COLLECTION AND REPORTING OF SCIENCE AND TECHNOLOGY (S & T) STATISTICS IN SRI LANKA

by

T. C. Wijesinghe
National Science Council
of Sri Lanka

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1. INTRODUCTION

1.1 The development of Science and Technology (S & T) in Sri Lanka has been extremely slow. The bulk of the Research and Experimental Development (R & D) activities are restricted to a handful of institutions. The three main export crops tea, rubber and coconut have been traditionally well supported by three research institutions viz. Tea Research Institute (TRI), Rubber Research Institute (RRI), and Coconut Research Institute (CRI). The Ceylon Institute of Scientific and Industrial Research (CISIR), the Industrial Development Board (IDB) and the National Engineering Research and Development (NERD) Board are in charge of undertaking industrial research in the country, while medical research is centered around the Medical Research Institute (MRI). The agricultural sector is supported by research activities under the Department of Agriculture, with a number of research centres scattered around the country. The seven Universities are also centeres of R & D activity. A number of manufacturing corporations and departments in the public sector undertake limited R & D in areas such as fisheries, food preservation, ceramics, cement, paper, steel, etc. Almost the entire research effort is applied and development oriented and verylittle basic research is conducted.

1.2 The expenditure on R & D has had to be curtailed due to diversion of funds for urgent development projects, and a survey carried out by the National Science Council (NSC) has indicated that the expenditure on R & D was of the order of 0.2% of the GNP in 1975. In terms of manpower engaged in scientific and technological activities, the most serious problem has been the brain drain. The number of scientists and engineers in Sri Lanka in 1973 was estimated at 5.2 per 10,000 population, and a NSC survey now being carried out indicates that there has been an appreciable drop since 1973 (ref.1).

1.3 The community of active researchers is not larger than roughly 900 of whom 2/3 are senior research staff. The Manpower study referred to above also shows the extremely strong

dependence on foreign education at the post-graduate level. In some areas ("hard sciences") practically all senior acadamic teachers (lecturers, professors) have been Ph.Ds from universities abroad (the feature that also relates to the problem of brain drain). Also, the number of post-graduate programmes at the master level is limited, and only very few doctorates are produced in Sri Lanka universities. (ref. 2)

1.4 The science and technological policy for Sri Lanka was formulated and accepted only as recently as December 1978. The implementation of the Science & Technology Policy has been left to the respective Ministries and Departments in the public sector. However, there is no co-ordinated science and technology plan for Sri Lanka through which this policy could be implemented. Utilization of science and technology statistics for national planning is very limited. Surveys on Scientific and Technological Activities (STA) are generally carried out by the National Science Council of Sri Lanka. The Manpower Division of the Ministry of Plan Implementation also carries out appropriate surveys of Scientific and Technological Personnel (STP) for specific purposes. In the absence of an established pattern of collection and utilization of statistics on scientific and technological activities unique to Sri Lanka, the UNESCO recommendations have been adopted as much as possible. However, some efforts have been made to highlight national interests in these surveys.

2.0 CLASSIFICATION OF SCIENTIFIC AND TECHNOLOGICAL ACTIVITIES (STA)

Classification of survey data on Scientific and Technological Activities (STA) has been carried out as much as possible in accordance with the UNESCO recommendations. Further clarifications have been obtained from OECD resource materials. Classification of related activities have not been undertaken as they were excluded from the surveys.

2.1 Classification of Expenditure on Research & Experimental Development (R & D)

Expenditure on research experimental development was classified as follows;

(i) Gross National Expenditure on Research Experimental Development (GERD): Total Intramural Expenditure as capital and re-current by type of cost, sector of performance, type of category and field of science.

(ii) Capital Intramural GERD by sector of performance and type of cost.

(iii) Recurrent Intramural GERD by type of cost, sector of performance, type of activity, field of science and socio-economic aims.

(iv) Extramural GERD by funding organisation.

2.2 Classification of Scientific and Technical Personnel (STP)

Scientific and Technical Manpower excluding auxiliary personnel was classified as follows;

(i) Total stock of Scientific & Technical Personnel (STP)

(ii) Total stock of R & D personnel by sector of performance, objective category, geographical distribution, education and field of study, by research interest and area of activity and major socio-economic aims.

