# A look into the black box: What difference do IWT R&D grants make for their clients? (Belgium)

## 1. Introduction

This case study presents a methodologically important evaluation commissioned by one of Europe's most active regional innovation agencies, looking at its financial support for businesses' in-house research and innovation activities.

The evaluation report is entitled, a look into the black box: What difference do IWT R&D grants make for their clients?[1] IDEA Consult carried out the evaluation, in cooperation with Professor Bart Clarysse, on behalf of the Agency for Innovation by Science and Technology[2].

As the title suggests, this particular evaluation sought to determine the behavioural effects of public grants for private R&D within assisted businesses.[3]

IWT is the lead agency for research and innovation in Flanders, Belgium, having been established by the Flemish government in 1991. IWT reports to the Flemish Government's Department of Economy, Science and Innovation and it carries out its tasks based on framework agreements with the government.

The Agency provides funding for various types of R&D and innovation-related projects in Flanders and it acts as a policy advisory body for the Flemish government. The financial support provided by IWT is open for all different types of organisations but the Agency pays particular attention to improving the innovative performance of the SME sector. In 2008 the Agency's budget was €297 million, out of which 40%[4] was dedicated to business-related projects. The strong focus on the SME sector is well reflected in the fact that 77% of the business support projects were dedicated to SMEs.

The study was aimed at assessing the effectiveness, efficiency and added value of IWT funding channelled to the Flemish businesses, particularly to the SME sector between 2001 and 2004.

### 1.1 Description of the evaluated measure

The study evaluated the behavioural additionality[5] of IWT R&D programme for companies and the IWT's SME support programme, and was commissioned in 2006 with a provisional timing of a 5.5 months set for the completion of the evaluation.

The R&D programme for companies targets both small and large enterprises. There are three main types of activities to be supported within the programme. Firstly, there is support for industrial basic research that is generating new knowledge. Secondly, there is support for prototyping or for further development of a project in its initial stages and thirdly, they provide support for mixed research, that is, research that has a basic as well as an applied component. The support is most often for projects that are

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[1] www.innovationtools.com/PDF/IWT-RandD-study.pdf

[2] Agentschap voor Innovatie door Wetenschap en Technologie (IWT)

[3] The title of the evaluation report neatly invokes the work of Nathan Rosenberg and his seminal book, Inside the black box: technology and economics (1982) in which he sought to go beyond the narrow interest of mainstream economists and explore what happens within innovating enterprises in order to more clearly connect technological innovation with economic effects.

[4] Source: IWT: Annual activity report, 2008

[5] Note: Behavioural additionality means the extent to which the financial assistance provided by IWT had produced changes in attitudes and behaviour at the beneficiaries that endure beyond the life of the grant. The word additionality is used instead of impact and net effects and should not be understood as usually applied in the context of the Structural Funds.

longer-term and thereby require the development of specific knowledge. In some cases IWT has financed parallel research paths. An important area of IWT support addresses fundamental research for which the profit motive is not clear. All companies, including non-technological companies, are eligible for funding.

IWT's SME support may come in the form of direct financial support for projects that are related to product, process, or service innovation, comprising both technological and non-technological innovation-related activities. IWT has also been successful in creating linkages between small businesses and universities to fill in the missing knowledge by improved collaboration.

# 2. Designing the evaluation study

## 2.1 The process of designing the Terms of Reference

The main motivation for launching the study was that the Flemish Government wanted to gain evidence of the impacts of the grants used by IWT. In the past, IWT commissioned evaluations to understand the added value and direct economic benefits of its grants, however these studies did not reveal whether IWT grants made a difference to assisted businesses attitudes, capabilities and relationships.

> *"... do IWT funds help companies to conduct their R&D-activities in another way than they would have done without the help of IWT? Does IWT really make a difference?"*[6]

In 2001, IWT went through a reorganisation, which resulted in a simplified programme portfolio. Therefore the study was aimed at revealing the effects of the IWT-support granted between 2001 and 2004.

The evaluation was commissioned by IWT, with the Flemish Government being the formal client. As the study was focused solely on IWT grants, a decision was taken not to involve external stakeholders in the design process. The Terms of Reference were developed by the IWT team internally, based on the Agency's prior experience with a significant number of evaluations commissioned nationally and internationally. Programme evaluations commissioned by IWT are carried out on a regular basis, with an annual number of studies ranging from five to ten. Therefore IWT has its own internal capacity to design appropriate specifications and choose the most suitable offer and negotiate the detailed design with a contractor built up based.

