GUIDE TO THE COLLECTION OF EXPENDITURE DATA IN THE NATURAL SCIENCES

MAIN ESTIMATES
SCIENCE ADDENDUM
1982 – 83

GUIDE TO THE COLLECTION OF EXPENDITURE DATA IN THE NATURAL SCIENCES

1. INTRODUCTION

1.1 This introduction is intended to provide an overview of the process of collecting science expenditure data; definitions of and explanatory notes on natural sciences, human sciences, scientific and technological activities, performance sectors, and other terms used are given in subsequent sections.

1.2 The collection of science expenditures is organized by the Ministry of State for Science and Technology (MOSST) in cooperation with the Treasury Board Secretariat and the Science Statistics Centre of Statistics Canada. Collection is carried out twice yearly in conjunction with submissions by departments and agencies of their Program Forecasts and Main Estimates to the Treasury Board.

1.3 Collection is undertaken to gather essential data describing the recent, current and proposed state of the federal resources allocated to science and is coordinated by the Program Review and Assessment (PRA) Division of MOSST, which works in close cooperation with the collecting agency, Statistics Canada, in editing, verification and entry into MOSST's computer data bank. Federal science expenditure data are analyzed and used in the development of advice to MOSST's Minister and the Treasury Board Secretariat, as well as in policy development and in monitoring the implementation of science policies. Statistics Canada maintains the historical expenditure series in natural and human sciences dating back to 1963.

1.4 The basic reporting unit is the budgetary program of a department or agency. Each budgetary program forms the subject of separate scientific expenditure reports for the natural and for the human science activities within it. Both the program and the program activities within it may be scientific in whole or in part only. It is only expenditures on the scientific components of a program or its activity which are reported on. In

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some programs it will be difficult to distinguish between the natural and human sciences. However, some allocation must be made and in determining this allocation, the dominant orientation of the projects and the area of expertise of the personnel involved must be considered. Detailed definitions are given on the following pages.

1.5 On the questionnaires, the identified expenditures are looked at from several different viewpoints and in various subdivisions. Expenditures on research and development (R&D) and related scientific activities (RSA) are subdivided to provide an indication of the "what" of a department's scientific effort. Expenditures in each category of scientific activity are further subdivided into "current" and "capital" segments. Current expenditures are additionally subdivided by sector, to indicate the "where" and "by whom" the activity is performed (e.g., in industry, in universities).

1.6 The human resources allocated to scientific activities are summarized in terms of the involved categories of personnel (executive, scientific and professional, etc.) and the principle focus of their efforts (R&D, RSA, administration of extramural programs).

1.7 The "why" of the scientific activity is addressed by asking departments to identify areas of expenditure application (e.g. oceans, energy), as well as to summarize the sector of performance (intramural or extramural).

1.8 When completed, checked for consistency with previous reports, entered into the data base and totalled along the various dimensions, these data provide snapshots of the federal resources allocated to science, supporting not only the work of central agencies but also the submissions of departments and agencies requesting resources.

2. GENERAL

2.1 In order to assist departments in the preparation of science expenditure reports, computer print-outs of data previously submitted at the time of Program Forecast and Main Estimates are available from MOSST upon request (593-5947).

2.2 The remainder of this guide consists of definitions/explanations for terms used in the questionnaire. In order to make these as readily identifiable as possible, they are arranged by questionnaire page number. The numbering of the row and column headings of the dummy questionnaire pages serves to identify defining/explanatory notes.

2.3 The natural sciences consist of disciplines concerned with understanding, exploring, developing or utilizing the natural world. Included are the engineering, mathematical, life and physical sciences.

2.3 The term human sciences is to be regarded as synonymous with social sciences and humanities and thus embraces all disciplines involving the study of human actions and conditions and the social, economic and institutional mechanisms affecting humans. Included are such disciplines as anthropology, business administration and commerce, communications, criminology, demography, economics, geography, history, languages, literature and linguistics, law, library science, philosophy, political science, psychology, religious studies, social work, sociology, and urban and regional studies.

