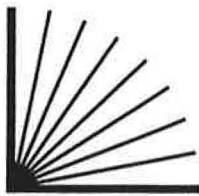


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Problems in the Measurement of Government Budget Appropriations or Outlays for Research and Experimental Development (GBAORD). Results from a Norwegian Survey

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Summary

In this paper we discuss problems in assessing the R&D content in the Norwegian State budget. Empirically, the paper draws on results from a survey of Norwegian ministries' interpretation of the R&D concept in general and their assessment of the R&D content in their budget portfolio in particular. The survey results were compared to national GBAORD data. At the national level the survey results seem to be in good correspondence with the GBAORD data, but at the detailed level the analysis shows several discrepancies between the two data sets. First, the deviations seem to be largest for non-institutional budget items that contain a mix of R&D and other expenditures. Second, they seem to concern the development part of the R&D definition rather than the research aspect. Third, a particular set of conceptual problems seems to concern the ministries' policy making tools, e.g. policy studies and evaluations, which also relate to insufficient guidelines for discrimination between R&D and non-R&D in the social sciences. Ministries using the R&D definitions actively tend to adapt them to the realities within their own policy area, and in ways not always compatible with the R&D definitions in the Frascati Manual.

1. Introduction

Arguably, the concept of Research and Experimental Development (R&D) was developed within the OECD in order to monitor and promote the technological and economic progress of the Western World. The OECD countries have, thus, collected data on Government Budget Appropriations or Outlays for R&D (GBAORD) since the late 1970s, utilising the definitions and guidelines of the Frascati Manual. In Norway the collection and processing of R&D data is the responsibility of the Norwegian institute for Studies in Research and Higher Education (NIFU), except for the Business Enterprise Sector.

Consequently, as we will argue in this paper, the concept is biased towards R&D in the natural sciences and engineering (NSE) and also industrial development. On the other

hand it seems slightly less well suited in other contexts. Sirilli and Del Santo¹ address the problem of discrepancies between R&D figures measured in an innovation survey and figures stemming from an R&D survey². Irvine, Martin and Isard³ discuss problems of defining R&D inside and outside academia, and propose a narrower concept. In this paper we will discuss a few aspects regarding its appropriateness for the analysis GBAORD.

As the Norwegian Government is now considering the introduction of a separate R&D budget, several of NIFUs GBAORD figures have been questioned. NIFU was commissioned to perform a study i.a. in order to validate the GBAORD data. NIFU thus performed a survey in the autumn of 1998, in which the ministries were asked to give their own assessment on the R&D content in their budget, and also to elaborate on their interpretation and understanding of the R&D concept as such.

In this paper we outline some main features of the study. First, we give a closer description of the data and methodology (2). We then describe the discrepancies between the survey data and the GBAORD data, and try to present some possible explanations (3). In part four we summarise some of the variety in interpretations of the R&D concept within Government (4). Finally, we summarise and discuss briefly some of the problems arising from the study, focusing on issues with special relevance for the forthcoming revision of the Frascati Manual (5).

2. Data and methodology

In the first empirical part (cf. Chapter 3) of the study we compare two data sets:

- the national Norwegian GBAORD data
- survey data collected from the ministries during the autumn of 1998

The survey also included information about the ministries' interpretation and practical use of the R&D concept, which constitutes the basis for the second empirical part (cf. Chapter 4). In the following we will describe the data material and method for the two data sets.

2.1 Method for collecting national GBAORD data

The GBAORD data are collected according to OECD guidelines. The main purpose is to describe the development of Government R&D funding in the years following a performer based R&D survey. The R&D content in the Government budget is estimates in a model based on three different broad types of inputs/sources:

¹ Giorgio Sirelli and Aldo Del Santo: "Old and New Paradigms in the Measurement of R&D", in Statistics on Research and Development, Proceedings from the Third CEIES Seminar in Aarhus, Denmark, 3 and 4 December 1997, European Communities 1998

² Also addressed in the paper DSTI/EAS/STP/NESTI(2000)21 prepared by Eurostat.

³ John Irvine, Ben R. Martin and Phoebe Isard: Investing in the Future: An International Comparison of Government Funding of Academic and Related Research, E. Elgar, Aldershot UK 1990.

