Jointly published by Elsevier Science Ltd, Oxford and Akadémiai Kiadó, Budapest

Scientometrics, Vol. 38, No. 1 (1997) 71–85

THE EVALUATION OF EUROPEAN PROGRAMMES AND THE FUTURE OF SCIENTOMETRICS

P. CUNNINGHAM

PREST (Policy Research in Engineering, Science and Technology), University of Manchester, Oxford Road, Manchester M13 9PL (UK)

(Received October 3, 1996)

This paper presents the results of an examination of a selection of published European evaluations. The incidence of quantitative and scientometric approaches has been reviewed and an assessment made of their contributory role in each evaluation. The various approaches have been broadly categorised according to the type of data they draw upon, and by the issues they attempt to address. The author analyses such approaches with regard to the degree of success in meeting the objectives of the evaluation. In the light of this some likely future trends are suggested.

Introduction

Questions over the contribution of science and technology to wealth creation and to the maintenance and improvement of the quality of life, coupled with the ever increasing costs of research, are focusing political and public attention on the role of science and technology in national economies worldwide.

In turn, the rising demands of policy makers (over issues such as selectivity, impact, utility, socio economic benefits), have called for higher degrees of sophistication in the approaches used by the evaluation community. At the same time concerns about the costs of evaluation have led to a demand for more routinised and transparent approaches. Both of these trends have led to a renewed interest in performance indicators, and preferably those which measure the outputs and impacts of research.

The scientometrics research community may contribute to this demand in two ways: by developing quantitative techniques which utilise the outputs of the research process in order to provide an assessment of the efficiency and effectiveness of the research process; and by improving our understanding of the characteristics of the research process itself.

0138–9130/97/US $ 15.00

The evaluation community (which includes a subset of the scientometrics research community) also has a role to play in further developing the quantitative techniques employed for evaluations through the construction of coherent sets of indicators which demonstratively reflect research activities. The rationale behind both these statements has its basis in the findings of this study.

Object

The evaluation of European Research and Technology Development programmes (notably those of the European Commission's Framework Programmes, and EUREKA) has become a long established practice and has contributed to the growth and development of a world-recognised community of experts in evaluation.[1,2] From the evidence presented here it is less clear to what extent these evaluations, particularly *ex post* evaluations, now and in the future, rest upon quantitative evidence of the effects which they examine.

In a review of the evaluation activities of the European Commission, *Muldur*[3] presents data based on 50 reports resulting from vertical evaluations. According to this data, only 16% of the reports reviewed used "bibliometrics" and 20% used "statistics". 64% used surveys, presumably based on written questionnaires. These, admittedly generalised, results suggest that the use of scientometric techniques to assist in the evaluation of EC programmes has not become widespread.

This study was designed to investigate this issue further and to obtain a more qualitative assessment of the impact of scientometric methodologies in evaluation.

Method

The study was based on a review of a sample of reports resulting from a number of European evaluation studies, mainly those of the European Commission and EUREKA. Each report was analysed in terms of:

- The terms of reference (TOR) for the evaluation, i.e. the issues addressed by the evaluators;
- The methodologies used to obtain evidence on the conduct of the programme;
- Any quantitative data gathered and used in the evaluation (including basic programme statistics);
- The role and contribution of quantitative data in meeting the TOR.

A total of 61 reports was reviewed. These spanned the period 1980 to 1995 (Table 1) and comprised evaluation reports and reviews, mainly of specific programmes or sub-activities.

Table 1
Year distribution of reviewed reports

80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
1	1	0	2	1	2	5	0	8	6	4	6	6	6	8	5

Results

a). Terms of reference

Throughout the entire sample, the terms of reference provided to the evaluators (generally comprising a panel of experts) were highly consistent. This is unsurprising, when one considers the efforts made by the European Commission to standardise the process of evaluation. Whilst panels were given complete freedom in the choice of evaluative methods to adopt, guidance was provided in the form of briefings on previous evaluations and examples of evaluation reports.

The standard terms of reference are:

"To assess:

i. The scientific and technical achievements of programme taking into account their original objectives and milestones, and whenever relevant, changed circumstances;
ii. The quality and practical relevance of the results (including commercial development, exploitation & spin-offs);
iii. The effectiveness of management and of the use of resources;
*iv. (The programme's contribution to the development of Community policies and social & economic development);**
v. Benefits resulting from implementation of the programme at Community level."

Moreover, the terms of reference of evaluations specify that *"evaluations are expected to use quantitative indicators whenever appropriate"*.