(iii) Total stock of R & D personnel by age, sex, & occupational structure, training, year of graduation and field.

(iv) Total number of research publications and communications.

3.0 SCOPE AND METHOD OF COLLECTING DATA ON SCIENTIFIC & TECHNOLOGICAL ACTIVITIES (STA)

The collection of statistical data of S & T activities (STA) was carried out in the form of two surveys. Viz.

(i) Survey of expenditure on Research & Development (R & D)

(ii) Survey of Scientific and Technical Personnel (STP)

The two surveys were planned independently, even though the actual data collection and visits to institutions were undertaken simultaneously for economic reasons. The recent R & D

survey covered a period of ten years (1966-75). The volume of data to be collected restricted the depth of the studies. Collection of data on related activities was abandoned due to limitations in manpower available for the survey.

The latest Scientific & Technical Personnel Survey (analysis still incomplete) was for the period 1977/78. In this survey only Scientists Engineers and Technicians (SET) were included, and Auxiliary personnel were excluded.

3.1 Scope and method of the R & D survey

R & D survey was for the purpose of identifying the total expenditure incurred on Research & Experimental Development to the nearest approximate in the following areas;

(i) Intramural R & D expenditure by type of cost, by activities, by sectors and by major fields.

(ii) Extramural Expenditure by source of funding.

The survey was carried out in a number of stages as summarised below;

3.1.1 The initial stage or the preparatory stage consisted of a literature survey followed by the identification of the scope of the survey. Formulation of concepts and definitions was undertaken according to UNESCO recommendations. Clarification of certain concepts were made with reference to OECD publications.

3.1.2 The second stage or the preliminary data collection stage, involved the listing of organisations and institutions conducting or probably conducting R & D. These were obtained from the respective Ministries and from publications such as directories. Data collecting sheets were prepared and tested out by undertaking a few trials. This stage also involved the extraction of data and other information in regard to the research activities from Annual Reports, Government estimates and appropriation accounts.

3.1.3 The third stage consisted of personal investigations for the purpose of extracting information regarding expenditure. Supported by the preliminary data collected, the listed institutions were visited. Discussions were held with the Head of each institution to determine the objectives, functions and current and past research programmes.

Subsequently, the Accounts Division was visited and the Accountant was consulted for the purpose of understanding the pattern of recording of expenditure. The concepts and definitions that were adopted were explained using illustrations to clarify difficulties. The data in hand provided a valuable starting point. Care was taken to exclude items of expenditure such as depreciation of capital assets, expenditure on printing and publications, publicity, seminars and conferences etc.

Whenever possible detailed divisional expenditures were recorded. Clarifications whenever required were obtained from the respective divisional Heads and subsequently the data was edited.

3.1.4 The fourth stage or preliminary analysis of data was completed during the survey period itself. Items of expenditure of a uncertain nature were clarified after discussion by the team of investigators.

3.1.5 During the fifth and final stage the collected data was analysed and totaled for presentation in the final report.

3.2 Scope and method of the STP survey

The survey of scientific and Technical personnel was carried out for the period 1977/78 for the purpose of obtaining quantitative and qualitative information on the stock of scientific and Technical manpower in the country. The areas covered included the following;

(i) Total stock of Scientists, Engineers and Technicians (SET)

(ii) R & D personnel only by sector of performance, field, level of education and training, area of activity and geographical location.

3.2.1 The first stage consisted of a literature survey followed by the formulation of concepts and definitions according to UNESCO guidlines.

3.2.2 The second stage involved the listing of Ministries, organisations and institutions in both the public and the private sector. Lists of scientific and technical personnel in these institutions were obtained

by postal inquiries and were followed up by visits whenever so required.

3.2.3 In the third stage a questionnaire was prepared for the collection of data. The revision of the questionnaire was carried out after discussions with persons from various professions and institutions.