- Performer based R&D statistics for institutional budget items
- Budget documents
- Other, written material (e.g. plans), or direct contact with ministries or agencies

Information from these sources is combined to assess R&D content in the various budget items. Based on information from the latest performer based R&D statistics and other information R&D coefficients are established for each budget item (chapter, sub-chapter etc.). The R&D coefficients are then applied on the figures in the budget documents. The main question is what effect the proposed or final budget will have on R&D funding given the knowledge about the R&D-coefficients. This way of reasoning applies to Higher Education establishments, research institutes and the Research Council of Norway. The R&D activity level in such institutions tends to be relatively stable over a shorter period of time, and the R&D coefficients are therefore relatively valid and stable.

For the other budget items the R&D assessments rely heavily on text analysis of the information in the budget documents, and in some cases this information is complemented with direct contacts to ministries or agencies. The coefficient uncertainty is greater than for the institutional budget items. These budget items typically include both R&D and non-R&D appropriations. R&D is often a secondary objective and of marginal significance. In addition they are given on an ad hoc basis (cf. Table 1).

Table 1: Main source for GBAORD estimates by type of budget item.

Type of budget item	Performer based R&D statistics	Budget documents	Other sources
Higher Education institutions	*		
Other research institutions *)	*		
The Research Council of Norway			*
Abroad		*	
Other		*	

*) *In international R&D statistical terms this category covers research institutes and other units performing R&D in the Government Sector, Private-Non-Profit Sector and non-integrated non-profit institutes in the Business Enterprise Sector.*

2.2 The Survey

The first preliminary phase, i.e. prior to the actual survey, we performed informant interviews with six selected ministries. The purpose was to discuss conceptual and practical issues to develop the survey design, and to clarify practical aspects of the budgetary process organisation to help ease the second phase, which was a postal survey to all departments of all ministries. As appendices to the questionnaire were sent the R&D definition and a list of the budget items included in the GBAORD to the respective ministries. The ministries were also asked to elaborate on their interpretation and understanding of the R&D definition and to

pinpoint practical delimitation problems regarding their budget portfolio. They were then asked to list the budget items with an R&D content and to explicitly give a R&D estimate for each.

As the preliminary phase had shown varying organisation of the budgetary work among the ministries, the survey was directed to the administrative departments or similar within ministries, who were asked to distribute the questionnaires to the relevant departments. The task was solved in various ways; in some cases the administrative departments have answered the questions themselves, while in other they merely acted as a co-ordinator. In yet other cases the survey hardly seems co-ordinated within the ministries at all. However, after substantial follow-up efforts, all ministries, except the Ministry of Cultural Affairs, filled in and returned the survey forms. In sum, the budget items in the resulting data set corresponded quite well with the budget items covered in the GBAORD.

3. Comparison of the two GBAORD data sets

At the macro level the two data sets give the same total Government R&D expenditure. The deviation is only 1 million on a total of 8,9 billion NOK. Thus, in sum the survey results seem to support the validity of the national GBAORD in total, and also the main purpose of the GBAORD analysis: to monitor the development of Government R&D funding at large, i.e. at the national level. A more detailed comparison, however, suggests this is merely a coincidence, i.e. a large number of deviations in either direction tend to outweigh each other when aggregated.

Confining ourselves, initially, to the ministries R&D expenditure (cf. Table 2), the survey results turn out 532 mill. NOK higher than the GBAORD figures. This is almost completely attributable to material investment under the Ministry of Defence. The ministry considers its total R&D appropriations to be twice the estimated GBAORD, while the latter corresponds quite well with the level of Ministry of Defence funded R&D in the performer based R&D statistics. The total expenditures for this purpose are substantial and the purchases etc. are administrated directly by the various defence branches, i.e. army, navy and airforce, and for these the text in the budget document is hardly indicative of the R&D content.

The Ministry of Education, Research and Church Affairs also gives substantially higher estimates than the GBAORD, though the relative discrepancy is considerably lower than for the Ministry of Defence. The explanation is mainly twofold. Firstly, while the ministry considers all general funds for the Research Council of Norway as R&D, NIFU has excluded expenditure for advisory, strategic and pure funding functions (cf. Frascati Manual). Secondly, along the same line of reasoning the ministry assumes that research institutes only perform R&D, while GBAORD figures appreciate that such institutes also perform non-R&D tasks, such as certain types of policy studies, statistical work, routinely supervision, advisory functions etc. These two types of factors also account for most of the deviation regarding the ministries of Agriculture, Fisheries and Trade and Industry.

