA evaluations are more often discussed more broadly across and beyond government, and they are more often targeted towards the general public and towards users. However, when policy-makers were asked about usefulness of recommendations in the reports, evaluations applying BA are not perceived to be significantly more useful for changes in policies than other evaluations.

### 3.4 The Interactive Use of BA: Learning from Cases

The previous sections have shown that the application of BA is a common practice in innovation policy evaluations. Evaluations applying it have a set of distinct features, but the concept – although powerful as a learning and assessment tool – is still not clearly defined, has many implicit or explicit variants, is still poorly operationalised in those different variants and, thus, appears to be underexploited.

In a last empirical step we elaborate on the opportunities and challenges of applying the BA concept in evaluations. Five in-depth evaluation case studies have been conducted which all cover programmes that seek to change behaviour. The selection of cases covers different forms of operationalisation, different forms of policy measures and different applications of the BA concept for the evaluation. The horizontal reading of the cases allows us to observe the challenges for the evaluation of behavioural change (see Table 3).

To begin with, there are very different ways in which behaviour is tackled in policy measures. The targeted behavioural change is often implicit or not pre-defined at all (case 5), it can be one-dimensional (e.g. targeting cooperation capabilities of one type of actor, case 1), or very broad and ambitious, extending to different types of actors, to different kind of action parameters and attitudes in different innovation stages and so on (cases 2, 3, 4). The latter asks for a much more elaborate and differentiated conceptualisation of the BA concept and poses more challenges for measurement and for the link to the final impact of the measure. It is a common shortcoming of

most of our cases that they limit themselves to a simplistic definition of BA as cooperation capabilities, even if the policy measure suggests otherwise (case 1 and 4).

Second, partly in consequence of this first observation, we see very different forms *and* processes to operationalise BA. Some BA evaluations try to break down perceived change in different components of actions and attitudes (as a basis for future action) measured at different points in time (e.g. case 1 to 3). The cases also show that it is possible to conceptually link the change of parameters with change in the actual impact dimension (e.g. more innovation, case 2). Ideally, this is done early in the process when designing the measure. The conceptual link between action and final intended impact needs constant check and triangulation.

A third observation is that the BA concept is not a core evaluation concept as yet. It is contested and thus often *not* clarified at the outset of a programme or even the evaluation, but included only *during* the evaluation process. In two cases evaluators (case 1) and programme managers (case 5) have realised during the evaluation process that they need to measure change in behaviour in order to show the impact of the programme in the short and mid-term and to understand the ways in which further impact occurs. In both cases BA measurement had been contested, with policy makers either neglecting its importance and for a long time insisting on final output measurement only (case 1) or using it entirely for legitimisation purposes without taking advantage of the learning benefits BA concepts offer (case 5). Interestingly, in one case the evaluator was not flexible enough to adjust to BA once the programme managers had realised its importance during the process (case 4). All this points to the need of clear and early communication about the position and operationalisation of BA between evaluator and programme management. This is crucial not only for a reliable and valid measurement of impact, but it is also essential for the learning process of policy makers about BA and programme impact logics. Especially case 1 is a key example for policy makers' learning, albeit within limitations, while case 5 shows how a sophisticated evaluation failed to trigger learning because of a lack of embedding evaluation into the programme management agency.

Fourth, there is a gulf between basic methods that are already being used broadly, and the necessary sophisticated methods for the purpose of BA evaluations. As we have already seen in the statistical analysis, most cases that apply some form of BA use very similar methods: monitoring data analysis, surveys, and interviews. This is seen by most actors as sufficient, and thus more sophisticated methods are rarely applied. There seem to be two more general limitations here. One is that even if evaluators are aware of what an appropriate method and skill mix to fully capture behavioural change would look like (e.g. sociological, organisational, psychological skills and methods, applied over time), in the context of concrete policy relevant evaluations this breadth and longitudinal approach is not realistic. Another limitation is that multiple control group, counterfactual approaches etc. (case 5) necessitate advanced methodological skills and conceptual knowledge, which for BA evaluation have not yet diffused and apparently are not easily and automatically translated into policy learning.

