

Handbook on
Civil Registration and
Vital Statistics Systems
Computerization



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Vital Statistics Systems
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PREFACE

The present *Handbook on Civil Registration and Vital Statistics Systems: Computerization* provides guidance to decision makers and the relevant authorities of countries for the development and implementation of administrative electronic data-processing systems for civil registration and vital statistics systems. The *Handbook* focuses on guiding the advance process and analysis leading to such computerization, and offers a number of options for countries to consider, including model organization structures for planning, implementing and maintaining the computerization. It examines the framework, goals and purposes of the computerization of civil registration, looks at the interface between civil registration, the vital statistics system and other governmental agencies, and enumerates some of the major decisions and problem areas that can be anticipated in a move to computerization. It is the experience of several countries that the success of computerization depends on organization, advance planning and clear decisions and goals far more than on technical matters. Illustrations from the systems of a number of countries are used in the analysis. The present *Handbook* gives priority to a system concept according to which the registration of vital events takes place in the civil registration system, which by extraction from the database delivers the required data to the vital statistics system for statistical treatment. The *Handbook* has been prepared as part of the International Programme for Accelerating the Improvement of Civil Registration and Vital Statistics Systems.

The International Programme was designed by the United Nations Statistics Division, the United Nations Population Fund (UNFPA), the World Health Organization and the International Institute for Vital Registration and Statistics. It was adopted by the Statistical Commission at its twenty-fifth and twenty-sixth sessions, in 1989 and 1991. The International Programme encourages countries to undertake long-term self-sustaining programmes of reforms to strengthen their civil registration and vital statistics systems. It is being implemented in phases by the United Nations Statistics Division, focal point for the Programme, with the cooperation of the regional commissions

and the UNFPA country support teams. Financial support has mainly been provided by UNFPA.

A vital part of the International Programme was the convening of five workshops between 1991 and 1995, with the participation of senior civil registration experts and statisticians from specific countries and regions in the world. The workshops served as a forum for exchange of information and experience between member States, and adopted several resolutions to support the improvement of civil registration and vital statistics systems in each region of the world, which are included in the reports of the workshops.¹

In continuation of the International Programme and with financial support from UNFPA, the United Nations Statistics Division has prepared a series of five subject specific handbooks to assist countries in improving their civil registration and vital statistics systems, as follows:

- (a) *Handbook on Civil Registration and Vital Statistics Systems: Management, Operation and Maintenance;*
- (b) *Handbook on Civil Registration and Vital Statistics Systems: Preparation of a Legal Framework;*
- (c) *Handbook on Civil Registration and Vital Statistics Systems: Developing Information, Communication and Education;*
- (d) *Handbook on Civil Registration and Vital Statistics Systems: Policies and Protocols for the Release and Archiving of Individual Records;*
- (e) The present *Handbook*.

¹See report of a Latin American workshop on strategies for accelerating the improvement of civil registration and vital statistics systems, Buenos Aires, 2-6 December 1991, pp. 18 to 23; report of a western Asia workshop on strategies for accelerating the improvement of civil registration and vital statistics systems, Damascus, 20-24 June 1993; report of an East and South Asia workshop on strategies for accelerating the improvement of civil registration and vital statistics systems, Beijing, 29 November - 3 December 1993; report on an African workshop for English-speaking countries on strategies for accelerating the improvement of civil registration and vital statistics systems, Addis Ababa, 5-9 December 1994; report of an African workshop for French-speaking countries on strategies for accelerating the improvement of civil registration and vital statistics systems, Rabat, 4-8 December 1995.

Readers are encouraged to consult all five *Handbooks*, including the present *Handbook* and its annexes and references.

The present *Handbook* describes in its eight chapters the activities that countries should carry out to tailor their own civil registration system to their specific historical, demographic, legal and administrative conditions at the time of computerization of such a complex system. Only in this way will countries benefit from the investment made in computerization.

A phased approach is suggested for the computerization of civil registration and vital statistics systems. One suggested scenario for phased computerization would tie each phase to specific vital and civil status events, beginning with basic vital events and—if countries so wish and resources permit—culminating in a population registration system. The importance of initializing the computerized system with population status data is a key element of the present *Handbook*. It is anticipated that the concepts presented in the text and the annexes will be helpful in easing the process of computerization of the civil registration system. The *Handbook* should inspire the responsible authorities to analyse the administration in place and carry out the computerization based on the actual status of each specific country.

