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RESEARCH AND ANALYSIS WITHIN A STATISTICAL SERVICE

by

The Central Bureau of Statistics of Norway

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This paper was prepared at the request of the Conference of European Statisticians for discussion at its twenty-sixth plenary session in Geneva, 26-30 June, 1978.

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RESEARCH AND ANALYSIS WITHIN A STATISTICAL SERVICE

A DISCUSSION PAPER

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I. INTRODUCTION

1. The principal task of a statistical service must be the production of official statistics: To collect micro-data, to process them into macro-data, and to make the results available to various types of users. Research in statistical methodology and, in most countries, also a certain amount of analysis of the statistical output, have always been considered necessary elements in the production process. However, it has been increasingly realized that there are reasons why a statistical office may wish to systemize and broaden its engagement in research and analysis beyond traditional practice. In particular, it is being argued that analysis of statistics should be undertaken to a greater extent than hitherto and engaged in by statistical services as a regular activity, supplementary to that of the production of statistics.

2. Broadly speaking, the case for more research and analysis is based on two groups of consideration:

- The first has to do with the numerous beneficial feed-back effects which engagement in research and analytical work may have, directly and indirectly, for the quality of statistics.
- The second bears on the type of output for which a statistical office should aim: Statistics are not collected for their own beauty but in order to be used, and analysts in a statistical agency may be particularly effective for many types of analyses.

To the extent that these considerations are valid, the real issue is not whether a statistical agency should at all engage in research and analysis, but rather what kind of research and analysis it should undertake and how much.

3. The answer to this question of what and how much is unlikely to be the same in all countries. It will, for instance, be different in centrally planned economies of Eastern Europe from what it is in the market economies in the West. One reason for this is that the statistical services of the

centrally planned economies are charged with certain functions, partly of an analytical kind, which are unknown to the statistical services of the market economy countries. Even among the latter the right answer will probably not be the same everywhere. One important consideration is likely to be the size of the country: A large country, with a great research potential, may well afford to set up numerous research centers with overlapping research programs; for instance, there may be several research centers within a large country which engage in analyzing current economic trends. A small country, with limited funds and - even more important - a limited number of qualified statisticians, economists, sociologists, etc., cannot afford such a luxury: She must pay more attention to priorities and seek a concentration of resources on a limited number of centers. To this effect, several alternative arrangements may be about equally efficient. Since the statistical service already exists and has the data needed, it may well be deemed appropriate to charge it with some analytical work, in addition to its principal task of producing statistics.

4. In this paper we are restricting ourselves to a discussion of the problems facing the statistical services of the Western market economies. While conditions may differ considerably from one country to the next even within the West, it is probably true that all statistical agencies, to the extent that they consider engaging themselves in research and analysis, will have to choose from a common list of potential fields of research. This may serve as a useful take-off point for discussion and has dictated the lay-out of the paper. We shall start by reviewing some fields of research and analysis, which we think should be of potential interest to statistical agencies, making a distinction between methodological research (Section II) and substantive analysis (Section III), in the latter case distinguishing further between economic analysis and socio-demographic analysis. Having gone through this list, we set out some observations on priorities (Section IV). Finally, answers are suggested to the questions of what and how much, drawing heavily on Norwegian experiences (Section V).

5. One word on terminology may be in order at this stage: We see no need here to be philosophical about the precise meaning of the terms "research" and "analysis", or what the difference is between the two. Nor is it important to state exactly where the borderline goes between the production of statistics on the one hand and research and analysis on the other:

We all know that the advancement of knowledge is an integrated, iterative process involving problem-formulation → observation → interpretation → theory → problem-formulation, etc., in a never-ending chain; in this process the production of statistics (fact-finding) and research and analysis both play their parts. Our approach is a pragmatic one. We shall mean, in a rough-and-ready way, that the production of statistics starts with the collection of micro-data and ends with the dissemination of statistical macro-data. The two terms research and analysis are used in conformity with a terminology used on earlier occasions by the UN Statistical Office. In this terminology "research" applies to methodological work undertaken in relation to the process of providing statistical information, and "analysis" applies to the efforts of deriving substantive knowledge from the statistics produced. Hence the basic distinction in this paper is between "methodological research" and "substantive analysis".