The third largest deviation between the two data sets concerns the Ministry of Health and Social Affairs, but goes in the opposite direction of the former two. This is because the

ministry has declined to give any R&D estimates for hospitals or other institutions within the health and social policy areas. Behind this is a rather unique definition of R&D used by the ministry, that we will return to below. The diverging assessments of the R&D appropriations under the Ministry of the Environment are also, largely, due to different views on the R&D content on agencies organised in this policy area. The ministry hardly considers any of it as R&D, while the GBAORD includes some R&D funding and activities applying information from performer based surveys. On the other hand appropriations through the RCN and to the research institutes are given a 100 per cent R&D share, as above.

Table 2: Government Budget Appropriations or Outlays for R&D (GBAORD) in 1998, by ministry*). Survey results compared with national GBAORD figures (NIFU) and deviation between the two data sets. Mill. NOK.

Ministry	Ministry survey	GBAORD (NIFU)	Deviation
Ministry of Foreign Affairs	249	335	-86
Ministry of Education, Research and Church Affairs	4343	4090	253
Ministry of Justice and the Police	8	7	1
Ministry of Local Government and Regional Development	116	154	-38
Ministry of Health and Social Affairs	256	483	-227
Ministry of Children and Family Affairs	35	28	7
Ministry of Trade and Industry	1236	1188	48
Ministry of Fisheries	419	361	58
Ministry of Agriculture	470	348	122
Ministry of Transport and Communications	168	124	44
Ministry of the Environment	265	426	-161
Ministry of Labour and Government Administration	25	21	4
Ministry of Finance and Customs	45	57	-12
Ministry of Defence	1053	472	581
Ministry of Petroleum and Energy	201	263	-62
Sum ministries	8889	8357	532
Other	0	533	-533
Total GBAORD	8889	8890	-1

*) Except the Ministry of Cultural Affairs, which did not answer the survey.

The large discrepancy between the two data sets regarding the "Other" category is dual. Firstly, government investment in buildings utilised for higher education and other R&D performing institutions is technically separated from the appropriation for current expenditures. While the latter is accounted for in items under the ministries responsible for the respective policy areas, the responsibility for the former is united in Statsbygg - The Directorate of Public Construction and Property, which is the Norwegian Government's manager and advisor in construction and property affairs. Formally, this agency is under the jurisdiction and also in the budget portfolio of the Ministry for Labour and Government Administration, which does not, however, take such budget items into consideration. This would contribute to underestimating R&D expenditures for R&D institutions.

Secondly, there is the Norwegian Industrial and Regional Development Fund (SND) which shall promote innovation, business development and industrial turnaround operations in Norway, applying financial tools as equity capital, low risk loans, venture capital loans, grants and guarantees. Formally, this agency is not financing R&D, according to the division of

labour between SND and the Research Council of Norway. However, the SND does give some R&D loans, that according to the Frascati Manual should be, and are, included, in GBAORD.

Table 3 sums up deviations between the two data sets, grouped according to the type of budget item, also taking R&D intensity into consideration. The first category, R&D institutions, includes higher education institutions and other R&D performers, for which GBAORD estimates are made from performer based R&D coefficients. The ministries tend to give substantially lower estimates than the GBAORD, due to the two particular circumstances explained above; the Ministry of Health and Social Affairs and the R&D building investment and administration under the Ministry of Labour and Government Administration. Thus, the main picture is that ministries tend to attribute 100 per cent R&D to research institutions, while other institutions which have R&D as a marginal activity tend to be excluded from the R&D "budget" all together.

Table 3: National GBAORD estimates 1998 compared with survey results, by type of budget item. Mill. NOK. Per cent.