In terms of methodological requirements, the design of the specification also took into account the results and recommendations of a previous IWT pilot study[7] on behavioural additionality. This pilot study was published in 2004 and explored a range of methodological options for measuring behavioural additionality.

## 2.2 Key elements of the ToR

The specification was clearly drafted and set out all of the key requirements for the study, from its principal focus (subject) to its scope and the evaluation questions. The specification was published in Dutch, however the final report was required to be published in English in order to facilitate wider dissemination and peer review. The following list provides a brief overview of the key aspects of the specification:

- The main objectives of the study comprised five overarching evaluation questions:

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[6] *A look into the Black Box: What difference do IWT R&D grants make for their clients?* IWT publication, November 2006.

[7] Luke Georghiou, Bart Clarysse, Geert Steurs, Valentijn Bilsen and Jan Larosse, Making the Difference: The Evaluation of "Behavioural Additionality" of R&D Subsidies, July 2004 http://www.iwt.be/sites/default/files/publicaties/iwt_studie48.pdf.

  - Difference in impact between the SME population and the non-SME population;
  - Impact on non-financial (behavioural additionality) and financial characteristics (economic additionality);
  - Additionality of public support: what market or system failures are addressed by the measures?
  - What is the 'deadweight' or cost efficiency of the assessed measures?
  - The analysis should be done at three levels: project, enterprise and macro, i.e. at the level of the economy.
- The specification also set some minimum requirements regarding the methodology to be applied. The specification required the study questions to be addressed by surveying a beneficiary group of IWT grantholders and by setting up a control group. The minimum sample for the survey was 200 beneficiary enterprises, computed by IWT based on the overall IWT client population.
- The evaluation was overseen by a project steering committee, constituted by IWT and which comprised IWT budget holders and evaluation specialists as well as three international domain experts.

While the ToR set clear requirements for the beneficiary survey and control group, it also left room for anticipated changes during the study implementation phase, with the aim of achieving the most robust findings and results possible.

IWT's choice in selecting evaluators who had state-of-the-art knowledge of the subject field and methods required to tackle to evaluation questions, combined with a flexible approach regarding how to address the key evaluation areas fitted the exploratory nature of the study to a high degree.

# 3. Implementing evaluation: methodology and process

The evaluation was carried out by independent external evaluators. The evaluators had in-depth knowledge of the region, the performance of the Flemish innovative enterprises and the recent theoretical developments in the field of behavioural additionality studies.

## 3.1 The approach and methodology

The assessment of behavioural additionality is a developing area with a growing literature. The majority of preceding IWT innovation evaluations had focused more narrowly on the economic benefits realised by beneficiaries, using participant surveys to estimate the degree to which public support had lead to increased sales or employment, while ignoring the important and possibly wider, more sustained impact on attitudes and competence.

In addressing the issues of behavioural additionality, the evaluators tested new assessment methods, by establishing two control groups. Notwithstanding the intrinsic difficulty of constructing control groups for these sorts of innovation support measures, it was decided that a matched reference group was especially important with a study designed to investigate the effect of public support on assisted businesses' internal attitudes and capabilities. Beneficiary surveys have refined over years to arrive at a series of reasonably questions that encircle the issue of increased employment and or turnover attributable to the public support in question. Evaluators have less experience of preventing response bias when investigating changes in innovation culture or research processes, and there is a greater risk of respondents answering questions quickly and somewhat carelessly and thereby producing unduly positive or negative results.