II. POTENTIAL FIELDS OF METHODOLOGICAL RESEARCH

6. We may divide the methodological research into the following six main fields:

- Research into the theory and practice of the design of sample surveys.
- Research into the measurement and control of non-sampling errors.
- Research into statistical methods for analyzing data.
- Research into the development of generalized computer processing systems.
- Research into a methodology to control statistical disclosure.
- Other potential fields of methodological research, including design of statistical investigations.

7. For quite some years many statistical agencies have been able to benefit greatly from the theory of sampling. In the 1930's sampling was more an art than a science, but in the 40's and the 50's the theory and practice of sample survey design was developed to become a power-full tool within most statistical agencies. Recently, new approaches to the theory of sampling have been suggested. These approaches have not yet proven to be of practical use in the production of official statistics, but some of them seem to be sufficiently promising to deserve attention from persons involved in methodological research within statistical agencies. In Norway we have as an example used a time-series model when estimating employment and unemployment from Labour Force Surveys.

8. Parallel with the development of sampling, statisticians became aware of the impact of non-sampling errors, and the first papers on sampling theory were quickly followed by attempts to measure the impact of certain components of non-sampling errors: In the 1940's attempts were made to find efficient techniques for removing the non-response bias. Later a model was established for the combined effect of sampling and non-sampling errors which aimed at finding the optimal balance of the two components of the total mean square error. Today there is general agreement among statisticians that while it is difficult to develop formal models for solving the resource allocation problem, the systematic use of information pertaining to response and non-response errors and to cost components permits rendering surveys more efficient, as well as improving resource allocation in the long run. Research should therefore be made into statistical errors, including response and other reporting errors, biases of surveys and censuses.

9. After data are collected, edited and ready for processing, descriptive tables are usually produced as quickly as possible. In addition, the data may be analyzed by means of mathematical statistical models. Some use of time-series models to eliminate seasonal variation is common in many statistical offices, but very few agencies have been able to benefit from other methods of analyzing data developed within the theory of statistics. This is particularly regrettable as many agencies today have facilities making it technically simple to analyze very large amounts of data. In order to benefit from these possibilities, it is necessary to make research into methods such as contingency table analysis, path analysis, regression and variance analysis, and other similar fields.

10. Since 1890 when the tabulating machine had its first large-scale application in the census in USA, the technological development in the production of statistics has been revolutionary. In the future influence of computers and computing technology on the national statistical services will be profound and cause far reaching changes in the role, functions and operations of these agencies. Today it seems that the ultimate objective will be the formation of a national data base which will contain, or have accessible to it, all data that the society deems necessary in its statistical system. Such a data base will be a logical rather than a physical concept. The definition of the scope, content, coverage and comprehensiveness of the data base, as well as decisions on its organizational, administrative and physical

organization, are immediate and urgent tasks for statistical agencies. This work should be done by computer specialists in cooperation with statisticians so that the results will be meaningful for both categories.

11. The phenomenon of statistical disclosure has lately received great public concern, and as a consequence statisticians have been looking for methods to prevent inadvertent publication of confidential micro-data. The problem is not new, but the change that has taken place with respect to the volume and detail of statistics produced, has served to enhance the public concern about statistical disclosure. To control disclosure, statistical offices must carefully scrutinize their publications. This task has never been easy and straightforward, but now that computers have become such a powerful tool in the hands of both users and producers of data, the magnitude of the confidentiality problem has become seriously larger, and the need for the development of mass production methods of checking for disclosure is evident.

12. We believe that the larger majority of potential fields of methodological research can be classified under one of the five first categories mentioned in paragraph 6 above. However, some important potential fields do not fit in, and among these, two may be mentioned: The present concern for problems in relation to environment and energy has created a demand for statistics in fields which are comparatively new to statistical services. This may well give rise to new methodological problems. Secondly, there is a need for further research within the field of record linkage and other methods of utilizing the information potential of stored micro-data; for instance, there is a need to explore the extent to which information traditionally collected through population and housing censuses may instead be extracted from regularly updated data files.

