The Computers in the Service of Demography in the African Countries

(On the international seminar "Demographic statistics and the use of computers taking into consideration especially demographic research" organized by the German Foundation for the Developing Countries and the Office of Statistics of the Federal Republic of Germany, in Wiesbaden and Paris, between November 23rd and December 7th 1972).

The developing countries are making huge efforts for their social and economic development, for turning their natural resources and labour potential to good account in view of ensuring the material and cultural progress of their peoples. The world community, through the United Nations Organization, its specialized institutions — the Food and Agriculture Organization, U.N.E.S.C.O., B.I.T.. the World Health Organization, the economic Commissions — have inscribed in their activity the granting of technical, scientific and methodological assistance, the training of specialists and the establishment of international co-operation meant to speed up the development of these countries. The U.N.C.T.A.D. decades are a testimony to the scope of these activities.

The taking of the demographic factor into consideration in the development programmes makes necessary a statistic information about the number and structure of the population, about the main demographic phenomena and about their territorial variation. The short and medium term projections are indispensible for drawing up the social-economic development programmes. That is why, the organisation of a demographic statistics which should correspond to the requirements for the elaboration of social and economic programmes is inscribed among the priorities; of course, the problem is neither simple nor easy. Therefore, the use of the experience of the developed countries and of their assistance is acquiring great importance.

Inscribed in this context is a prestigious international manifestation organized by the German Foundation for the Developing Countries [1]), with the technical and methodological support of the Office of Statistics of the Federal Republic of Germany, the proceedings of which took place in Wiesbaden and Paris, between November 23rd and December 7th, 1972. The first seminar organised by the above institutions, with the support of the United Nations Economic Commision for Asia and the Far East, took place in 1969; the second international seminar was organized for the English speaking countries, members of the United Nations Economic Commission for Africa, in 1971; finally, the latest manifestation is the afore-mentioned seminar organized for the French speaking countries, members of the United Nations Economic Commission for Africa.

The seminar was attended by specialists in demographic statistics and in data processing from 17 French speaking countries from Africa: Algeria, Burundi, Cameroon, Tchad, the Ivory Coast, the Congo, Gabon, the Malgashi Republic (Madagascar), Morocco, Mauritius, Niger, Ruanda, Senegal, Togo, Tunisia, Upper Volta and Zair. Specialists from Bulgaria, Canada, France and Romania were also invited as guests. The United Nations Bureau of Statistics, the United Nations Population Division, the United Nations Economic Commission for Africa, the International Bank for Reconstruction and Development and the Organization for Co-operation and Economic Development, the Commission of European Communities, the German Organization for the Advancement of the Developing Countries (GAWI) were also represented.

The general title of the international seminar "Demographic statistics and the use of computers taking into account especially demographic research" synthetizes, in fact, three themes: a. the collection of demographic data and the carrying out of the census of the population and dwellings in Africa; b. the use of computers for processing demographic census data including the detection and correction of errors; c. demographic research, the analysis and projection of the population, households and families.

The proceedings of "the International Seminar on Demographic Statistics" took place on the basis of synthesis reports drawn up by the United Nations experts (the Bureau of Statistics, the Population Division, the Economic Commission for Africa) and the reports of various countries. An important place was held by the studies presented by a number of experts in

[1]) The German Foundation for the Developing Countries (Deutsche Stiftung für die Entwicklungsländer) was set up in 1959 through the joint efforts of the parliamentary groups of the Bundestag and of the federal government, representing an essential part of the programme of assistance granted by the Federal Republic of Germany to the developing countries; its activities are financed by the federal government and by the governments of the different lands. The fields in which the Foundation is carrying on its activity: exchange of experience on a world scale, transfer of technical knowledge through the organization of international and national seminars, the carrying out of programmes for the training and perfection of specialized staff, the co-ordination of documentation and reference material in the field of development, co-operation in the drawing up of conceptions in the field of the policy of assistance of development. The leadership of the "Foundation" is ensured by an Administration Council whose chairman is Mr. Hans Matthöfer, deputy to the Bundestag.

demography and data processing of the Office of Statistics of the Federal Republic of Germany [2]), including dr. H. Schubnell, R. Deininger, L. Herberger and K. M. Teuscher.