The pioneering nature of the study required a flexible approach from both the evaluators and IWT. This was reflected in the fact that there were a number of differences in the implementation of the study compared with the original specification. Discussions during the inception phase between the evaluator and IWT resulted in the refinement of the original evaluation questions. Instead of the originally identified set of questions, the evaluators concentrated on the following three research questions:

1. 'Do IWT projects and subsidies lead to behavioural additionality?
2. Which characteristics stimulate behavioural additionality and which do not?
3. Are behavioural additionality, input and output additionality reinforcing or merely co-existing?'[8]

The data collection methods for the study involved three main tools: desk research, including a literature review, telephone surveys and an interview programme. The study was implemented in four stages:

- In the first stage the telephone surveys were set up for the beneficiaries and two control groups;
- During the second stage of the study the evaluators provided a descriptive analysis on the primary results of the telephone surveys;
- The third and fourth stages of the study comprised an in-depth analysis of the results of the surveys and the interview programme that was carried out along the different dimensions of behavioural additionality (see chapter 3.1.1 below for further details); and the evaluators conducted about 50 interviews which were aimed at gathering qualitative, illustrative information on a number of selected beneficiaries.

### *3.1.1 Desk research*

Desk research reviewed the available literature on additionality concepts and resulted in an assessment and description of the theoretical background of additionality such as input, output and behavioural additionality. Measuring additionality is a challenging task and it requires the evaluators to have a comprehensive understanding of the behaviour of the intervention target group. Furthermore it is also very important to apply clear definitions of additionality. The evaluators reviewed a number of different approaches to behavioural additionality. The main concepts reviewed are presented in the table below.

Figure 1 Additionality Definitions

**Behavioural additionality**, defined as the difference in firm behaviour resulting from a government intervention. This emerging approach to evaluation aims to measure explicitly changes in the ways firms conduct R&D as a result of government policy instruments. The literature shows that behavioural additionality is a multi-dimensional concept. Different types of behavioural additionality are distinguished. Falk (2005), for instance, mentions the following types of behavioural additionality:

- *Scale additionalities* are said to be on hand if public funding allows the project to be conducted on a larger scale.
- *Scope additionalities* refer to cases where the coverage of an activity is expanded to a wider range of markets, applications or players than would have been possible without public assistance.
- *Cognitive capacity additionality* refers to the positive impact on competencies and expertise.

[8] Source: IDEA Consult in cooperation with Prof. Dr. Bart Clarysse: Study and Evaluation of Behavioural Additionality of R&D -subsidies, Brussels, September 29, 2006.

- *Acceleration additionalities* are said to be in place if participation in innovation schemes speeds up the course of the project.

In a summary of country studies, an OECD synthesis (2006)[9] mentions four more types of behavioural additionality:

- *Challenge additionality:* when government support helps to take more risk in projects.
- *Network additionality:* when government support helps to creates networks.
- *Follow-up additionality:* when government support helps to establish follow-up projects.
- *Management additionality:* when government support improves company management routines.

... In addition, the difference with input and output additionality is also not always very sharp. Some authors like Shin (2005) consider changes in R&D- investments over time also as a behavioural change. But this would imply that the difference between input and behavioural additionality becomes very subtle."

Source: IDEA Consult in cooperation with Prof. Dr. Bart Clarysse: Study and Evaluation of Behavioural Additionality of R&D-subsidies, Brussels, September 29, 2006

Based on the discussion referred to above, the evaluators adopted a classification of behavioural additionality which is closest to the approach applied by Falk and they discussed the survey and interview results along different additionality dimensions, covering resource-based (input additionality), result-based (output additionality) and progress-based (behavioural additionality) approaches.

### *3.1.2 Telephone surveys*

The study comprised a large-scale telephone survey targeting three distinct groups. In addition to the novelty of the evaluation topic, the methodology applied had new approaches as well. Instead of applying only one control group to assess the additionality issues, the evaluators established two control groups. The identification of the control groups presented a major challenge for the study team.

The three survey groups consisted of the following companies:

- Beneficiary group (referred to as 'experimental group' in the original study). Beneficiaries that received IWT grants, identified in the IWT client database, for the period 2001-2004. This resulted in a population of 1,312 projects and 712 companies from a cross-section of sectors and size groups. The final sample that was surveyed during the study represented 27% of the companies of the beneficiary population (192).
- Control group A: companies that had some contact with IWT in the past e.g. companies that submitted project applications to IWT but were not successful in their application during the same 2001-2004 period. The population of this group covered 293 companies in total across a number of industrial sectors, mainly SMEs and starter companies. The sample contacted comprised 88 companies.
- Control group B: companies that were known to be innovative but had not had any contact with IWT previously. The source for putting together a database of potential companies for Control group B relied on two main sources:
  - The database of regional companies that had participated in the Community Innovation Survey, focusing on those that rated themselves as innovators.
  - An ad hoc database that was compiled by the IWT's 'innovation advisors'.