III. POTENTIAL FIELDS OF SUBSTANTIVE ANALYSIS

A. General Considerations

13. As already mentioned, some analysis is a necessary element in all statistical work. During the planning of a statistical inquiry decisions must be made on the questions to be asked, on definitions and classifications to be used, on the format and lay-out of tables in order that they shall

bear on relevant issues. At various stages of the processing of the data, judgements must be made on whether the results up to that stage make sense, and this frequently involves systematic probing of the consistency of the data. Such probing becomes particularly critical at the final stages prior to publication. Further analysis is called for when publication of results takes place. Numbers, even if reliable and valid, are usually not enough to convey information to the public. Some verbal presentation of highlights is also needed. Press releases may be issued which explain, in simple terms and mostly without tables, the most interesting findings. In other forms of publication, where the results of statistical inquiries are published in the form of tables, some verbal description of the content may also be desirable. However, since the writing of such descriptions necessarily takes time and causes delay in the publication of the figures, many countries restrict their verbal comments to a minimum, or delete them completely. This has created the need for a further category of analysis, namely the writing of monographs on specific topics (income, fertility, emigration, etc.) involving a synthesis of large masses of data, and perhaps covering many years.

14. The types of analysis referred to above, be they press releases, written commentaries in statistical publications, or monographs, are mostly of a descriptive nature. They will not be much discussed in what follows, since they are already established elements in the work programs of most statistical services. Our main concern is whether a statistical agency should aim beyond mere descriptions and engage itself also in explanatory analysis and, if so, what kind of problem areas could be covered.

15. The potential fields of analysis open to statistical services are many; they span, like the statistical system itself, over virtually all aspects of economic and social life. In what follows some of the more obvious candidates are listed together with brief indications of purpose and typical projects under each heading. In the interest of organization a distinction is made between economic analysis and socio-demographic analysis even though the borderline between the two is not sharp.

B. Economic Analysis

16. Current Economic Trends

Purpose: Information base for formulation of short-term economic policy. Demand management. Reports to business enterprises and the general public on current economic trends.

Typical projects: Publication of monthly or quarterly business cycle reports and annual economic surveys. Systems of cyclical analysis. Occasional studies of topics of current interest. In-depth studies of the structure and functioning of the national economy, such as: Historical studies of the business cycle; the problem of cyclical stock movements; interrelationships between quantity and price variables; ties with the world economy, especially trends and fluctuation in imports and exports. Development of quarterly dynamic models.

17. Economic Growth

Purpose: Information base for the formulation of a national policy for economic growth and structural changes. Reports to business and the general public on long-term economic trends, nationally and internationally. Teaching material for higher education.

Typical projects: Extending the national accounts series backward to earlier decades. National wealth. Factors of economic growth, including studies of macro-economic production functions. Productivity. Economic and social trends as associated with growth. International comparisons of the growth process. Economic history. Possibly: Projections of long-term trends (futurism).

18. Distribution of Income and Wealth

Purpose: Information base for a variety of social and economic policy decisions: Income policy, taxation policy, social relief policy, etc. Provision of organized data files for related fields of research: Consumers' behaviour, macro-economic models, taxation research.

Typical projects: Continuous analysis, based on national accounts data, of developments (trends and cyclical fluctuations) in functional income shares, by industry. The interrelationships between functional and personal income distributions. Continuous monitoring of changes in the distribution of personal incomes. The problem of poverty. Theoretical models to explain the distribution of income and wealth by person/household. Effects of taxation

on the distribution of income, including studies of how changes in tax rules, actual or proposed, will affect persons/households with different characteristics.

19. Prices. Wages. Inflation

Purpose: Analyses of the processes of wage and price formation, and their effects on income distribution. Study of the causes and process of inflation. Theoretical and empirical base for the formulation of price and income's policies. The formulation of wage and price relations for inclusion in numerical economic models.