Type of budget item	Deviation between national GBAORD and survey results	National GBAORD	Deviation as share of national GBAORD
	Mill NOK	Mill. NOK	%
R&D institutions	-885	4525	-20
The Research Council of Norway	228	1895	12
Other "pure" R&D budget items	10	999	1
Other "mixed" budget items	648	1469	44
Sum	1	8888	0

The latter problem, i.e. whether and how to calculate R&D coefficients exclusive of non-R&D activities, also applies to the second category - the Research Council of Norway (RCN). Obviously, the main purpose of the RCN is to promote R&D activity. However, the council also performs advisory, strategic and budget allocation tasks not meeting the R&D criteria proposed in the Frascati Manual. As mentioned above, ministries tend to consider all general appropriations to the RCN as R&D, which gives slightly higher estimates than in the GBAORD data.

The third category - other "pure" R&D appropriations - is subject to little discrepancy between the two data sets, as it mainly includes fees etc. for Norwegian participation in international R&D programs and institutions, e.g. the EU framework programs. Though not covered by any performer-based statistics, the R&D content in these appropriations are hardly controversial in this context.

The three above categories, i.e. R&D institutions, the RCN and other "pure" R&D budget items, account for almost 85 per cent of total GBAORD in Norway, and the basis for calculation of R&D coefficients is either found in performer-based statistics, or is quite straight forward to be found in the budget documents. The fourth category - other "mixed"

R&D budget items - is, however, all the more problematic. For the most part this category includes budget items where R&D is a secondary or one of many objectives or activities involved. The basis for the calculation of R&D estimates is mainly budget documents, which rarely addresses R&D explicitly in such instances. What is more, the appropriations are typically of an ad hoc nature, e.g. knowledge about R&D content generated from one budget, is rarely applicable the next year. Measured in terms of expenditure, some larger budget items dominate, predominantly defence investments as mentioned above. However, the category also contains funds ministries utilise for their own policy purposes, i.e. policy studies, evaluations and other Government measures which are conceptually far from clearly defined

The discrepancies also vary between ministries. They seem to be at the minimum when ministries have long experience dealing with R&D in general and the Research Council of Norway in particular. Ministries operating policy areas dominated by R&D in the natural sciences and engineering also tend to be more comfortable with the R&D concept and definitions. These conditions pertain especially to the ministries of Agriculture, Fisheries and Trade and Industry.

4. Conceptual interpretations and practices

Interviews as well as survey results show considerable variations in interpretations and practical use of the R&D concept. For most respondents the R (research) part of the concept seems relatively uncomplicated and subject to quite unitary assessment. The large conceptual problems seem to relate to the D (development) part. Due to some bizarre linguistic circumstances even the & (and) has, in some cases, been given a substantial interpretation. In general this also pinpoints the problem of addressing such conceptual issues. Some of the misinterpretations, deviating practices etc. are caused by rather co-incidental connotations in the Norwegian language, that may seem rather non-intuitive and difficult to understand when translated into English⁴. In the following we will try to describe some of the variation discovered in the survey.

Only seldom is the R&D concept referred to as research and *experimental* development. The variation may be illustrated by the following list (Norwegian terms in brackets):

- Research ("forskning") and development ("utvikling")
- Research and studies ("utredning")
- Research and education ("utdanning")
- Research, supervision ("og", i.e. and) and development
- Research and studies or policy studies ("utredning")
- Tests ("forsøk") and development

⁴ The official Norwegian term for research and experimental development is "forskning og utviklingsarbeid", abbreviated "FoU".

To elaborate a little more on some of these conceptual interpretation and practises we will apply a few examples from the survey material. The Ministry of Health and Social Affairs, as mentioned above, declines to give any estimate for R&D activity in hospitals and other institutions in the health and social security areas. This is reflected in the Ministry's definition of R&D, which only includes:

project based activity performed systematically to enhance the knowledge base and to use existing knowledge to promote applications. (...) Examples are research, various tests, evaluations, policy studies and development of e.g. information systems.

The definition thus excludes most medical R&D performed on a permanent basis, and is mainly relevant for the ministry's own policy tools.

Another type of problem occurs regarding the Ministry of Defence and its large material investments. The ministry purchases R&D from domestic and foreign industry and other R&D performing units. One question is therefore where to draw the line between pure purchases of e.g. technical equipment on the one hand, and research collaboration on the other. While the former does not involve R&D activity, the latter does. Another question concerns the availability of data from the defence sector at large, due to secrecy considerations. The reporting procedures are not very transparent even to the ministry itself. The exact nature of the investment regarding R&D involvement thus remains somewhat obscure.