3. ACTIVITIES/PERFORMERS

3.1 Pages 1-3 refer to different fiscal years and the headings of all three are identical. One set of definitions/ explanations therefore suffices.

3.2 Actual and planned expenditures on scientific and technological activities are to be classified according to the type of scientific activity and the performance sector in which the activities were or will be conducted.

3.3 Scientific and technological (S&T) activities are required for the generation, dissemination or initial application of the new S&T knowledge. The central activity is scientific research and experimental development (R&D). In addition there are a number of activities closely related to R&D, and are termed related scientific activities (RSA). Those identified as being appropriate for the federal government in the natural sciences are: scientific data collection, information services, testing and standardization, feasibility studies, education support, and museum services.

3.4 The performer is equivalent to the sector in which the scientific activity is conducted. The basic distinction is between intramural and extramural performance. Extramural payments are classified on the basis of the performance sectors to which they are made. The appropriate extramural performers are Canadian industry, Canadian universities, Canadian non-profit institutions, foreign performers, Canadian provincial and municipal governments, and other performers.

3.5 Questionnaire pages 1-3 and 3(a):

EXPENDITURES ON ACTIVITIES IN THE NATURAL SCIENCES:
EXPENDITURES BY ACTIVITY

Department _____

FISCAL YEAR 1982/83

Program _____

Activity \ Performer	14. Intramural	15. Canadian industry	16. Canadian universities	17. Canadian Non-profit instns.	18. Provincial and municipal gvts.	19. Foreign performers	20. Other	Total
	($'000)							
2. RESEARCH AND EXPERIMENTAL DEVELOPMENT:								
1. Current expenditures:								
3. In-house R & D								
4. Contracts:								
4(a) R & D contracts								
4(b) Supporting contracts	[1]							
5. R & D grants and contributions								
9. Research fellowships								
13. Administration of extramural programs								
1. Capital expenditures								
RELATED SCIENTIFIC ACTIVITIES:								
1. Current expenditures:								
7. General purpose data collection								
8. Information services								
9. Economic and feasibility studies								
10. Operations and policy studies								
11. Education support								
12. Museum services								
13. Administration of extramural programs								
1. Capital expenditures								
TOTAL EXPENDITURES								[2]

[1] Must equal total supporting contracts for 1982/83, page 3(a).

[2] Must equal human science funds reported for 1982/83, page 7.

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EXPENDITURES ON ACTIVITIES IN THE NATURAL SCIENCES:

DETAIL OF SUPPORTING CONTRACTS ACTIVITY

Department _____

Program _____

Fiscal year \ Performer	Intramural	Canadian industry	Canadian universities	Canadian Non-profit instns.	Provincial and municipal gvts.	Foreign performers	Other	Total
	($'000)							
1980/81	[1]							[2]
1981/82	[1]							[2]
1982/83	[1]							[2]

[1] Intramurally performed contracts only.

[2] Transfer this amount to intramural column of supporting contracts activity on pages 1-3, according to fiscal year.

Page 3(a)

Activities:

Item 1. Expenditures on construction, acquisition or preparation of land, buildings, machinery and equipment are capital expenditures. All other expenditures are current expenditures.

Item 2. Research and experimental development (R&D) - creative work undertaken on a systematic basis to increase the stock of scientific and technical knowledge and to use this knowledge in new applications.

The central characteristic of R&D is an appreciable element of novelty and of uncertainty. New knowledge, products or processes are sought. The work is normally performed by, or under the supervision of, persons with postgraduate degrees in the natural sciences or engineering.

R&D is generally carried out by specialized R&D units. However, an R&D project may also involve the use of non-R&D facilities (e.g., testing grounds), the purchase or construction of specialized equipment and materials, and the assistance of other units. Costs of such items, attributable to the project, are to be considered R&D costs.

R&D units may also be engaged in non-R&D activities such as technical advisory services, testing, and construction of special equipment for other units. So far as is practical, the effort devoted to such operations should be excluded from R&D.