Typical projects: Development of an integrated set of price indicators. Study of the price formation policies of business and the wage determination process, including role of "wage drift" and foreign competition. Formulation of wage and price relations for economic models. Study of causes and effects of inflation.

20. Foreign Trade

Purpose: Gaining insight into the determinants of imports and exports and the interdependence of the national and foreign economies. Effects of changing relative and absolute level of prices on imports and exports, on the terms of trade, and on the trade balance.

Typical projects: Publication of periodic studies of foreign trade, market shares, etc. Studies of determinants of demand for imports and exports, and factors affecting supply conditions of exporters. Determination of price and income elasticities of exports and imports, lag structure of the adjustment processes, and influence of cyclical factors. Role of select foreign trade partners. Special aspects of trade with developing countries.

21. Regional Analysis

Purpose: Information base for regional decision-making both at central level and in the regions and for the formulation of regional development plans. Determination of regional effects of national policies.

Typical projects: Development of regional national accounts. Determination of proper choice of regions. Study of center-periphery interrelationships. Development of regional models, reflecting the characteristics of various regions. Assistance in preparation of regional development plans.

22. Environment.

Purpose: Information base for an environmental policy. Analysis of the impact of human activity on the environment, including problems of waste disposal and externalities connected with production and consumption.

Typical projects: Development of a system for resources accounting. Development of models incorporating the production of waste. Study of alternative methods of waste disposal and of the extent and consequences of externalities. Development of methods requiring decision-making units to take into consideration the externalities associated with their actions.

23. Development and Use of Numerical Economic Models

Purpose: Construction of models to be used as instruments in economic forecasting and in the formulation of economic policy

Typical projects: Experiments with alternative model formulations. Development of various models for different fields. Systems of models. Keeping the models updated and ready for use at any time. Applying the models for studies of current economic problems, and for economic forecasting. - Economic model-building will have to borrow its inputs (in terms of theory, parameters and data) from the above listed projects and from the literature.

C. Socio-demographic Analysis

24. Demographic Trends

Purpose: To establish synthetic measures of demographic phenomena, in order to convey a deeper insight in past and current trends than that which follows from standard tabulations and indexes. Interpretation and commentaries on tendencies. To identify and quantify explanatory factors behind changes in demographic parameters.

Typical projects: Organization of registers and data files; meaning and characteristics of demographic indexes; alternative and optimal ways of describing given phenomena. Studies of fertility, mortality, nuptiality, mobility, etc. Longitudinal studies of fertility and differential fertility, by educational level, income, labour force activity, region, etc. Mortality, trends and differentials by occupation and other social characteristics. Testing hypotheses about functional relationships between demographic and other variables. Studies of motivational factors behind fertility, nuptiality and migration.

25. Social Trends

Purpose: To describe and interpret past and current trends in phenomena such as labour force participation, education, health, criminality, etc. Description of social processes, attitudes and perceptions of living conditions.

Typical projects: Trends and morbidity; morbidity analysis in analogy to mortality; hereditary and contagious ailments, etc. Possibly combinations of characteristics: Fertility, education, labour force participation, etc., see 24. Perceptions of class, social success and frustrations. Explanatory analysis of social phenomena.

26. Demographic Projections

Purpose: To project or forecast demographic phenomena.

Typical projects: Comparative studies of the comportment in time of alternative indexes referring to the same phenomenon. Application of alternative methods of time-series analysis and extrapolation to demographic data.

27. Methods in Demographic and Social Measurement

Purpose: To develop and test methods of processing and interpreting raw demographic data. To develop meaningful and operational indexes of social conditions.

Typical projects: Graduation of age-specific rates of fertility, mortality, etc. Development and testing of new synthetic measures of demographic phenomena. Development and implementation of a System of Social and Demographic Statistics (SSDS). Development and registration of social indicators. Statistical methods for social analysis.

28. Model-Building for Demographic and Social Phenomena

Purpose: To develop numerical models in an effort to make better projections of demographic and social phenomena, taking into account expected changes in social, economic and political conditions which influence the variables to be forecasted.