3.2.4 The administration and collection of the completed questionnaire constituted the fourth stage. This was accomplished in a number of ways. Whenever possible Heads of institutions were requested to nominate an officer to be in charge of distribution and collection of questionnaires. This officer was briefed on the concepts and definitions used. Another method used was the mailing of questionnaires directly to each person, followed by an appeal to the Head of each institution to request his employers to co-operate. At the same time wide coverage was given to the survey in both the newspapers and the radio. Persons who had failed to receive questionnaires were requested to call for them.

3.2.5 Those who failed to reply were sent reminders. The Heads of institutions were given telephone calls and several reminders were broadcast over the radio. A fresh set of questionnaires were sent to some institutions which had a poor response rate.

3.2.6 The response up to the fifth stage were analysed to identify institutions from which the response was poor and grouped according to priority. Personal visits to these institutions were carried out and

questionnaires were completed. The coding of data for computerization continued side by side with data collections.

3.2.7 The data was computer processed and the following reports are being prepared.

(i) Directory of Scientific and Technical Personnel (STP) of Sri Lanka

(ii) Directory of Medical Personnel of Sri Lanka

(iii) Report on the Survey of Scientific and Technical Manpower of Sri Lanka

4.0 PROBLEMS AND LIMITATIONS OF THE SURVEY

4.1 Some constraints encountered in the conduct of the R & D Survey

4.1.1 The problems encountered in the collection of data differed from institution to institution. In most institutions the recording systems of financial expenditure do not facilitate the separation of R & D activities from related activities i.e. the accounting system has not been designed for the separation of R & D expenditure. In order to make allowance for these differences in the accounting systems, items that were easily identifiable as being outside the R & D activities were excluded. The percentage of related activities were estimated by consultations with the Head of the institution and the divisional Heads. This procedure injects a certain amount of

subjective errors, but prevents a gross over estimation. This method proved to be useful in institutions where the R & D activities had commenced fairly recently. In most such cases the initial period of an R & D programme consisted of routine testing and quality-control. Such expenditure however, was accounted for under R & D.

4.1.2 In a number of institutions, funds for research were obtained from non-research and quasi-research sources and was rather difficult to identify. In such cases only actual expenditures which could be identified were recorded. Whenever actual expenditure items such as salaries, were not specifically recorded the number of persons involved in R & D work was recorded and their salary component worked out subsequently.

4.1.3 There were wide differences in the accounting practices of various institutions. Some institutions were used to programme budgeting and some had evolved a decentralised system of budgeting. In such cases these separate units had to be visited in order to identify R & D expenditure.

4.1.4 There were also wide differences in regard to financial years. The financial year in a majority of institutions was from October to September until 1972 and subsequently changed to the calendar year. However, some organisations continue to follow April to March of the next year as their financial year.

4.1.5 The survey covered a total of ten years and as such officers detailed to furnish data were not acquainted with the history of the institution and could not provide certain clarifications. In such instances published research papers and annual reports had to be referred to. However, even this did not give a true reflection of past activities.

4.1.6 Expenditure appearing in annual reports usually reflect the programmes falling within the budget of the institutions. No records were available in regard to research funds received by individual scientists directly from foreign agencies. Capital expenditure especially in the form of equipment could not be identified in the higher education sector ie. the universities.

4.1.7 Considerable difficulties were encounted in distinguishing between industrial development work that could be considered to be of scientific value, and thus qualify for inclusion under R & D, and work of a routine and commercial nature. Considerable subjective judgement was required in order to separate expenditure on experimental development and actual commercial production.

4.1.8 Most research projects were of a multi-disciplinary nature and as such separation of expenditure into the respective fields was not straight forward. In such cases knowledge derived from annual reports and discussions

with the officers of the institutions provided a subjective basis for separation of expenditure into the respective fields.

4.1.9 Classification of institutions by sector was also an area of difficulty. Some organisations could easily qualify under more than one sector. This was especially true in the case of the general service sector and the productive sector.

4.2 Difficulties encountered in the conduct of the STP survey

4.2.1 There are numerous difficulties encountered in undertaking a survey of this nature. One of the basic problems is the lack of a tradition of collecting and reporting scientific and technological data, in the country. There are also no definite plans for the utilisation of data in National Science Planning. This makes it difficult to justify to various individuals the importance of the survey, and as to why they should respond. The lack of interest in a survey of this nature is further aggravated by the fear among many qualified persons that the data collected will be used against them to restrict their travel abroad. Thus an effort had to be made to inform the scientific and technological personnel that this data would be used only for Science and Technology Planning.