These "standard terms of reference" generally stipulate that:

"the evaluation should lead to recommendations on:

1. the future of [field of research/topic] within the relevant Community RTD and policy contexts;
2. the management of the programme;
3. the use of research results by organisations carrying out the work;

* This term of reference (iv.) was included only in a limited number of evaluation.

4. the dissemination of the research results.
Panels may also be expected to seek answers on specific questions relevant to the programme under review."

b). Types of indicators

Bearing these evaluation issues in mind, it is worth digressing somewhat to focus on the types of indicators and techniques which are available for addressing them. We can then return to the results of the review to assess the degree of convergence between available indicators and those actually employed in the evaluations.

Following the broad requirements of the general Terms of Reference, it can be seen that there are three main categories of indicators:

1. Indicators used to examine scientific impacts.

It has become accepted evaluation practice that the measurement of scientific impact, or more precisely, scientific output is best achieved by an examination of the publications emerging from a corpus of research. This quantitative data may be used in three ways: as a binary indicator (that is, publication did/did not occur); as a measure of the volume of output (generally in comparison with some national or international benchmark); or in more "traditional" bibliometric approaches, generally extending the analysis to cover aspects of co-authorship and/or citation analysis.

The various advantages and disadvantages associated with the use of bibliometric indicators are well known and have been the subject of numerous reviews [see, for example, *Barré* (1994)[4]]. For example, in the context of the evaluations under consideration here, their dependence on "historic" data would appear to militate against the widespread use of bibliometrics for reasons of timing, although programmes which have been running for a significant period of time prior to their evaluation would offer some scope for their application. The use of citation based methodologies is even more problematic with respect to timing. In addition, there are problems of comparability and benchmarking, which may be overcome but entail the additional expense of accessing large commercial datasets, or the construction of customised datasets.

Data derived from co-authorships, whilst obviously suffering from a number of the disadvantages connected with publication-based data, can provide useful indicators of the extent of collaboration as reflected in programme outputs.

Finally, indicators such as those derived from co-word and co-citation analysis, introduce a further level of variation into the data set together with difficulties concerned with interpretation and analytical complexity.

2. Indicators used to examine the quality and practical relevance of the results.

These indicators may be derived from three sources. The first, *indicators derived from programme databases*, possess the major advantage of being inexpensive to compile and, at least in theory, readily available to the evaluators. Examples of such indicators include information on: types of participant; geographical distribution of participants; patterns of collaboration; and training effects (e.g. information on exchanges, visits, doctorates, completion rates). Disadvantages associated with these indicators include their emphasis on process issues and the need to overlay them with a further qualitative, and perhaps subjective, assessment of the outcomes of the processes measured.

Patents form the best example of indicators in the second category – those *obtained from public databases*. Their suitability as indicators of the utility of EU R&D programmes has been thoroughly investigated by *Schmoch* et al.[5] As was the case for scientific publications, the authors note that the use of patents data is also only appropriate with a sufficient time lag from the performance of the research. Attribution is again a problem and the need for care in the technical approach to the analysis is stressed. Overall, however, *Schmoch* et al. conclude that patent indicators are *"very effective tools for the assessment of programme assumptions"*, that is, their strength lies in their potential contribution to contextual or prospective *ex ante* evaluations. For the sake of completeness, one could also include in this category publications data held in databases such as the Science Citation Index. This data, essential for the derivation of citation-based indicators and possibly required for the construction of comparison data sets, will offer the advantages and disadvantages noted above.

Third, *indicators derived from participant surveys* possess the major advantage that they may be customised to elicit specific information on a range of indicators. These indicators include: characteristics of participating organisations and individuals; participants' expectations and the degree of their realisation/achievement of objectives; collaborations, exchanges, formation and persistence of partnerships; output types – either actual or anticipated; direct and indirect market effects, timing; and level of participants' satisfaction, sources of dissatisfaction. Other advantages include their use to elicit information from withdrawn participants or from non-participants in order to acquire comparison data. They also afford the opportunity to move away from a reliance on historical data towards a more forward-looking perspective.

Obviously there are also a number of significant weaknesses with such indicators: they may be highly subjective, particularly when reflecting anticipated outcomes or effects; aggregation may be problematic; and benchmarking, attribution and additionality may pose problems of interpretation.

The networks formed as a result of participation in research programmes have also been the subject of extensive analyses using data derived from participant surveys. This also includes the use of co-nomination based techniques.