Typical projects: Models for population projections by sex, age and marital status for the country as a whole and for regional subdivisions. Fertility, marriages and migrations linked to social and economic variables. Models for the supply of labour, possibly specified by qualification and region. Models for education and distribution of the population by level of education. Models for prevalence and spread of diseases.

29. The various fields of analysis listed in the preceding paragraphs differ in their requirements for resources. While some of them may not be too demanding, others cannot be successfully undertaken until one has assembled a well qualified staff and established a good analytical milieu. This applies in particular to the construction of numerical models for the analysis of economic, social and demographic phenomena. Yet this is a task in which the statistical service has a definite comparative advantage due to access to and experience in handling large bodies of data. The construction of numerical models may well serve as a challenging long-term target, and as a guide in the choice of immediate projects, when a statistical agency decides to extend its activities in the direction of explanatory analysis.

IV. THE DECISION TO BE TAKEN: WHAT AND HOW MUCH

30. The preceding sections have shown that there is a very wide range of topics for research and analysis in which a statistical agency could usefully engage. The following questions therefore arise: How extensive should such an engagement be? Are there criteria which help single out topics in which it may be particularly fruitful or appropriate for a statistical agency to engage?

31. Questions about "what" and "how much" probably do not have answers which are universally valid. Rather, the right answers will depend on local conditions, including the availability of qualified personnel, and the extent to which economic and socio-demographic analysis is conducted elsewhere, at universities and other research institutes. Where many centers for applied economic and socio-demographic research exist, as will often be the case, it would seem, as a general rule, that each center ought to develop its own specialized area of competence. Such a division of labour between research centers would appear to be particularly important in a small country with more limited resources in order to avoid duplication and at the same time ensure expertise in the main analytical areas.

32. To the extent that the choice is between methodological research on the one hand, and economic and socio-demographic analysis on the other, it would seem obvious that priority ought to be given to methodology. As already indicated, a minimum of methodological research is a prerequisite for reliable and efficient production of statistics, and should be a basic requirement for any

statistical agency. Two reasons present themselves. First, the distance is generally short from methodological research to fruitful practical applications of results achieved in the daily production of statistics. And second, there is the well-known gap between theoretical statistical formulations on the one hand and the application of statistical methods to concrete problems on the other.

33. Methodological research should aim primarily at increasing the efficiency of the different work operations involved in the production of official statistics. Here the term "efficiency" is broadly defined: e.g. it includes the concept of reliability / cost trade-offs, evaluation of survey errors and their components, dissemination of information about the reliability of statistics and the methodology used in compiling them, etc. The following areas of work should be well suited for a unit for methodological research:

- Development of standard definitions and classifications in order to ensure that data from different sources will be consistent and compatible; this is particularly important when administrative data are used for statistical purposes.
- Work aiming at finding an "optimal" allocation of resources on the work operations; this implies i.a. identification and estimation of errors introduced in the different work operations involved in the production of statistics.
- Development of practical interactive systems to allow statisticians to store, retrieve, and analyze data without the intervention of a programmer.

The work on optimal allocation of resources entails fields like design of questionnaire, work to reduce non-response, evaluation studies, design of surveys, comparing different estimation methods, etc. The choice of areas where research should be concentrated will have to depend on our evaluation of which areas have the largest potential for future improvements.

34. In order to keep methodological research in contact with the development within statistical theory, a close liaison should be established between the statistical agencies and the academic statisticians. At present, there exists in most countries a wide gap between these two categories of statisticians. To close this gap statistical agencies should take the initiative to improve the co-operation with statistical theorists in order

to take more advantage of the existing statistical theory and to stimulate further theoretical advance in fields which are of particular interest to official statistics. One way of improving the co-operation with the academic statisticians is to have a separate group within a statistical agency composed of members with a strong background in theoretical statistics and interested in applications on problems related to the production of statistics. There are also several other ways in which co-operation can be improved, such as employing leading academic statisticians as temporary members of the methodological staff, hiring them as consultants and as research advisers, employing promising graduate students and allowing them to write their thesis on problems related to their work, permitting own staff to do part-time lecturing at universities, etc. However, a further discussion of this is beyond the scope of this paper.