The present *Handbook* looks at some of the effects that computerization will have on civil registration, including the possibility of developing a unique personal identification number as the key to the system. The computerization of civil registration will require uniquely identifying each individual and ensuring that each and every vital event is recorded once and only once, in both the civil registration and vital statistics systems. It recommends, for example, that countries follow a process that leads to a unique numbering system to track the records of its vital events. However, a recommendation on the appointment of the unique personal identification number as the national identification number for each individual in the country is beyond the scope of the present *Handbook*.

Some of the examples used in the *Handbook* are taken from countries where population registers are closely linked with the civil registration system. In some cases, the numbering system for civil registration is closely tied to the personal identification number used to update information on individuals in the population register. As with cases in which the civil registration system is not tied to the population register, the examples provided are meant to

be illustrative of the computerization process rather than to recommend a particular course of action. The *Handbook* concludes by considering some of the security measures needed by the two systems to ensure confidentiality and the preservation of data. It also outlines the requirements of the hardware and software needed to operate and maintain the systems.

It should be realized that a computerized civil registration system is not merely an electronic registration of chronological series of vital events and their retrieval. Indeed, computerization of the civil registration system means much more than merely doing electronically what is being done manually by the present structure, or else it would not be an important and useful substitute for a manual civil registration system. Accordingly, it would be a great mistake to consider the computerization of such complex systems as civil registration and vital statistics as a mere technical matter that can be achieved by any country.

The target groups of the present *Handbook* are made up of countries with: (a) very different technological practice, experience and skills; (b) very different legal and administrative practices; and (c) different financial means for accomplishing a computerization project. In addition, target groups range from countries with only manual registration procedures to countries that have initiated computerization partly or to a great extent. Because of that diversity of scenarios at the country level, the *Handbook* avoids step-by-step instructions for a particular computerized civil registration system; the usefulness of the *Handbook* would be very limited if only one definite concept and one set of procedures to be followed were given.

The present *Handbook* was prepared by the United Nations Statistics Division, with the assistance of CSC DataCentralen of Denmark, a consultant for this purpose. A final review and revision of the *Handbook* from a technical and editorial point of view was conducted by Mr. Joseph Carney, Director of the Division of Health Statistics and Vital Records, Colorado Department of Public Health and Environment. Expert advice in the preparation of the *Handbook* is gratefully acknowledged from Mr. Bent Dall, Project Manager, CSC DataCentralen; Mrs. Jane Bloch, CSC DataCentralen; and Mr. Joseph Carney, United States of America. The United Nations is also grateful to Mr. David B. L. Brownlee of the General Register Office for Scotland, and Mr. G. P. Ah-Shung, Electoral Commissioner and Chief Officer of the Civil Status, Government of Seychelles, for their contributions

with case studies to the present *Handbook*. The following bodies and individuals are also acknowledged for their comments on the manuscript: Ms. Pamela Akisson, Director of the Bureau of Production Systems and Management, New York State Department of Health; Ms. Dorothy S. Harshbarger, State Registrar and Director, Center for Health Statistics, Alabama Department of Public Health; Health Statistics and Vital Records Division, Colorado Department of Health and Environment; Mr. Vito Logrillo, Director, School of Public Health, New

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INTRODUCTION

1. The present *Handbook on Civil Registration and Vital Statistics Systems: Computerization* is divided into eight chapters, as described below.

2. Chapter I outlines the key purposes and goals of civil registration and vital statistics systems. It looks at some of the effects that computerization will have on civil registration, including the possibility of developing a unique personal identification number as the key to the system. The chapter then examines the key areas of interface between the civil registration and vital statistics systems. With reference to implementing the computerized system, chapter I recommends a phased approach.

3. Chapter II provides an overview of the different stages of computerization, and discusses the computerization of individual portions of the civil registration system for countries that may not be in a position to attempt full implementation. The chapter concludes with more detailed information concerning the recommended phased approach.

4. Chapter III enumerates some of the major decisions and problem areas anticipated in a move to computerization. It specifically outlines nine major decision points that need to be anticipated, whether considering partial or complete computerization.

5. Chapter IV examines the purpose of computerizing the civil registration system, including its effect on the vital statistics system and other governmental agencies. The chapter looks at the option of using a personal identification number and considers the benefits to be reaped from computerization of civil registration.