As a general estimation, it must be said that the three classical sources of demography-censuses, statistics of vital and demographic inquiries — are unequally represented in the French speaking countries in Africa. Apparently paraxodical, the sample demographic inquiries — sometimes in very refined variants — enjoy a large circulation. In the last few years, remarkable progress was scored in connection with the implementation of the data processing systems and their use to the purposes of demography. No less significant is the experience gained in the field of demographic projections, both as regards the projections of the number and structure of the population by sex and age and projections of households and families.

These groups of problems will be expounded in the following, with special reference to the use of computers [3]).

The collection of statistical data and the carrying out of the census of the population and dwellings. The situation in this field may be characterized with the aid of the undermentioned statistical data. After 1960, 24 independent African countries have carried out at least one census of the population and another 14 intend to organize a general census in the coming years; five countries have not yet carried out a census of the population, which means that so far, there exist no census data for a number of 19 African countries. In exchange, there are many countries which have resorted to demographic inquiries and to estimations based on various hypotheses. The observation programme both in censuses and inquiries comprises a reduced number of characteristics.

The most poorly represented sector is the vital statistics. Measures have been taken for the organization of civil status registration — birth, death, marriage — but, implementation is going on at a low pace. In most cases, civil status registration is limited to towns. Taking into account the necessities and the difficulties in the obtaining of information, the following is recommended as minimum data: estimates on the number of persons, of their structure according to sex and age as well as estimates on international and internal migration, on fertility and mortality.

It is an interesting fact that the United Nations experts recommend that only the data on the total population and the structure on sex and on

---

[2]) The official statistics of the Federal Republic of Germany is represented by the Federal Office of Statistics (Statistische Bundesamt), which celebrated a century of existence in 1972 and by 11 boards of statistics of the lands (Statistische Landesamt), inclusively of the towns having this status. President of the Federal Office of Statistics is Mrs. dr. *Hildegard Bartels.* It is a centralized statistics as regards methodology and co-ordination, which is based on a large decentralization. The following "divisions" are part of the Federal Board of Statistics: Mechanography and Mathematics, Technical problems of general statistics and General National Accounting, Finance and Taxes, Food and Agriculture, Industry and trades, Trade and Transport, Prices, Wages, Family Budgets; Movement of the population, education and public health and censuses of the population, labour and dwellings including general demographic analyses. A demographic research institute was set up on January lst, 1973 as part of the Federal Board of Statistics whose director is the well known demographer, dr. H. Schubnell.

[3]) A more detailed information on the other aspects was presented in "Economic Studies and Research", no. 1, 1973.

the population on localities should be obtained with the aid of an exhaustive registration; the other information may be obtained conveniently with the aid of polls.

Although several types of demographic inquiries were used, priority was given to the P.G.E. (Population Growth Estimation) [4] type and to the inquiries by repeated passages [5]). It was specified that the P.G.E. method is less recommendable because the double registration of data is very expensive whereas the gain of data is relatively reduced. Preference was given to the method of inquiry by repeated passages; about 160 inquiries have been carried out in various Afro-Asian countries, during the last few years. In this respect too, there are difficulties engendered by the size of the sample for small geographical units, which causes the estimation of the birth and death rate to be sometimes questionable.

The use of computers. The fields in which the use of ordinators is very adequate are: the processing of census data with special reference to the detection and correction of errors and the demographic projections.

Nearly all African countries have passed on to the manual processing of census data, to mechanographic and afterwards to electronic processing. The advantages are indisputable in spite of certain difficulties, such as: the selection of equipment, the training of personnel and co-operation between statisticians and specialists in data processing. In the opinion of the experts present at the seminar, the most adequate equipment is the middle-sized computer comprising a central storage, devices with cards, with magnetic tapes and discs for processing the census data of the population. Yet, the danger exists of an untimely ageing of the equipment because of the technological transformations, imposing the recycling of the personnel and important financial means.