3. Indicators used to examine the effectiveness of management and the use of resources.

These indicators derive largely from information contained in programme databases or that obtained from participant surveys. Generally, however, they are far removed from scientometric applications. Examples of such indicators are: time taken for processing of proposals; programme administration (including evaluation) costs as proportion of total expenditure; and participant's views on administration issues.

The first two have the advantage that they may be benchmarked against similar indicators from other programmes, although some interpretation may be necessary. As they may be obtained from customised surveys or collection processes, they share the same strengths and weaknesses as the preceding set of indicators.

General results

It is clear that there are a large number of indicators which can be used to provide information to programme evaluators. Indeed, those discussed form only a sub-set of the available range. We can now turn to the results from the study and determine the extent to which these indicators have actually been used in European evaluations.

In our sample, the terms of reference were distributed as shown in Table 2. It can be seen that 45 out of 61 of the reports were based on standard terms of reference or variations thereof. Thus, bearing in mind the range of indicators discussed above it seems that there should be considerable of scope for the use of quantitative and perhaps scientometric evaluative methodologies.

Table 2
Type of Terms of Reference of evaluation

Standard	32
Standard plus additional issues	8
Restricted set of Standard	5
Specific	7
Review/overview	6
Impact	3

However, as can be seen from Table 3, methodologies are highly orientated to "traditional" peer review or subjective techniques such as interviews, document review and questionnaire surveys. This is understandable, as the major role and strength of scientometric studies is in support of qualitative approaches. Nevertheless, the incidence of such supporting quantitative approaches was very low and our review uncovered only seven instances of what might be termed full bibliometric studies, and two of these were specifically commissioned in order to examine the utility of certain methodologies. (For the purpose of this paper, bibliometric studies are broadly defined as those where data on published outputs (scientific articles and patents) are collated and analysed).

Table 3
Methodologies used by evaluations

Document review	39	
Project/contract review	15	
Project assessment + criteria scoring	7	
Questionnaire surveys	32	
Site visits	11	
Interviews	49	
Case studies	3	
Tracking studies	1	
Statistical profiles	6	
Bibliometric studies	7	(+7 using simple outputs data)

An analysis of the types of quantitative data used by the reports' authors (Table 4) indicates that, unsurprisingly, statistics derived from questionnaire surveys and from analyses of project data dominated all others. Generally, these statistics reflected subjective assessments of project participation rather than quantified outcomes or effects. This was also true with regard to the use of evaluative criteria, which reflected the subjective views of the evaluators. Even so, quantitative data on publications, patents and collaboration or exchanges was available and was used by a number of evaluations, albeit with a low level of analytical sophistication and interpretation.

Table 4
Quantitative data approaches used by evaluations

Programme statistics (basic)	25	
Programme statistics (detailed)	16	
Questionnaire data	27	
Evaluation criteria scores	5	
Publications	10	(+2 very generalised data)
Patents	6	(+1 very generalised data)
Collaborations/exchanges	13	

It should be noted here that the authors of one programme evaluation did recognise the utility of bibliometric techniques but specifically discounted their use for two reasons, namely: because insufficient time had elapsed since the start of the programme; and because of the difficulty of making comparisons between fields. Moreover, another programme evaluation report contained the recommendation that bibliometric analysis of the quality of the research results should be performed "in due course". The authors also recommended that the Commission's evaluation services should provide evaluation panels with full lists of publications resulting from a programme. It is not known whether this recommendation was acted upon.

With regard to the impact of quantitative studies on each evaluation, Table 5 is highly significant and shows that in less than a quarter of the sample quantitative data provided a major input to the assessment of the original terms of reference. In over half of the sample of reports, little or no use was made of quantitative evidence.

Table 5
Role of quantitative data in addressing Terms of Reference

None	Minimal	Moderate	Supported specific concs.	Important/crucial
18	17	12	7	7
		"Full" bibliometric studies		
–	2	–	2	3*
		"Partial" bibliometric studies		
1	4	–	1	

More specifically, an analysis of the reports which featured bibliometric studies indicates that, of the seven "full" bibliometric studies, 2 had a minimal input, 2 were supportive and 3 were important. Of the six partial bibliometric studies, 1 had no impact, 4 had a minimal input and one was supportive. The "full" bibliometric studies are given in *Appendix 1*.

Discussion

Much of the quantitative data available to the evaluations was used in the analysis of *process* issues rather than *outputs*, let alone *impacts*. This, in part, is a result of the timing of evaluations and the consequent limited availability of information on these latter two. Nevertheless, three of the supporting studies which did use bibliometric approaches (including citation data) were able to provide specific evidence to the questions posed by the evaluators.