On the other hand, R&D may be carried out by units normally engaged in other functions (e.g. a marine survey ship used for hydrological research, a geological survey team may be directed to work in a certain area in order to provide data for a geophysical research project). Such effort is part of an R&D project and, again, so far as is practical, the costs should be assigned to R&D expenditures.

Examples:

1. Routine autopsy on the causes of death is not research, but special investigation of a particular mortality in order to establish the side effects of certain treatments is research. Similarly, routine tests, such as blood and bacteriological tests, are not research, but a special program of blood tests in connection with the introduction of a new drug is applied research.

2. The keeping of daily records of temperature or of atmospheric pressure is data collection and not research. The investigation of new methods of measuring temperature is research as is the study and development of new systems and techniques for interpreting the data.

3. The development of new methods of identifying tree species and determining if they are diseased is R&D; the use of recently developed methods, such as remote sensing and infra-red photography, as part of normal forestry surveys, is not.

4. The operation of a new transportation system as a demonstration project is not R&D; however, the creation of the system as a prototype and the technical evaluation of its operations should be considered R&D.

5. Grants to provide equipment for an R&D laboratory are to be considered R&D grants; however, when given to provide equipment primarily for teaching or medical care they should not be considered in the R&D category.

Item 3. In-house R&D - R&D performed by personnel assigned to the reporting program. It may include R&D carried out on behalf of another program on a cost recovery basis.

Item 4. Contracts - payments to organizations or individuals outside the federal government for the conduct of R&D by the recipient or to provide support for the federal government's in-house R&D program.

a) R&D Contracts - contracts to an outside institution or individual to fund R&D performed by the institution or individual. The criterion is: would the performer report the contract as intramural government-funded R&D if asked?

b) Supporting contracts - contracts to an outside institution or individual to provide goods or services necessary to support the in-house R&D program. Examples are contracts with data processing firms for computing services, maintenance contracts for R&D facilities, or procurement contracts for specialized equipment which is not considered capital. The total amount reported for this activity on page 3(a) should be reported under the intramural column on pages 1-3 and 5 and should not be included in any of the extramural columns in the questionnaire.

Contracts for related scientific activities (RSA) should continue to be reported in the appropriate activity and performance sector spaces provided on the questionnaire.

Item 5. R&D grants and contributions - awards to organizations or individuals for the conduct of R&D and intended to benefit the recipients rather than provide the program with goods, services or information. These funds are normally identical to that portion of the budgetary "grants and contributions" line object of expenditure which is devoted to R&D activities.

Grants and contributions for related scientific activities (RSA) are to be reported in the appropriate activity and performance sector spaces provided on the questionnaire.

Item 6. Research fellowships - awards to individuals for advanced research training and experience. Awards intended primarily to support the education of the recipients should be reported as education support.

Item 7. Scientific data collection - the gathering, processing, collating and analyzing of data on natural phenomena. These data are normally the results of surveys, routine laboratory analyses or compilations of operating records.

Data collected as part of an existing or proposed research project are charged to research. Similarly, the costs of analyzing existing data as part of a research project are R&D costs, even when the data were originally collected for some other purpose. The development of new techniques for data collection is also to be considered a research activity.

Examples of scientific data collection are routine geological, hydrographic, oceanographic and topographic surveys; routine astronomical observations; maintenance of meteorological records; and wildlife and fisheries surveys.

Item 8. Information services - all work directed to recording, classifying, translating and disseminating scientific and technological information. Included are the operations of scientific and technical libraries, S&T consulting and advisory services, the Patent Office, the publication of scientific journals and monographs, and the organizing of scientific conferences. Grants for the publication of scholarly works are also included.

General purpose information services or information services directed primarily towards the general public are excluded, as are general departmental and public libraries. When individual budgets exist, the costs of libraries which belong to institutions otherwise entirely classified to another activity, such as R&D, should be assigned to information services. The costs of printing and distributing reports from another activity, such as R&D, are normally attributable to that activity.