Some ministries also mention the treatment of administrative costs, others special problems regarding the borderline between education and R&D. These, however, are problems thoroughly treated in the Frascati Manual. Other problems, as suggested in the definition presented by the Ministry of Health and Social Affairs above, are hardly offered sufficient attention in the Frascati Manual. The following delineation problems are, coincidentally or not, largely connected to the social science. One such problem concerns policy studies, which according to the Frascati Manual should not be included in R&D. Contrary to this several ministries consider at least some policy studies as R&D. The same pertains to evaluations, which also may or may not include research and research methods. A third type of activity is test activities, typically related to government reform processes. In a societal context this may involve e.g. small-scale trial and error, e.g. a new budget system imposed on say 10 municipalities, for potential later full-scale implementation, i.e. for all municipalities.

Another ministry pointed out that development involves a combination of de facto new knowledge and organising or reorganisation of existing knowledge. What are the criteria for deciding on whether this is R&D or not?

The most confusing aspect of the definition as such seems to be development. Part of an explanation may be that the term *experimental* is left out of the Norwegian translation. Consequently, the borderline towards issues regarding e.g. developing countries, industrial development and development of specialised teaching plans tends to be blurred.

5. Summary and discussion

The conceptual and practical problems arising in our survey may be attributed to several solutions. Some of them, e.g. the treatment of administrative cost in relation to R&D, would obviously be remedied through more detailed information about the international guidelines for R&D surveys. Other problems, such as the inclusion of institutionally performed R&D or education in the R&D concept, might also be removed through information measures, but the ministries would probably also need some motivation to stick to the Frascati definition and not to their own that might be more practical in their present day to day work. The introduction of a research budget would certainly represent such a condition, with the consequent need of a set of common rules.

However we have also come across problems of a more conceptual nature, for which the present Frascati Manual is of little help. The Norwegian GBAORD analysis is performed as an analysis of documents based on R&D coefficients from the performer based R&D statistics. Knowledge from performer based R&D statistics gives coefficients for GBAORD estimates for budget items involving R&D institutions. Together with "pure" R&D budget items and the coefficients for the Research Council of Norway this accounts for well over 80 per cent of the total GBAORD. However, there is still more than 15 per cent of the GBAORD about which the knowledge base is far from sufficient. This, one may argue, represents a marginal problem acknowledging that the main purpose is to estimate GBAORD development at the national level. However, when there is a bias towards R&D in the natural sciences and engineering, and most of the uncertainty pertains to R&D measures at the disposal of the ministries themselves, it hints at important deficiencies in definitions and guidelines. These deficiencies are partly intertwined with the lack of elaborated guidelines for the social sciences. Arguably, the guidelines seem more liberal when it comes to including marginal technological improvement than appreciating large parts of applied social science research.

The guidelines rather bluntly proclaims that policy studies should be excluded from R&D. Some of them obviously should, while other involve quite a lot of "creative work on a systematic basis", and certainly increases "the stock of knowledge", even on a global basis. However, there are few criteria in the guidelines helping to draw the line between routine work and applied social science research in this area. This created problems for ministries of defining the R&D content in their budgets, and when contacted or involved in discussions we were of little help in guiding them in this respect. Other Government tools such as evaluation or experimental reform designs could be considered along the same lines. Moreover, the term development represents the most problematic aspect of the definition. This is partly due to the experimental being left out of the Norwegian translation of the definition, and some rather curious connotations in the Norwegian language.

In general, we think that some criteria for discriminating between R&D and non-R&D need to be developed in this area. One way of proceeding towards such criteria might be to relate the "basic criterion", i.e. whether the activity contains "an appreciable element of novelty and the resolution of scientific and/or technological uncertainty" (Frascati Manual 1993, p33), to the various levels in a research project, i.e.:

- The conceptual level
 - The methodological level
 - The empirical level
- One might then argue that a project, e.g. a policy study, is to be considered R&D as long as there is an appreciable element of novelty on either level. One would of course also have to consider such criteria's relation to other elements in the FM, e.g. the requirement that data should be collected for an R&D project, and not for general purposes, to be considered R&D.