35. When selecting areas of analysis in which to specialize, it seems natural for a statistical agency to have in mind the unique advantages which it possesses as a producer of statistics: Easy access to a large and varied body of data and equipment, and experience necessary to handle it. The following fields of analysis would seem particularly well suited for a statistical agency:

- analyses requiring simultaneous use of data from many areas of statistics,
- analyses requiring a detailed knowledge of the data (coverage, reliability, etc.),
- analyses requiring capability for large and complex numerical/statistical computations,
- analyses requiring large bodies of data,
- analyses requiring access to data subject to confidentiality, and the linking of such data files,
- analyses, where the feed-back effects to data production may be expected to be considerable.

In the area of economic analysis, it is natural therefore that the statistical agency should utilize fully its comparative advantage by concentrating on topics requiring the national accounts as their main body of data. By the same criteria, socio-demographic analyses ought to concentrate on areas requiring extensive use of data relating to individuals - possibly in linked form - from population and social statistics. This is particularly the case in countries where the statistical service has responsibility for maintaining a central population register and where the need for confidentiality may give the service a virtual monopoly on certain uses of the information contained in this register.

36. Circumstances exogenous to the statistical agency would often seem to be an important factor in determining the content of its analytical program. One would, for example, have to take into consideration work already in progress at other research institutes with a view to avoiding duplication. Also, the interests and qualifications of the available staff will influence the choice of topics. Furthermore, it is incumbent upon the statistical service to consider the needs which the society has, in various fields, for new awareness and new knowledge. A statistical agency cannot permit itself the luxury of doing analyses for its own sake: An expectation of productive and concrete results, at least indirectly or in the long run, is implicit in the allocation of funds to explanatory analyses at the statistical agency. Occasionally, the agency may be mandated by political authorities to conduct analyses in a specified area. Even when such directives are not forthcoming, the agency should give priority to projects which are likely to give useful results within a reasonable span of time. This requires a certain ability to understand the needs of the society, to predict which problems will be in the political focus in the near future, and to evaluate realistically which problems might benefit from analyses.

37. A statistical agency should, as a general rule, concentrate on analyses with a strong empirical bias, leaving the basic theoretical research to other institutions, particularly the universities. Both such a rule should not be too strictly enforced. Within the fields of speciality chosen, it would seem desirable, and perhaps even a pre-requisite for progress, that some staff members have knowledge reaching to the frontiers of current theoretical research. If such staff members occasionally are provoked by some theoretical problems, then work on this should be permitted, even though the work does not necessarily hold promise of giving immediate practical results.

38. A separate question is, to what extent should a statistical service engage in research and analysis at the international level, for example, by participating in international projects? International co-operation appears particularly promising in the field of methodological research where many problems are common to most statistical services. It would seem, therefore, that such co-operation should be encouraged and that it will be in the interest of national statistical agencies - in particular in countries with small resources - to engage activity in international work. The answer is not so obvious when it comes to analytical work. One consideration is that many

international analytical projects are feasible only if the national statistical services do participate; this imposes certain obligations on each country towards the international community. Furthermore, such a co-operation with research centers in other countries, or at international agencies, is likely to provide the national service with valuable impulses. On the other hand, assistance to international analytical projects often requires the effort of highly qualified staff members, and may represent a heavy burden on a small country. There are likely to be so many important, unsolved research tasks at the national level that a small country may well find it necessary to avoid engaging itself too deeply at the international level. - However, a statistical agency engaging in analysis in certain fields should feel an obligation to keep abreast with research in these fields at the international level in order to relay quickly results to the domestic milieu.

39. The question of "how much" remains. It is not possible to suggest an answer to this except to point out the obvious, namely that there is a lower limit which must be surpassed if an analytical unit is to be viable. Quality of staff is in this respect more important than quantity since research centers are not judged by the mass of their output but by the quality of their best pieces of work. In fact, given high-quality leadership, a group of no more than, say, 5-6 analysts, working with the backing of other units of the statistical agency, may be able to achieve valuable results. On the upper side the corresponding limit is, of course, still more flexible. It will depend chiefly on the breadth of the research program which the statistical agency wishes to adopt.