Table 3: Overview of case studies on use of BA

	Case 1	Case 2	Case 3	Case 4	Case 5
<b>Key feature</b>	Dynamic definition of BA during evaluation and contested nature of BA evaluation	Interactive operationalisation, behaviour change as explicit proxy for outcome	Elaborated methodology, pre-defined by policy maker, longitudinal, good BA capture	Multiple BA mechanisms (firms Universities, individuals), not exploited in evaluation	Most elaborated methodology to tackle BA, good BA capture, but under-utilisation in political process
<b>Policy Measure</b>	Support for cooperation of SME with firms and PROs, broadening networks, leading to products and market introduction	Improve the effectiveness of intermediaries who support SMEs in innovation activities.	Support start-ups, risk funding and networking in Bio-Tech sector.	Support to hire young staff for university-industry link	Traditional R&D grant programme on regional level, focus on input and output additionality
<b>Intended Impact on behaviour</b>	Firms: cooperation capabilities, project management, technology. and absorptive capabilities Policy: broader network funding	Improved capabilities to innovate (firms), improved capabilities to support innovation (intermediaries)	Multi-dimensional, change of attitude in sector (risk taking) and capabilities for networking / clustering	Making staff more capable of moving between firms and universities, organisations to understand benefit and challenges	Originally no behavioural dimension tackled in programme
<b>Purpose of evaluation</b>	Formative and summative, initially focus on impact on markets rather than learning	Mandatory check for accountability and progress measurement	Summative and formative, to be used to market programme and region	Summative, measure uptake, impact, cost effectiveness, output additionality, largely for accountability	Trace BA to further increase legitimacy of funding
<b>Operationalisation of BA</b>	Components of cooperation capabilities and changes in action	Interactive definition of action and change parameters, conceptually linked to programme	Qualitative measure of risk taking attitudes and capabilities to cooperate, quantitative; numbers on collaboration and foundations	No operationalisation of BA, value of the concept only became clear during the evaluation itself. BA was, then, defined as an extension to input and output additionality.	Definition of BA in categories “more resources for innovation”, “more ambitious”, “more cooperation”, “Smarter”, “Faster”
<b>Interaction evaluator – policy maker</b>	Evaluators convinced policy maker to look at BA change (not only at final impact) and add on post project follow up 2 years later.	Evaluators entirely free in design, BA as concept not included, but evaluation in fact did look at BA!	Little interaction, but policy maker insisted early on qualitative aspects and understanding of mechanisms of change	Programme manager drove the evaluation, evaluator was reluctant to extent evaluation to BA	Programme manager driving, asking for robust BA evaluation after poor input and output results. No further interaction in process
<b>Methods used</b>	Context analysis, participant survey, focus groups, workshops with programme owners, long term case study approach (interviews over a range of years, beyond project completion)	Monitoring data and interviews, data capture for clearly defined action and change parameters, no measurement of final impact (as change is proxy for impact).	Control group approach (non-funded vs. funded), monitoring data, survey and interviews (risk taking, capabilities)	Surveys of all beneficiaries reinforced by small number of case studies	Most sophisticated, multiple control groups, counter-factual approach, survey and interviews, several pilot cases
<b>Challenge for the concept</b>	Learning in itself not seen as hard enough proof of policy maker that programme is successful.	Link between action parameter and programme: multiple interactions and permanent revisions needed	Demonstration of long term capability building and definition of control group	Limited understanding of additionality during design of Terms of Reference, policy learning too late	Good understanding of the concept but pragmatic and simple manipulation of the definition
<b>Limits</b>	Evaluation limited to cooperation dimension of BA, in-depth analysis of other facets needs more time and methodological breadth	Link of change parameter with final impact is contested and needs close monitoring itself, thus cross check with final outcome data needed	Lack of explicit definition of BA	Programme effects under-stated because of lack of conceptualisation, evaluator not flexible to adjust to BA logic during the process	Low process and policy benefit due to isolation of evaluator and lack of recommendation
<b>Perceived Benefit of evaluation</b>	Educating policy makers about impact mechanisms	Broad & interactive understanding impact mechanisms	To market programme & region	Legitimisation	Legitimisation

## 4 Discussion: Idiosyncrasies and Three Types of Uses BA Evaluations

The empirical analysis of the use of the BA concept in evaluation practice has unearthed a set of critical findings that must lead to further improvements of both the concept and its operationalisation and use. The text analysis has shown that the concept itself is used in very different ways; there is no dominant understanding in evaluation and policy practice of what it means. The problem is not so much the fact that there are different understandings of a concept. The problem is that the concept is often not explicitly stated and defined, and that is defined in ways that are not adequate to the purpose of the evaluations and the intervention logic of the measure that is evaluated. Very often the label is a misnomer, as evaluations do not look at change in behaviour, but simply at the immediate effect as a result of the condition of a programme. There is no persistency analysis and often change is limited to increases in collaboration.