Item 9. Testing and standardization - work directed towards the establishment of national and international standards for materials, devices, products and processes, the calibration of secondary standards and non-routine quality testing. The development of new measures for standards, or of new methods of measuring or testing, is R&D and should be reported as much. Exclude routine testing such as monitoring radioactivity levels or soil tests before construction.

Item 10. Feasibility studies - technical investigations of proposed engineering projects to provide additional information required to reach decisions on implementation. Besides feasibility studies per se, the related activity of demonstration projects are to be included. Demonstration projects involve the operation of scaled-up versions of a facility or process, or data on factors such as costs, operational characteristics, market demand and public acceptance. Projects called "demonstration projects" but which conform to the definition of R&D should be considered R&D. Once a facility or process is operated primarily to provide a service or to gain revenue, rather than as a demonstration, it should no longer be included with feasibility studies. In all demonstration projects, only the net costs should be considered. Examples of demonstration projects are the Spry Point Ark, the Geothermal Heating Project, Regina, and the Fluidized Bed Combustion System, P.E.I.

Item 11. Education support - grants to individuals or institutions on behalf of individuals which are intended to support the post-secondary education of students in technology and the natural sciences. General operating or capital grants are excluded. The activity includes the support of foreign institutions. Grants intended primarily to support the research of individuals at universities are either R&D grants or research fellowships.

Item 12. Museum services - the collecting, cataloguing, and displaying of specimens of the natural world or of representations of natural phenomena. The scientific activities of natural history museums, zoological and botanical gardens, aquaria, planitaria and nature reserves are included.

The activity involves a systematic attempt to preserve and display items from the natural world; in some ways it could be considered an extension of information services. Parks which are not primarily restricted reserves for certain fauna or flora are excluded. In all cases the costs of providing entertainment and recreation to visitors should be excluded (e.g. restaurants, children's gardens and nurseries).

If practical, resources of museums and like institutions devoted to other activities such as R&D or information services should be excluded from museum services and assigned to those activities.

When a museum covers not only natural history but also aspects of human cultural activities, the museum's resources should be apportioned between the natural and the human sciences. However, museums of science and technology which display man-made objects and also illustrate the operation of scientific "laws" should be considered as engaged in museum services in the human sciences.

Item 13. Administration of extramural programs - the costs of identifiable units engaged in the administration of contracts and grants and contributions for scientific activities that are to be performed outside the federal government. These expenditures should be broken down by the type of scientific activity supported, i.e. R&D or RSA.

Performers:

Item 14. Intramural includes costs incurred for:

- scientific activities carried out by in-house personnel of units assigned to the program;
- the related acquisition of land, buildings, machinery and equipment for scientific activities;
- the administration of scientific activities by program employees;
- the purchase of goods and services to support in-house scientific activities.

The intramural expenditures reported for scientific activities are those direct costs, including salaries, associated with scientific programs. These costs should include that portion of a program's contribution to employee benefit plans (e.g., superannuation) which is applicable to the scientific personnel within the program. Non-program ("indirect") costs such as the value of services provided by other departments without charge and accommodation provided by the reporting program are to be excluded.

Item 15. Canadian Industry - business and government enterprises including public utilities and government-owned firms. Industrial research institutes located at Canadian universities are considered to be in the university sector.

Item 16. Canadian universities - including affiliated institutes owned, administered or staffed by universities.

Item 17. Canadian non-profit institutions - charitable foundations, voluntary health organizations, scientific and professional societies, and other organizations not established to earn profits. Non-profit institutions primarily serving or controlled by another sector should be included in the controlling sector (e.g. the Pulp and Paper Research Institute is in Canadian Industry).

Item 18. Canadian provincial and municipal governments - departments and agencies of these governments. Government enterprises, such as provincial utilities are included in the Canadian industry sector, and hospitals in the Canadian non-profit institutions sector.

Item 19. Foreign performers - all foreign government agencies, foreign companies (including foreign subsidiaries of Canadian firms), international organizations, non-resident foreign nationals and Canadians studying or teaching abroad.