Scientific publications and, to a much lesser extent, patents, or more correctly, citations to publications and patents, formed the main output indicators by which *scientific impact* was measured. The alternative source of information on this issue was derived from aggregate impressions of qualitative, and therefore subjective, assessments of individual projects made by panel members. Some efforts were made to improve the objectivity of these assessments by the introduction of criteria against which performance could be scored but again this quantitative data was generally presented only as aggregate distributions. Whilst it is impossible to quantify, it was clear that a considerable amount of time has been spent by panel members in making these detailed assessments of project performance (by examination of progress reports, or end-of-project reports) and that, particularly in the case of large programmes consisting of scores or hundreds of projects, such assessments could be based only on small samples of projects.

Studies based on co-authorship data were well represented within the bibliometric studies and provided much evidence for the assessment of programme effects on collaboration and transnationality. It also seems that such data was found to be relatively useful by the evaluation panels and generally made a contribution to the report conclusions.

Co-citation analysis was not represented in any of the reports. Neither was co-word analysis and similar text-based analytical mapping techniques. This was not an unexpected finding as both techniques are more appropriate to the definition of the structure of a research field rather than as means to measure quality of output. Moreover, the sophistication (and hence cost) of these techniques would tend to militate against their use in evaluations of the sort under review here.

Nevertheless, in a number of the evaluations reviewed, the potential for the use of relatively unsophisticated bibliometric approaches was clearly evident. However, for unknown reasons (apart from the one example mentioned before) such techniques were not employed.

Surveys formed a major source of quantitative statistics, although the information gathered by such means was frequently subjective and produced in response to an enquiry regarding the research activities under review rather than by the activity itself. Nevertheless, as noted in the above discussion on indicators, the utility of such information cannot be discounted. In many cases, the value of the bibliometric studies performed in the sample of evaluations was often enhanced by parallel or complementary questionnaire surveys which provided greater qualitative depth to the analysis.

Overall, the analytical treatment of quantitative indicators, whether derived from objective or subjective lines of enquiry proved somewhat mundane. Data were generally presented as aggregate distributions with little or no correlational analysis between data sub-sets, although there were a small number of exceptions to this, perhaps the most notable being that of *Laredo*, et al.[6] in their supporting study for the evaluation of the concerted actions of the Medical and Health Research Programme.

Conclusion

Based on the evidence examined, what are the likely future trends in the development of scientometric indicators in evaluation?

At first glance it appears that the role of scientometrics in evaluations of the type reviewed here is unlikely to change. Overall, the study shows that over the entire 15 years under review, scientometric techniques have not yet acquired a firm presence in the toolkit of *(ex post)* evaluation methodologies used by European evaluators. This is despite some notable contributions both to evaluation studies and to the development of the application of scientometrics techniques in general.

So why have quantitative indicator-based techniques played such a minor role in European evaluations such as these? There seem to be a number of contributory factors:

The first appears to be a lack of awareness and understanding on the part of some evaluators (that is, panel members) of the role that even relatively unsophisticated bibliometric methodologies may play in evaluations. This is despite the fact that the Commission evaluation services provide a briefing to the panellists. In at least two cases, bibliometric supporting studies were used primarily because of the intercession of a member of the evaluation secretariat who recognised their potential. This may, in part, be compounded by a deeper reticence by members of the scientific community (from which many panellists are drawn) to admit that the complexities of the research process can be reduced to aggregate statistics. Indeed, this is a fundamental tension between policy makers, who require the research process to be reduced to a numeric value, and the research community whose performance they wish to measure.

Second, it seems that, despite a number of cases where they have been used successfully, bibliometrics still suffer from a perceived absence of any clear demonstration of their utility. Naturally, this perception is not held by bibliometric practitioners but pervades the wider policy making community and those who commission evaluations. To some extent, this lack of demonstrated utility has been exacerbated by the need to accompany bibliometric studies with a host of (necessary) caveats and to provide expert interpretation of the results, particularly in the case of more sophisticated bibliometric techniques.

Third, bibliometrics have been largely restricted to the measurement of scientific outputs and associated characteristics of the research process, such as transnationality. Indeed, it is with regard to the latter issue that bibliometric techniques have demonstrated perhaps their greatest utility.[7] Their role in measuring the wider innovation process has, however, been underexplored and, as noted in the introduction, questions over the contribution of science and technology to wealth creation will continue to stimulate the demand for the quantification of socio-economic impacts.