  In total, Control group B consisted of 527 companies of different size and scope, out of which 100 companies were selected to be included in the sample.

[9] Government R&D Funding and Company Behaviour: Measuring Behavioural Additionality, OECD, 2006.

The control groups were established taking into account the size of the companies in the beneficiary group and by matching the activity areas of the enterprises included in the beneficiary group. The selected seven industrial and service activity areas included: chemistry, electronics and electro mechanics, metal, other industry, material services, immaterial services and other services.

The survey for the beneficiary group was based on the questionnaire trialled in the pilot study in 2004[10]. This questionnaire was then used as the basis for the control group questionnaires, which comprised a core set of common questions to facilitate comparative analysis among the three samples as regards changing attitudes, processes and outcomes. There were question groups that needed tailoring to gain valuable information from the control groups or there were even different sub-sets of questions were completely left out from the surveys targeting the control groups. The survey developed for the beneficiary group can be found in the appendix of the study.

#### *3.1.3 Interview programme*

The evaluators carried out 49 qualitative, follow-up interviews with IWT clients to gain a broader understanding of the behavioural additionality of IWT grants on the beneficiary companies. The companies interviewed were grouped into occasional clients and regular clients based on the number of approved IWT projects.

The interviews also served as a basis for developing three case studies, which were used to illustrate the different types of behavioural impacts.

### 3.2 Organisation of evaluation process

Due to the experimental nature of the evaluation, there was relatively frequent interaction between IWT and the contractor. As the Terms of Reference specified, the evaluators submitted the required progress reports and participated in progress meetings. There was at least one face-to-face meeting organised by IWT every month, which was complemented by more frequent e-mail and telephone discussions.

There was a Steering Group established to support the study with the involvement of international experts. The experts provided advice and suggestions for the evaluators during the implementation of the study, especially for the questionnaire development, based on the experiences of the exploratory study[11]. The panel was also in charge of approving the deliverables submitted by the evaluators.

## 4. Effectiveness and efficiency of evaluation

There were a number of methodological problems and limitations during the evaluation that required particular attention from the study team.

### 4.1 Telephone surveys

Surveying companies involves a number of limitations that may affect the robustness of the results of the data collection and analysis and its effectiveness. These include:

- SMEs might not be able to allocate resources easily for the completion of a questionnaire, biasing the distribution of responses towards larger companies.
- Survey responses are highly subjective, reflecting the perceptions of the companies which can be affected by the time passed by or if the company's application was successful or unsuccessful.

[10] Georghiou et al (2004), op cit.

[11] Georghiou et al (2004), op cit.

- Telephone surveys, especially covering such a large population – there were 382 companies contacted during the evaluation – can be very time-consuming to conduct and might require a relatively longer time period to complete the desired sample; in addition to setting up the appointments, the telephone interviews took on average 40 minutes to complete.

To increase the efficiency of the surveys, the evaluators subcontracted the implementation to a market research company specialising in carrying out large-scale telephone surveys. This gave the study team immediate access to interviewers trained in using CATI software and confident in conducting very large numbers of lengthy (40 minutes), highly structured interviews. The CATI software also permitted the team and the sub-contractor to monitor the profile of respondents continuously. This meant the team could refine their targeting of calls to ensure the representativeness and comparability among the beneficiary and control groups and between the groups and their original populations. The study team took great care over the design of the questionnaires to ensure the evaluation questions were fully and properly addressed through what were predominantly closed questions. They took advice from the market research company on the detailed design of the accompanying explanatory text and questionnaire routing. This approach allowed the team to benefit from the procedural skill and efficiency of the CATI team, without losing any control over the relevance of the resulting data. Moreover, the use of closed questions – to gather data suitable for quantitative analysis – was complemented by a follow-up programme of qualitative interviews. The study team carried out these exploratory discussions, using a semi-structured interview technique, where domain knowledge is key to identifying and probing any issues that may arise.

Subjectivity is a general limitation of stakeholder consultation, which can be addressed by the use of control groups to a large extent.