Just as in the developed countries, the problem of the dialogue between the statistician and the informatician is far from being solved. Most statisticians have no knowledge of informatics and most informaticians have no statistic knowledge and are not trained in the preparation of inquiries. The ensurance of a common language between informaticians and statisticians is thus one of the most important problems.

The experience of electronic processing of the population census in countries, such as Algeria, Morocco, Tunisia, Cameroon, Upper Volta and others is extremely interesting: the existence of some "narrow places" was

---

[4]) According to *James C. Abernathy:* Organization and Methods of the Dual-Report System in Pakistan (The University of North Carolina, Chapel Hill, N. C. 1972), the P.G.E. method consists in the registration by sample of births and deaths in one or several regions and in the obtaining of data on the population through the carrying out of quarterly or half-year polls, on the basis of the Chandrasekaran-Deming method, two sets of data being ensured, after which the birth and death rate indices are determined. The largest experience was gained in Pakistan. The theoretical generalization of this method is a concern of the Demographic Statistic Laboratory of the North Carolina University led by professor *Forrest E. Linder.*

[5]) Cf. Les enquêtes démographiques à passages répétés. Application à l'Afrique d'expresion française et à Madagascar. Méthologie. O.R.S.T.O.M. I.N.S.E.E., I.N.E.D., 1971, 290 pages. The demographic inquiry by repeated passages is, in fact, an observation at various periods of time, of a permanent sample of population allowing the control of the changes caused by births, deaths, space shitfings, changes in the economic and social status. Such an inquiry allows, among other things, longitudinal analyses.

noted in almost all cases; some countries propose to use the optic reading, others the "Mark Sensing" method for the operations of obtaining the basic files. As to the programming methods, some countries have used general programmes, such as "SELINE" (Cameroon) and CENTS (Morocco). The latter allows the obtaining of a number of statistical tables through passages and is adapted to small computers (IBM 360). This system uses a big number of magnetic tapes and intermediary tape-files, but, it has the advantage of preserving on tapes the difinitive statistic tables.

The experience gained in connection with optic reading in the Federal Republic of Germany and France was of interest.

Three types of reading were used in the census of the population of the Federal Republic of Germany, in 1970: the mark reading for closed questions for which one of the alternatives was sensed; for the reading of manuscript signs (figures and letters), the coding of some answers was done manually at the Office of Statistics; the reading of the questions typed with the aid of typewriters with special characters. The latter is less efficient than manual coding. The Federal Office of Statistics uses mainly 800 BPJ tapes because they were more rapid until 1966, in the epoch of the 1401 computers. Later they used those of the 1600 BPI type; storing on magnetic tape is more advantageous than on disc. There is "an inter-connected system" between the Federal Office of Statistics and the boards of the lands, using the same (IBM 360 and 1401) computers and the same programming language. Only the simple language (PLD) was used so far, but, the gradual passing to the COBOL and FORTRAN languages is being envisaged.

Great attention was given to the problem of detection and correction of errors in census data. In the Federal Republic of Germany, for example, a printed form — questionnaire was used for processing the 1970 census, the data of which are recorded on tape after the respective checkings and corrections. They comprise: the identification control, the coding control and the coherence control. The automatic corrections use the "passive cards" method. There will exist standard programmes in the future, which will require less personnel.

The French experience in the field of error detection and correction followed another line; the "hot deck" method or the active cards methods was used. For the future census of the population in France (1975), a method is planned according to which the introduction of data will be made to the extent of their collection through the terminal systems implanted in the regional boards of statistics.

It was pointed out that the check up must be more rigorous for the data obtained by inquiries, the punching validity tests, the internal coherence tests and the inter-cards coherence tests being recommended to this purpose. The exhaustive tests can be used for a complex file.

Romania's experience in the field of the processing of the census data of the population appears instructive in this context. The first census which was mechanographically processed (punched cards with punch, sorter and tabulator sets) was that of 1930, which allowed a complex and relatively operative processing: the nine monumental volumes which were published *attest to this fact. The 1941, 1948 and 1956 census data were also processed with mechanographic equipment.*

The first census the data of which were electronically processed was the census of the population and dwellings in 1966. Many new problems were put on that occasion. Their final successful solution was presented at the international session on electronic data processing, organized as part of the United Nations [6], in Bucharest, between September 30th and October 4th, 1968.