40. Without it having been explicitly stated, it has been assumed above that the types of research and analysis discussed in this paper in the main will have to take place within units especially organized for this purpose; only in that way can one hope to build up the competence needed, and to create a milieu which is stimulating and prestigious enough to attract quality staff. However, such specialized units should work in close co-operation with subject matter divisions, and it may be unwise to centralize to the extent where all research and analysis is moved away from the latter.

V. CONCLUSIONS BASED ON NORWEGIAN EXPERIENCE

41. Some of the points made in the preceding section may be illustrated by the experience of the Central Bureau of Statistics of Norway. In Norway, as in most other countries, a considerable amount of work has always been carried out on methods and on mainly descriptive analysis. Most of this work has taken place within the subject matter divisions, where it still does take place to a considerable extent. But, in addition, the Bureau has, during the last thirty years, intensified its methodological research and extended its analytical activities in new directions, and this has led to the establishment of new organizational units. A brief description of this development is given in Annex 1.

42. The Bureau's active engagement in analytical work for nearly 30 years has turned out to be a fruitful line of development. The arguments in favour of such an engagement by a statistical agency can, on the basis of the Norwegian experience, be summarized as follows:

- i) A statistical agency has, due to its easy access to data, definite advantages in empirical analysis over other institutions when this activity requires a close co-operation between the producer of the data and the analyst. In Norway, the advantage has been particularly manifest in the development of large numerical models, but it has been clearly demonstrated in other areas as well, e.g. in certain aspects of taxation research (studies of the influence of taxation on income distribution).
- ii) By putting the data to own analytical uses a statistical agency will derive numerous feed-back effects which lead to improvements in the statistical system: Errors in existing data are revealed; inconsistencies in definitions and classifications are detected; the level of precision and the frequency of collection which uses of the data require, may be better judged; and a better basis is gained for determining the need and priorities for new statistics.
- iii) By engaging in analysis a statistical agency may demonstrate how statistics can help in throwing light on topical issues, and potential users gain a better understanding of their possible applications. In this way the user value of the statistics will increase. Norwegian examples are again represented by taxation research which has demon-

strated new applications for the income statistics, and by the analysis of energy problems which has increased the usefulness of the energy statistics.

- iv) The involvement in analytical work may lead to revisions of, or totally new ways of, classifying the primary statistics. An extreme example of this from the Norwegian experience grew out of the Bureau's work on price and income distribution problems in the early 1960's. This led to the "Scandinavian model of inflation" which is crucially based on the distinction between "exposed" and "sheltered" industries. This classification has since been utilized in parts of the basic statistics as an alternative to the traditional classification based on industry, and has proven itself useful in many applications. A second example is the development of a set of partial indexes of the consumer price index based on the sector of origin (agricultural goods, home-produced manufactured goods, imported goods, etc.) of the constituent commodities. These indexes have been published regularly for the last 10 years jointly with the traditional set of partial indexes based on types of commodities (food, clothing, etc.) and have proven themselves very useful in the understanding of the inflation process. Other examples could easily be listed.
- v) Engagement in analysis on its own will make a statistical agency more aware of the data needs of other analysts and will be conducive to forming good working relationships with universities and other research institutions. (It might be mentioned, however, that social scientists, other than economists, have on occasion felt resentment towards the Central Bureau of Statistics, arguing that they should be given the same access to confidential micro-data as the research staff of the Bureau.)
- vi) The research undertaken, if of high quality, will increase the prestige of the statistical agency. Such increased prestige will be a great help in many ways, e.g. in attracting qualified staff and in ensuring the goodwill and co-operation of respondents.

43. It has been argued that for a statistical service to engage in problem-oriented analysis will occasionally force it to tackle politically sensitive topics, and to make evaluations of and occasionally express opinions

about controversial issues. It is further argued that in such circumstances it may prove difficult to remain politically neutral; the statistical service may become politicized; and it may risk losing the confidence of respondents and users. The existence of such a risk cannot be completely neglected. It necessitates the use of a strong will to objectivity in analysis, and carefulness in formulations, when dealing with current and controversial topics. If this is observed, then experience demonstrates that a statistical agency can achieve respect and recognition for its analytical work by all political fractions.