Item 20. Other performers - include provincial research councils, and individuals or organizations in Canada not belonging to any of the above sectors.

4. PERSON-YEARS

4.1 Intramural expenditure data should be supported by data on the person-years devoted to scientific activities by all the employees engaged in these activities.

4.2 Questionnaire page 4:

PERSON-YEARS ON INTRAMURAL SCIENTIFIC ACTIVITIES IN THE NATURAL SCIENCES

Department _____

FISCAL YEARS 1980/81 1981/82 1982/83

Program _____

CATEGORY	1980/81				1981/82				1982/83			
	A	B	C	Total	A	B	C	Total	A	B	C	Total
Executive												
Scientific and professional												
Administrative and foreign service												
Technical												
Administrative support												
Operational												
Military personnel												
Total												

KEY
A: Personnel engaged in R & D
B: Personnel engaged in related scientific activities
C: Personnel engaged in the administration of extramural programs

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4.3 Person-year - a measure of the time actually devoted to the conduct of science activities. An employee who is engaged in scientific activities for half a year has a person-year equivalence of 0.5. Personnel data reported should be consistent with expenditure data.

5. APPLICATION AREAS

5.1 The application areas listed on the questionnaire do not represent the full range of possible applications. They do, however, attempt to cover the major areas of current economic, political and technological interest. In many instances projects do have multiple applications and a department should assign its expenditures to the various applications consistent with the stated objective of the department. Care must be taken to avoid "double counting".

5.2 Please list on page 5 the total expenditures on scientific activities in each of the application areas. On page 6 please list only the expenditures for R & D activities in the application areas. On both pages distinguish between intramural and extramural expenditures.

EXPENDITURES ON ACTIVITIES IN THE NATURAL SCIENCES

TOTAL SCIENTIFIC EXPENDITURES IN THE APPLICATION AREAS*

Department _____

FISCAL YEARS 1980/81 1981/82 1982/83

Program _____

Application areas	1980/81		1981/82		1982/83	
	Intramural	Extramural	Intramural	Extramural	Intramural	Extramural
	($'000)					
1. Advancement of science						
2. Communications						
3. Culture and recreation						
4. Construction (Exc. housing)						
5. Developing nations						
6. Energy (within energy R&D panel) (a) Panel Funds						
(b) Departmental Funds						
7. Energy (Other)						
8. Environmental issues – Air						
9. Land						
10. Water						
11. Other						
12. Food – Agriculture						
13. Fisheries						
14. Others						
15. Health						
16. Housing and urban development						
17. Northern development						
18. Oceans						
19. Official languages						
20. Policy development						
21. Resources – Forestry						
22. Mineral						
23. Water						
24. Other						
25. Security – Domestic						
26. National defence						
27. Social development and welfare						
28. Space						
29. Transportation						
30. Other						
TOTAL EXPENDITURES						

*NOTE: EXPENDITURES LISTED ON THIS PAGE INCLUDE THE R & D EXPENDITURES

Item 1. Advancement of science - all research and development activities primarily intended to contribute to the general advancement of knowledge. This includes basic research which cannot usually be associated with a specific objective, although some may be directed towards broad fields of general interest.

Item 2. Communications - activities in support of the development and regulation of communication services, including tele-communications.

Item 3. Culture and recreation - activities related to the development and promotion of artistic, cultural, fitness, sport and recreational activities.

Item 4. Construction - activities related to general construction. Specialized construction is more appropriately considered under the relevant application such as agriculture or transportation.

Item 5. Developing nations - activities towards the economic, technical, educational and social development of developing nations.

Item 6 (a), (b). Energy (within the Energy R&D Panel) - those activities which fall within the mandate (definition) of the Interdepartmental Committee on Energy R&D should be distinguished between those funded by the Committee-6(a), and those funded from the department's A-Base - 6(b).

Item 7. Energy (other) - those activities not included in the mandate of the Interdepartmental Committee on Energy R&D.