The statistical analysis of the nature of BA evaluations has shown, in general terms, fewer idiosyncrasies than expected. BA is predominantly evaluated together with input and output additionality. The three evaluation topics share a large common ground and their characteristics are somewhat different from the rest of the data. Within this pattern, BA shows the most distinct characteristics out of these three. One area of diversion from other types of additionality is that BA is related to knowledge generation as much as it is to value generation since it links more closely to scientific and technological impacts. Although there are some minor statistically significant differences, overall, BA evaluations are not dramatically method-biased. While qualitative methods are used slightly more often, both qualitative and quantitative methods are used together and separately. Furthermore, perceived quality and usefulness difference between these two method sets are minimal (c.f. Georghiou (2007)). Finally, BA evaluations are not perceived to be of higher quality or more useful than other evaluations in general.

The analysis of cases that made use of the concept confirmed, first of all, that the understanding as to what BA constitutes in each case had to be constructed. It is a more or less conscious process of defining what behaviour the intervention seeks to influence and how this is linked to the final goals of the programmes. The construction of this understanding is time consuming as it is complex to understand the building blocks of behaviour and the connections between behaviour and innovation performance. BA, while understood to be a means to an end, can become an end in itself if evaluations are done early in the policy cycle and an increase in performance cannot yet be measured. This is valid as long as the conceptual link between the change in behaviour and the innovation performance is plausible. There is, however, an inherent danger that even if this logic is implemented, the evaluation design does not – or cannot given constraints in evaluation studies (budgets, skills, mutual understanding) – match the actual needs.

As regards the uptake and use of the BA concept in evaluations, our exploratory cases indicate a (simplified) typology. As the case studies demonstrate, three possible *reasons for* and corresponding *uses of* BA evaluations can be discerned: (1) behaviour focused, (2) integrated and (3) instrumental.

First of all, some policy measures have an evolutionary rationale and thus seek to change behaviour of actors as a key objective in itself (*behaviour focused approach*). Correspondingly, they systematically plan for measuring BA effects and employ the concept as a learning tool. Case 1 to some extent, after a cumbersome learning process of policy makers, would represent such a case. In those cases, we observe that BA is more useful if it is defined *clearly* in key policy documents and embedded into policy rationale. Similarly, a shared understanding between programme owner and policy-maker of the behavioural effects that the policy measure is aimed to, results in a dramatic increase of the policy-making value of the concept. Involvement of all possible stakeholders in the process of BA evaluation increases both the product use (i.e. use of the actual report) and process use (i.e. use of the evaluation process) of evaluation (Patton, 1998).

Secondly, BA is evaluated in addition and complementary to traditional concepts (output and input additionality, impact etc.) in an *integrated* approach. In those cases it is understood that change of behaviour is a pre-condition for other effects to be achieved. An integrated BA approach needs a clear logic model for the intervention in order to understand the meaning of behavioural change and to achieve the final ends of the programme (case 2, case 3, to some extent case 4).

The third possible reason for evaluating BA stems from the need for legitimacy for policy measures – and in some cases we find an *instrumental* use of the concept (case 5, to some extent case 4). There are instances in which the policy makers and evaluators struggle to find evidence for the final programme goals related to input or output additionality. This may be because of time reasons, as especially output additionality and broader economic impact materialise only with a severe time lag. It may also simply be that the programme does not have such effects (i.e. it is unsuccessful). BA then is sometimes introduced ex post, to show impact in terms of learning effects. This is instrumental and questionable in cases in which BA is used to cover up the lack of effects in other dimensions, or to legitimise policy ex post. In those cases we find a lack of conceptual clarity for BA which allows manipulation of the result of evaluation. In specific case studies we observe that such BA evaluations are almost over-designed with extremely and unnecessarily sophisticated methods, while they completely fail to provide any sound recommendations, except for the continuation of the programme, and hence do not provide any policy learning (case 5).