RESEARCH AND ANALYTICAL ACTIVITIES OF THE CENTRAL BUREAU OF STATISTICS OF NORWAY

1. By long tradition, the Central Bureau of Statistics of Norway has devoted a considerable part of its resources to research and analysis. This engagement has been strengthened in recent years. While research and analytical activities continue to be carried out in the subject matter divisions, a small Unit for Research in Statistical Methods was established around 1950 and a Unit for Central Project Planning in 1966. These two groups today employ 12-14 persons, some of them with an education in mathematical statistics and others economists with extensive practical experience in statistical work. The groups give assistance to the subject matter divisions in their planning efforts, and in solving methodological problems. A separate (Economic) Research Department was established in 1952. In addition to being responsible for the national accounts, the department has a separate unit for economic analysis which - independently of the subject matter divisions - is charged with a variety of analytical tasks. This Unit for Economic Analysis has grown gradually, giving at present work to about 20 economists, assisted by some clerical staff and the computer facilities of the Bureau. The year 1968 saw the establishment of a separate Unit for Socio-Demographic Analysis. This unit today employs 12 professionals. With the two units for economic and socio-demographic analysis well established, the Bureau is no longer just a producer of statistics, but has become one of the main centers for empirical research in the social sciences in Norway. Of the total budget of the Bureau, about 9 per cent is allocated to the activities of these two sections, including costs of assistance given to them from other units (computing units, typing, printing, etc.). The activities of the sections have been chosen in part to assist the Bureau in its capacity as producer of statistics and in part, with the understanding of the political authorities, to develop tools and analysis of value for the management of the national economy. The choice of projects has to a considerable extent been influenced by the considerations set out in section IV.

2. Whereas the Unit for Central Project Planning, in close co-operation with the subject matter divisions, works on improving statistics in particular fields, the Unit for Research in statistical methods has concentrated its effort in four main areas:

- i) Construction of a basic two-stage sample design suitable for selecting nation-wide samples of persons and households. A program for estimation of sampling errors is developed.
- ii) Use of models in sampling from finite population. Arima-models are used in connection with the Labour Force Surveys. Also in connection with the estimation for small areas, a super-population model is being used.
- iii) Estimation and control of non-sampling errors. Evaluation studies are designed and analyzed, and experiments are designed to compare different coding and imputation techniques.
- iv) Research into statistical methods for analyzing data. Techniques like regression analysis, path analysis, log-linear models are being studied, and their relevance when analyzing statistical data is being tried out.

3. The activity of the Unit for Economic Analysis is today concentrated in three main areas:

- i) Current economic analysis and business cycle research.
- ii) Taxation research: This is a task which has been explicitly imposed on the Bureau by the political authorities. The stated intention is to raise the analysis of important tax issues above partisan politics by giving the task to an unbiased and independent institution.
- iii) Construction and operation of large numerical economic models to be used, inter alia, as instruments in short-term and long-term economic planning. This task occupies today about 2/3 of the staff of the section for economic analysis. They are engaged in studies of input-output relationships, consumption patterns, wage and price formation, productivity analyses, import and export relationships, production and consumption of energy, and other projects. These studies are undertaken not just because they provide insight needed for the model-building effort, but also because they are of considerable interest in themselves.

4. The activities of the Unit for Socio-Demographic Analysis is centered around three main themes:

- i) Development and operation of demographic projection models. The program entails both the construction and operation of models and the study of social and demographic processes to be represented in the model. Migration, fertility, nuptiality, and mortality studies have been taken up.
- ii) Analysis of the labour market, particularly studies of economic activities by married women, labour force participation rates, and models for the projection of the supply of labour.
- iii) Development of a system of social and demographic statistics (SSDS) and social indicators. The activities here have included editing of a Social Survey for Norway.