Item 8-11. Environmental issues - activities aimed at preserving or restoring environmental quality, including scientific work on pollution but excluding medical aspects. For example, R&D on diseases caused by pollution should be reported under the health application. Whenever possible, those activities dealing with air, land and water should be reported separately.

Item 12. Food - agriculture - activities supporting the primary industry of agriculture. The S&T activities for resources such as water should be included under the resources application.

Item 13. Food - fisheries - activities supporting the fishing industry. The S&T activities for resources such as water should be included under the resources application.

Item 15. Health - activities related to the maintenance of the physical well-being of the population. S&T activities involving food such as nutrition and food contaminants should be included under this application.

Item 16. Housing and urban development - activities for the building and designing of houses and in support of the orderly and rational development of urban areas.

Item 17. Northern development - activities intended to advance the social, cultural, political and economic development of northern Canada. These activities are distinguished from other applications by the fact that their primary purpose is the development of the north. Socio-economic and certain other S&T activities of pipeline development specific to the north should also be included here.

Item 18. Oceans - activities related to investigations of the oceans and the development of ocean technology.

Item 19. Official languages - activities related to the status of the two official languages in Canadian society and their compliance with the Official Languages Act.

Item 20. Policy development - activities in support of general government functions, development of economic science and other policies for attainment of national goals.

Item 21 - 24. Resources - activities related to evaluation, development and management of national resources. Activities dealing with forestry, minerals and water should be separated. When a particular resource is studied because of its specific role in some other operation (e.g. water for agriculture or fisheries, or forestry for energy) the expenditures should be allocated to the primary application.

Item 25 . Security - domestic - activities related to the protection of the citizen's life and property.

Item 26. Security - national defence - activities related to the security of the State from foreign intervention and civil disorder.

Item 27. Social development and welfare - activities related to social problems which include, for example, social services, consumer protection, working conditions and manpower development.

Item 28. Space - activities related to investigations of the upper atmosphere and outer space. Exploration may be carried out by satellites, rockets and balloons, or by ground-based means such as optical and radio telescopes. The development of satellites for other applications such as telecommunications or mineral location should be reported under the appropriate applications.

Item 29. Transportation - activities in support of the development and regulation of transportation services.

Item 30 . Other - should be identified if more than one item and reported on separate sheet if necessary.

6. PROGRAM SUMMARY

6.1 The department or agency should summarize separately by program its total submission and identify that portion which represents expenditures on scientific activities.

6.2 Questionnaire page 7:

EXPENDITURES ON ACTIVITIES IN THE NATURAL SCIENCES
PROGRAM SUMMARY

Department _____

FISCAL YEARS 1980/81 1981/82 1982/83

Program _____

	1980/81	1981/82 ($'000)	1982/83
1. Total Program			
11. Operating			
12. Capital			
13. Grants, contributions and other transfer payments			
14. Receipts and revenues credited to the vote			
Net Expenditures (11 + 12 + 13 − 14)			
2. Program funds available for human sciences			
21. Operating			
22. Capital			
23. Grants, contributions and other transfer payments			
24. Receipts and revenues credited to the vote			
Net expenditures on human sciences (21 + 22 + 23 − 24)			
3. Transfers for human sciences activities[1]			
31. Total transferred into this program			
32. Total transferred from this program			
HUMAN SCIENCE FUNDS REPORTED (21 + 22 + 23 + 31 − 32)	2	3	4

[1]The amount and the names of the originating and recipient programs should be identified on a separate page.

[2]Must equal total expenditures, page 1.

[3]Must equal total expenditures, page 2.

[4]Must equal total expenditures, page 3.

Item 31. Total transferred into this program - payments received by the reporting program from other federal government programs for services rendered in scientific activities. These funds should be included in the reporting program's breakdown of expenditures on each page of the questionnaire.

Item 32. Total transferred from this program - payments to other federal government programs for the conduct of scientific activities. These funds should be reported by the recipient programs as transfers into their programs and should not be included in the reporting program's breakdown of expenditures on pages 1-5 of the questionnaire.