## 4.2 The use of the control groups

The use of control groups raised the issues of representativeness and comparability. The evaluators had to consider and test these factors before the analysis phase:

1. **Representativeness** of the respondents. All three samples were deemed to be broadly representative of their respective populations. There were some slight variations, such as a higher success rate in the beneficiary sample than for the respective population and the proportion of projects with collaboration was somewhat lower among the firms in the sample than in the respective population. In achieving a fully representative sample, data availability i.e. the size of the total population available, creates insurmountable limitations.

Figure 2 Representativeness of the Samples Applied by the Evaluators

Table 2: Representativity of the samples

| Number of companies by size | Population | % | Sample | % | Representativity |
|---|---|---|---|---|---|
| **Experimental group** | | | | | |
| Large companies | 130 | 18% | 36 | 19% | 28% |
| SMEs | 403 | 57% | 111 | 57% | 28% |
| Starters | 179 | 25% | 47 | 24% | 26% |
| Total | 712 | 100% | 194 | 100% | 27% |
| **Control group A** | | | | | |
| Large companies | 35 | 12% | 9 | 10% | 26% |
| SMEs | 162 | 55% | 53 | 60% | 33% |
| Starters | 96 | 33% | 26 | 30% | 27% |
| Total | 293 | 100% | 88 | 100% | 30% |
| **Control group B** | | | | | |
| Large companies | 76 | 14% | 13 | 13% | 17% |
| SMEs | 400 | 76% | 81 | 81% | 20% |
| Starters | 51 | 10% | 6 | 6% | 12% |
| Total | 527 | 100% | 100 | 100% | 19% |

Source: IDEA Consult on the basis of data provided by IWT

Source: A look into the Black Box: What difference do IWT R&D grants make for their clients? IWT publication, November 2006.

2. **Comparability** of the results of the control groups with the beneficiary group: the evaluators applied statistical significance tests to assess whether the differences in the composition of the beneficiary and control groups - the comparability across the three samples - were statistically significant. The results showed that there was no statistically significant difference between the composition of the beneficiary group and Control group A, but Control group B differed significantly with the beneficiary group. Therefore comparison between these two groups had some limitations.

Applying two control groups allowed the evaluators to assess the responses of the beneficiary group against two sets of replies. This means distinguish between the 'hypothetical' project-related answers given by Control group A and the 'reality' project-related responses given by Control group B. This improved the robustness of the evidence for the evaluators in answering the evaluation questions.

## 4.3 The evaluation findings[12]

The evaluators discussed the findings of the study along the eight different additionality dimensions by pulling together all the information gathered through the different data collection and analysis methods and taking into account the results of the company and project characteristics analysis. Based on the research carried out and the evidence gathered the evaluation concluded that 'IWT does make a difference'.

The study team underlined the above statement by pointing out regarding project additionality that almost half of the IWT funded projects (40%) would have not been carried out without the IWT subsidies according to the responses received from the beneficiary group. This attrition rate was confirmed by the responses of Control group A. Furthermore, the responding beneficiaries believed that only 10% of the projects would have taken place with the same budget in the absence of IWT support. By

[12] Note: this section is based on to a large extent on Chapter 5 of the study: A look into the Black Box: What difference do IWT R&D grants make for their clients? IWT publication, November 2006 .

contrast, the responses of Control group A show that in reality 1 out of 3 projects took place with the same budget as planned without the grant.

In terms of input additionality, 70% of the beneficiary group stated that they were devoting more attention to research and innovation in general as a result of the IWT award, and an even higher proportion reported they (96%) intend to apply again for further IWT grants.

The study also revealed evidence of a positive impact on the size, scale, goals and speed of the projects, although to a limited extent. More importantly behavioural additionality effects were observed in 'the formalisation of the R&D process' especially among companies in traditional sectors, and which are much less innovative. 'In some of these companies, the IWT supported project is the only R&D project, which, moreover, would be cancelled without the support.'

The evaluation also showed positive results regarding the outputs of the funded projects, as 70% of the product innovation projects and 60% of the process innovation projects resulted in the introduction of new or improved products or services, of which 30% and 38% of the projects would have been cancelled without the IWT grant respectively.