Fourth, one cannot escape the problems associated with the timing of evaluations. It is frequently the case that suitable output data are not available. Also related to timing are the organisational aspects of evaluations. Panels are generally highly constrained by the available time to plan, perform and report on their evaluation. The additional time required to organise and subsequently undertake supporting quantitative studies may simply be unavailable. Moreover, appropriate data (or "clean" data subsets) on which such supporting studies may be based are rarely available or accessible and further time is often required in order to generate them. In at least two of the evaluations reviewed, the full results of supporting bibliometric studies were not available in time for them to contribute to the final report.

What potential solutions are available to overcome these problems?

The problem of awareness and understanding may be addressed by improved dissemination by programme sponsors and by the external community, including the scientometric community, of the potential of quantitative studies. This dissemination includes the not only the continuance of workshops such as this one from which clear statements emerge on the applied use of scientometric techniques, but must also involve attempts to educate a broader audience of policy-makers, researchers, etc., through seminars and related activities to publicise the outcomes of evaluations and through the delivery of courses on evaluative methodologies.

With regard to the second point, further studies are necessary which offer clear evidence of the linkage between scientometric techniques and evaluation issues – what *Barré* has referred to as "Function E".[8] Such studies should be conducted at both the macro-level and the micro-level in order to establish a rationale for some of the assumptions or conditions under which scientometrics has operated in the past. These include:

– Clarification of the role of scientific publication as a means of communication as opposed to an indicator of performance. It is probably now too late to separate these

two roles but the challenge to define indicators which do not elicit behavioural modifications in their "target" communities remains valid.
- The need for a so-called "theory of citation", or at least empirical evidence to derive a probabilistic rationale for citation as a positive factor.
- Determination of the relative role of, say, European Commission programmes in the promotion of transnational co-authorship.

Admittedly, significant steps to provide a framework of scientometric theories have already been taken,[9] but further empirical validation studies are required to substantiate these theories.

By virtue of the availability of the data on which they operate, scientometric studies have, as noted above, concentrated on the outputs of scientific (and, latterly, social science) research. However, to develop their utility in the field of evaluation there is a need to embed scientometric approaches within broader studies into understanding the innovation process. Attention should be placed on the development of quantitative indicators of innovation for analysis at the level of the firm, say. Similarly, the growth in electronic forms of communication (electronic journals, e-mail), wherein the interchange of information precedes traditional forms of publication, will demand the development of new indicators and data capture techniques.

The issue of timing remains a perennial problem. In cases where outputs are not available, approaches could be developed which employ anticipated outcomes or effects of process issues. An alternative is simply to concentrate on scientometric strengths at the macro-indicator level and develop their use in the roles identified by *Moed* et al.[10] That is in:
- evaluations of the effectiveness of national or supra-national science policy;
- overviews of national or supra-national scientific activities;
- assessment of the strengths and weaknesses of national and supra-national research performance; and
- identification of relevant scientific research areas.

With regard to the problems associated with organisation of evaluations, the onus here falls upon the sponsors of research and its subsequent evaluation for improved planning and programme management. Specifically, attention should be focused on the development of verifiable objectives and programme performance measures which may be better integrated into the processes of programme monitoring and evaluation. This would include improved routine capture of programme information and could draw upon an approach similar to that recommended in a recent study of performance measurement in a UK Research Council.[11]

It is clear that many of the above issues are already being addressed, for example the European Commission's move towards greater emphasis on monitoring activities and the attention being focused on the development of performance indicators by UK Government departments and the Research Councils. Nonetheless, for the requirements of *ex post* evaluations these issues require further attention.

To summarise, the broad messages are that:

- The scientometric community must continue to refine and develop techniques, but must demonstrate that such techniques are robust and practical for the needs of evaluators. There is a need for comprehensible (and, preferably, relatively unsophisticated) rather than esoteric approaches. New approaches are also required with perhaps greater emphasis at the micro-scale, the use of electronic-media based indicators, improved qualitative understanding of scientometric indicators.
- The wider evaluation community needs to focus attention on the development of routinised performance indicators which lend themselves to quantitative analyses.
- Sponsors of research must address issues concerning the management of programmes, with improved definition of expected outcomes and impacts, the setting of verifiable objectives and improved real-time data capture.
- All three communities must continue to work cooperatively on these issues. As science and technology policy increasingly focuses on the wider imperatives of wealth creation and the improvement and maintenance of the quality of life, the measurement of the contribution of research to these goals will become harder. It is the challenge to scientometrics to develop approaches which may assist in this measurement. Unless such techniques are able to demonstrate their utility in evaluation studies, their use will, we fear, continue to be on an *ad hoc* basis.