The programme for the processing of the 1966 census data envisaged the obtaining of 123 tables 58 of which for the population and 65 for dwellings and households; together with the variants for the territorial units, their number amounts to 278 tables.

Processing included the following stages: the creation of series on magnetic tape, faithful copies of the data on cards; b) the logical control of the faithful copies and the creation of data archives; c) ventilation; d) the drawing up of the final tables; e) the printing of data. The automatic corrections made at the unrefused registrations were: systematic and random corrections. The organization of analysis and programme referred to: the analysis of tables and the card models, the analysis of the indicators, correlations and controls to be achieved, the determination of the processing diagram, the definition of each programme programming and the testing of programmes. The FORTRAN and PLAN languages were used. The biggest operations were those of coding, check, punching and check; loo manhours for the punching and control operations were necessary for an hour of use of the computer. It is absolutely necessary to dispose of programme systems which should allow the drawing up of the tables in minimum time. The programmes written in PLAN and FORTRAN proved unsuccessful.

The experience of the electronic processing of the 1966 census data has enabled the Central Office of Statistics to later introduce the electronic processing of the data of vital statistics, allowing the obtaining of more detailed groups of the demographic phenomena, such as: natality, mortality, nuptiality, divorcement and migration. The demographic projections were also successfully approached and solved with the aid of electronic computers, various hypotheses of fertility, mortality and migration, for a period of time going up to the year 2000. Mathematical models for the demographic--economic divison into zones of Romania were also solved on the basis of several variables, a very important framework for demographic analysis. The studies initiated in connection with a permanent register of the population, as a data bank, with the aid of the electronic computer will lead, in the coming years, to the achievement of this extremely important instrument in demography, especially in the light of the introduction of social accounting and of longitudinal analyses.

Demographic research in Africa; *analyses and projects on the population, households and families.* Pertinent studies on this subject were presented by the United Nations experts: "Demographic projects with the aid of computers" and "Analyses and projects of households and families", expounding the modern methods in projection and analysis, begining with type life tables computers, the method of components, the models of stable population, programmes of projection on computers, etc. known from the text-books of

---

[6]) The electronic processing of economic data. The Central Office of Statistics, Bucharest, 1969.

the United Nations. The difficulties in this domain are generated by the lack of statistic information, a fact which obliges to the use of models, analogies, etc. That is why, the demographic projects made so far for the African countries, either by university institutes in Africa or in certain developed countries (the U.S.A., France) or by the United Nations Organization have an orientative character because of the basic hypotheses, lacking sufficient statistic support.

The recommendations formulated by the seminar, as a natural result of the shortcomings in demographic statistics and electronic processing refer to the following:

a) the necessity of building models adapted to the African countries;

b) the necessity of drawing up programmes of automatic correction of census data and inquiries, especially envisaged for the particularities of the African countries;

c) the opportuneness of the use of inquiries by repeated passages and the necessity of carrying out a vital system;

d) the necessity of organizing courses of data processing for statisticians and of demographic statistics for informaticians in view of ensuring a collaboration between them;

e) the necessity for the demographic projects on a world scale to take into consideration, to a greater extent, the particularities in Africa.

* * *

The proceedings of the "International Seminar on Demographic Statistics" occasion a few conclusions. As is known, the United Nations General Assembly has proclaimed 1974 as "the world year of the population", an event which will be marked by a number of activities on various planes. In this context, the improvement of statistic information, of demographic projects and of demographic analysis acquires particular importance for substantiating the measures of demographic and economic policy. All countries have engaged themselves in this action which will culminate in the World Congress of the Population to be held în 1974. That is why, "The International Seminar on Demographic Statistics" is being inscribed as an important and very useful manifestation meant to contribute to the progress of demography by the ample exchange of experience occasioned by it and a wonderful attesting to the spirit of international co-operation.

Dr. VL. TREBICI