The study also aimed at investigating the drivers of behavioural additionality in depth and therefore the evaluators tested eight hypotheses regarding the constructs of competence, project and outcome additionality[13]. The hypotheses were set up in collaboration with the international expert panel and were tested with regression analysis[14]. The results are presented at length in the final report of the study. The evaluation found that the drivers are many and varied: although they are interrelated, they also sometimes cause very different, even contrary effects on the additionality components that are distinguished by the study.

## 5. Conclusions and lessons learned

The study was a pioneering work, which aimed at assessing the behavioural additionality of IWT grants by applying two control groups. Both the theme of the study and the applied methodology contained novel approaches. The experimental nature of the work required flexibility in approaching the evaluation questions and finding the best ways to address them. The nature of the work also challenged the evaluators and required sound methodological and theoretical knowledge.[15]

Due to the novelty of the study focus and methods, the client and the evaluator worked more closely together than would be typical for an IWT evaluation. In practical terms, this meant a willingness to get together for ad hoc meetings and telephone

[13] Definitions applied by the authors: "Competence additionality refers to the effects on the competences of companies in relation to the IWT funded projects. The questions behind this construct refer to the acquisition of new knowledge, a positive impact on the ability to network with other companies as well as with universities and public knowledge institutes, an increase of the innovation management capabilities and the upgrading of the human resources, all as a consequence of the project" "The outcome additionality refers to the additional effects that have been realised because of the IWT funded project (e.g. turnover effects, effects on export, effects on employment, effects on cost cutting, etc.)." Source: *A look into the Black Box: What difference do IWT R&D grants make for their clients?* IWT publication, November 2006.

[14] Regression analysis is a statistical technique that is widely used in evaluations to test for an association between one variable (the dependant variable) and one or more other variables (the independent variables).

[15] Please see for further information: Geert Steurs, Arnold Verbeek and Elissavet Lykogianni (2009), "The behavioural additionality of business R&D subsidies: theoretical considerations and empirical results for Flanders", in W. Molle and J. Djarova (ed.), "Enhancing the Effectiveness of Innovation - New Roles for Key Players", Edward Elgar.

conversations in addition to the formal monthly progress meetings. It also revealed itself in the client's willingness to iterate its core evaluation questions, which were changed as a result of discussions with the contractor and the project steering group. It also meant the client had to do a little more work than might be customary and in particular through commenting on the three questionnaires and supporting / advising on the development of the control groups.

The international experts also proved to be very helpful in the advice they gave on the formulation of key questions within the questionnaires, as well as more generally in their feedback on interim and final deliverables.

The study also confirmed that it is possible to tackle the question of behavioural additionality using questionnaire surveys and semi-quantitative techniques. Of course, the pilot study and the literature review (to identify good prior art in addressing the question) contributed to the quality of the questionnaire. Moreover, the decoupling of the closed questions (CATI interviews) from the follow-up interviews also helped the study team to explain their first findings. The combination of data sources and methods managed to produce statistically significant findings and explanatory power and insight.

Working with two control groups generated more robust evaluation findings and persuaded IWT officials that their grants do have an important positive impact on client behaviour. While the results were greatly reassuring, the study also underlined how much work (and cost) was involved in using an experimental methodology for a research programme for businesses. In light of this experience, the experimental methodology has not become the norm and the approach will only be used selectively.

The study concluded based on the evidence gathered and analysis conducted that 'IWT does make a difference'. Therefore the question raised by IWT, whether they make a difference could be answered in an affirmative way, underpinning the importance of the work and support provided by IWT in the Flemish region.

The success of the methodology is further confirmed by the subsequent use of a variant of the IWT-funded approach by other clients. The same questions around behavioural additionality were also addressed by the evaluators for the study entitled 'Does Europe change R&D-behaviour? Assessing the behavioural additionality of the Sixth Framework Programme'.[16] For the evaluation the study team applied only one control group composed of the rejected participants of FP6 projects, the sizes of the samples were however significantly larger than for the IWT study as were the total respective populations. This also enabled the evaluator to apply an increased number of characteristics to be taken into account when establishing the samples.

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[16] IDEA Consult in collaboration with Rahel Falk: Does Europe change R&D-behaviour? Assessing the behavioural additionality of the Sixth Framework Programme, Final report Prepared for: European Commission, Research Directorate-General, Directorate A – Inter institutional and legal matters – Framework Programme, Brussels, April 14th, 2009.