## 5 Conclusion and Prescription

The aim of this paper is to work towards an improved conceptualisation and application of the BA concept as an integral part of sound evaluation in innovation policy. Indeed, the analysis has shown that this is timely. Judging from the widespread use of the BA concept in evaluation, it appears that policy makers and evaluators recognise the need to measure, understand and interpret change in behaviour as an important effect of interventions which is a necessary – albeit not sufficient – condition for innovation policy measures to work. It seems that many policy makers have realised that without looking at the scope of those effects, their strengths, their pre-conditions and their linkages to the other types of additionality (input, output) higher order effects (outcome, impacts), we are indeed running the risk of under-evaluation (Georghiou, 2007).

However, since the concept of BA has been introduced in evaluations in innovation (and science) policy, it has remained fuzzy and stirred controversy about its specific character, its preconditions and its usefulness. Our analysis has shown that although the importance of BA 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 conceptualised.

A further detriment for evaluation and policy practice in this context is that despite a consensus in the *academic* literature on the significance of the concept, there is no such academic unanimity about what exactly BA is and what it means. While some scholars put it at the very heart of the evolutionary / structuralist understanding of innovation policy, others see it as an additional dimension that may fill gaps in understanding policy effects. As the effects of BA on innovation dynamics in firms are complex, time consuming, and intertwined with other influences, evaluations must clearly establish the conceptual link between behavioural change and the innovation effect and empirically verify it. In order to do so, the concept still requires a better theoretical foundation to derive a more suitable framework of analysis with a better defined unit of analysis: behaviour and its various components.

Furthermore, the concept needs methodological clarifications. Empirically, BA evaluations do not apply a significantly different set of methods and approaches and even the most sophisticated

approaches fail to ask the “right questions”. However, our conceptual discussion and in depth analysis of cases has shown that a full analysis of changes over time would need a range of methods (ethnographic, time sensitive and accompanying interviews etc.), drawing on different disciplines (innovation studies, psychology, organisational sociology). A comprehensive understanding of behavioural change would need a broad mix of methodologies that cannot be applied in all cases. Experimental methodological developments are called for to allow for a simplified yet relevant set of approaches, especially if new disciplines such as organisational sociology with ethnographic means come in.

Furthermore, methodological clarification with regard to the epistemological stance of evaluations is necessary. The current practice of evaluation of BA employs *sustaining causation* which tries to explain how certain issues affect the equilibrium. The current corresponding counterfactual approach in evaluation is the *parallel worlds* view in which two stationary worlds are compared and the difference is attributed to BA by employing some experimental or quasi-experimental techniques. However, if BA is to be understood in an evolutionary framework as a more fundamental change in the organisational routines of firms, the corresponding mode should be *originating causation* which focuses on processes and developments, on becoming rather than being. This approach to BA requires a *branching view* which acknowledges that history is like a tree where each decision represents a separate branch. Therefore, counterfactual analysis is returning to a point where another branch is chosen. In order to understand what would have happened had there been no government intervention; one needs to trace every critical branching point after the public intervention up to the present. Comparative statics alone is insufficient to explain BA; in addition the evolutionary dynamics have to be unfolded (Gök, 2011).

The case studies have shown that BA is used for very different objectives ranging from legitimisation to operational learning. But no matter what the rationale, the complexity of BA asks for a strong interaction and communication between those commissioning the evaluation and the evaluators. For operational learning and sound policy feedback, key concepts as to the link of behaviour changes to innovation must be shared between them and expectations clarified early on. Sophisticated methods alone do not guarantee the full benefits of the concept, their applications and the results must be intensively discussed among all stakeholders involved.

Finally, this article and the study on which it is based are only a beginning. More research is needed for a more practical guide of how behaviour can be operationalised and measured in different contexts. It has to be linked to the theoretical literature, however without prescribing a certain understanding and a fixed set of methods. What is required is some guidance that allows policy makers and evaluators to design adequate evaluations that capture the specific nature of behavioural change and its link to the higher order programme objectives. All too often, it seems, we get stuck in a simplified or even instrumental use of a concept that should be at the heart of innovation policy thinking, as innovation is about changing behaviour.

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