*

I would like to express my gratitude to Luke *Georghiou* for his very useful comments and suggestions on the structure and content of this paper during its preparation.

References

1. L. GEORGHIOU, Research evaluation in European national science and technology systems, *Research Evaluation,* 5 (1996) No. 1, 3–10.
2. L. GEORGHIOU, Assessing the framework programmes: A Meta-evaluation. *Evaluation,* 1 (1995) No. 2, 171–188.

3 U. MULDUR, L'expérience de la Commission Européenn pour la R&D en matière d'évaluation des programmes de recherche et développement. *Measuring R&D Impact: Proceedings of the Second International Symposium on Research Funding,* Ottawa, Canada, 1995. Natural Sciences and Engineering Research Council of Canada, ISBN 0-662-62351-7, (1996) pp. 99–112.
4. R. BARRÉ, Methodological Note D: The SCI bibliometric data in: *The European Report on Science and Technology Indicators,* European Commission Report EUR 15897 EN, October 1994.
5. U. SCHMOCH, H. GRUPP, U. KUNTZE, N. KIRSCH, E. STRAUSS, *Patents as Indicators of the Utility of European Community R&D Programmes,* Commission of the European Communities Report EUR 13661 EN (1991).
6. P. LAREDO, B. KAHANE, J. B. MEYER, D. VINCK, *The Research Networks built by the MHR4 Programme,* Commission of the European Communities Report EUR 14700 EN. ISBN 92-826- 4823-0 (1992).
7. For example: G. LEWISON, P. CUNNINGHAM, Bibliometric studies for the evaluation of trans-national research, *Scientometrics,* 21, (1991) 223–244; F. NARIN, K. STEVENS, E. S. WHITLOW, Scientific cooperation in Europe and the citation of multinationally authored papers, *Scientometrics,* 21 (1991) 313–324.
8 R. BARRÉ, "The European perspective on S&T indicators". Paper presented at "Quantitative Approaches to Science and Technology Studies", workshop of the Network of European Centres in Science and Technology Studies (NECSTS), Amsterdam, 21–24 May, 1996.
9. For a comprehensive review and treatment, see L. LEYDESDORFF, *The Challenge of Scientometrics: The Development, Measurement and Self-Organization of Scientific Communications.* DWSO Press, Leiden University, 1995.
10 H. F. MOED, R. E. DE BRUIN, A. J. NEDERHOF, A. F. J. VAN RAAN, R. J. W. TIJSSEN, *State of the Art Bibliometric Macro-Indicators: an Overview of Demand and Supply.* Commission of the European Communities Report EUR 14582 EN ISBN 92-826-4613-0, 1992.
11 P. N. CUNNINGHAM, UK S&T policy: Recent changes and implications for the measurement of R&D. In: *Measuring Impact: Proceedings of the Second International Symposium on Research Funding,* Ottawa, Canada 1995. Natural Sciences and Engineering Research Council of Canada, ISBN 0-662-62351-7, 1996 pp. 71–79.

Appendix 1

Reports in which "full" bibliometric studies employed

i. EUR11945 (1988) *Evaluation of the Community Programme on Forecasting and Assessment in the Field of Science and Technology – FAST – (1983–1987).* (Panel).
ii. EUR11953 (1988) *Evaluation of the Research and Development Programmes in the Field of the Environment (1981-1985) and (1986-1990).* (Panel).
iii. EUR 11833 (1989) *Evaluation of the Biomolecular Engineering Programme BEP (1982–86) and the Biotechnology Action Programme BAP (1985-89).* (Panel).
iv. EUR 12147 (1989) *Evaluation of the Agricultural Research Programmes (1976-1978, 1979-1983 and 1984-1988).* (Panel).
v. EUR13001 (1990) *Evaluation of the Fourth Medical and Health Research Programme (1987–1991).* (Panel).
vi. *EUR 13661 (1991) *Patents as Indicators of the Utility of European Community R&D Programmes.* (External consultants).
vii. *EUR15698 (1994) *Assessment of Critical Technologies in Europe in Selected Fields Covered by the EC Research Programmes.* (External consultants).

* Specifically commissioned studies using bibliometric techniques.