4.2.2 Obtaining a complete list of personnel working in various organisations proved to be difficult. In many cases a complete list of persons employed

by each organisation with a number of outstation officers was not readily available. Thus a number of divisions had to be contacted in order to obtain this information which should have been available, at the respective Ministries or Head Offices.

4.2.3 Another fact which may have seriously affected the data collected was the long duration over which the survey was conducted. Sri Lanka, faced with a massive problem of 'brain-drain' is loosing scientific and technological personnel continuously. At the same time there are many internal transfers from one organisation to another. Thus the long time period taken for the completion of the survey resulted in the up dating of lists of persons a number of times. This could be solved by ensuring the rapid and complete collection of data by personal visits to institutions by a team of trained data collecters. The lack of a trained team of data collecters was yet other obstacle in undertaking this survey. This could only be solved by a greater national committment to the collection of scientific and technological data and the allocation of adequate resources in terms of manpower and funding.

4.2.4 The survey was not originally designed for computerisation. As such many problems were encountered in computerisation. Many

of these were due to questions which required a certain amount of subjective judgement in classifying. Another problem was the inclusion of many open ended questions. At the same time no computer facilities or computer personnel are available at the National Science Council for undertaking the survey. The reliance on external facilities and personnel has not proved to be satisfactory and has led to many delays.

4.2.5 Difficulties arose in calculating full-time equivalent of scientific and technological personnel. The calculation of work output into research and related activities depended on the judgement of the individuals. This may have led to an over-estimation of the time spent on research activities. There is no clear cut demarcation line between research activities and other activities.

5.0 RECOMMENDATIONS

5.1 In a developing country such as Sri Lanka, utilization of data on Scientific and Technological Activities (STA) for national science and technology policy making and planning, is relatively underdeveloped. This has invariably made S & T data collection a low priority area with little national impact. It is proposed that UNESCO undertakes to conduct training courses on the utilization of S & T statistics at the national level.

5.2 It is also recommended that UNESCO extends support for the setting-up of national centres for undertaking science and technology policy studies. This would ensure a regular supply of S & T statistics to UNESCO.

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REFERENCES

1. Sri Lanka National Paper, UNCSTD, 1979.
2. S. Schwarz : Development of Scientific and Technological Information Services, Sri Lanka, UNESCO, 1979.
3. Country Report, UNESCO Seminar on Management of R & D Institutions 1-10 August 1976, Bangalore, India.
4. Science Policy Studies Report No. 1 : A survey of Expenditure on Research and Experimental Development in Sri Lanka, 1966-75, National Science Council of Sri Lanka.
5. Directory of Scientific and Technical Personnel, National Science Council of Sri Lanka, 1977-78.
6. Directory of Medical Personnel, National Science Council of Sri Lanka, 1977-78.
7. Recommendations concerning the International Standardization of Statistics on Science and Technology, UNESCO, Paris, 1978.
8. Draft classification of R & D Activities by objective, Office of Statistics, UNESCO, Paris, 1977.
9. Development in Human and Financial Resources for Science & Technology, Office of Statistics, UNESCO, Paris, 1978.
10. R.O.B. Wijesekera : Scientific Research in a Small Developing Nation - Sri Lanka, CISIR, 1975.
11. Directory of Scientific and Technical Institutions in Sri Lanka, National Science Council of Sri Lanka, 1976.
12. Statistics on Science & Technology, UNESCO Statistical yearbook, 1975.
13. Preliminary report on the Field Survey of Manufacturing Industry in Sri Lanka 1975/76, Ministry of Industries & Scientific Affairs, Sri Lanka.

14. CASTASIA Final Report, UNESCO, 1968.

15. The Measurement of Scientific and Technological Activities, UNESCO, 1969.

16. Jean - Claude Bochet : The Statistical Measurement of Scientific and Technological Activities related to Research and Experimental Development, Feasibility Study, UNESCO, 1977.

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