6. Chapter V lists the phases to be included in a computerization project, whether the country has a full-scale project or a partial project as its

goal. A project to computerize the civil registration indexes in Scotland is used throughout the chapter to illustrate the phases.

7. Computerization of the civil registration system need not be limited to doing electronically what is being done manually by the present structure. Chapter VI considers the issues surrounding the current structure of civil registration within countries and what implications computerization can have on that structure. It gives specific recommendations concerning the type of structure to be used for both the advance planning and system development phases, as well as for basic organization after system implementation.

8. The principal focus of chapter VII is the transition from the civil registration system before computerization to the civil registration system after implementation. It introduces the concept of "initialization" of the system, and outlines the procedures necessary to avoid a register that divides the population into those reported and those not reported.

9. The *Handbook* concludes by looking at hardware and software requirements in relation to the functionality that the country desires to obtain from the computerization of its civil registration system. It considers issues surrounding the extraction of data from the civil registration system for use in the vital statistics system. Chapter VIII also outlines some of the security measures needed by the two systems.

10. Crucial to the impact of the present *Handbook* are its annexes: it is recommended that the reader consult each carefully. Of particular significance are annexes VII, which contains an illustration of computerization in Seychelles, and VIII, which describes the progress of computerization in Scotland in recent years.

I. FRAMEWORK OF CIVIL REGISTRATION AND VITAL STATISTICS SYSTEMS

A. DEFINITION OF CIVIL REGISTRATION

11. The United Nations defines civil registration as "the continuous, permanent, compulsory recording of the occurrence and characteristics of vital events... and as provided through decree of regulation, in accordance with the legal requirement in each country. Civil registration is carried out primarily for the value of the legal documents as provided by law. However, the usefulness of these records as a source of statistics is becoming increasingly recognized".² There is also a framework within which civil registration exists. That framework should cover all vital events occurring in all geographic areas and all population groups in the national area. Civil registration should include live births, deaths, foetal deaths, marriages and divorces. An ultimate goal is to also include annulments, judicial separations, adoptions, legitimations and recognitions.

1. Uses of vital records

12. Civil registration has many uses. Birth records provide individuals with legal proof of identity, age, nationality and parentage. The record can also help determine rights to insurance benefits, child custody and tax deductions. A death record can clarify inheritance rights, proper claim to insurance benefits and the right of the surviving spouse to remarry. Lists of deaths can be used to purge voter registration rolls and to close out retirement benefits. Divorce records are also important for establishing the right to remarry. Marriage records can be used for establishing tax deductions, proving the right to alimony in the event of divorce and establishing claim to property in the event of the partner's death. Uses of aggregated data from civil registration include population estimates, health statistics and demographic forecasts.

²See *Principles and Recommendations for a Vital Statistics System*, Statistical Papers, Series M, No. 19, Rev.1 (United Nations publication, Sales No. E.90.XVII.9), para. 278.

2. Effect of computerization

13. Computerizing civil registration will have a number of effects. When computerizing civil registration, a different viewpoint is taken. The civil registration system concept focuses on the individual as the main key to the civil events information linking all registrations to the individual. By establishing this linkage, the civil registration system is from the very first version prepared for future changes and additions. The present chapter describes and recommends a phased system of implementation. Aggregated data from civil registration produces vital statistics for use in population projections and estimates, health and population programmes.

14. The computerization of civil registration will broaden the uses that can be made of the civil registration system. Linkage of the civil registration system to other computerized systems will become possible. It will become more important to uniquely identify each individual, and to ensure that each and every event is recorded once and only once, in both the civil registration system and the vital statistics system. Issuance of a unique registration or personal identification number should take place at the time of birth or at the initial registration of an individual. How this is done will vary from system to system and from country to country. However, the appointment of the unique personal identification number as the national identification number for each individual is a subject that must be carefully assessed by the competent authorities, and is beyond the scope of the present *Handbook*.

15. As stated above, in civil registration the use of a personal identification number is important for linking a child to its parents and for linking two spouses. In vital statistics, the personal identification number is important for identifying each individual for linking a child to its mother and vice versa. Last but not least, the unique personal identification number provides the link between the civil registration register and the vital statistics register.

Other numbering techniques can also be used to accomplish these tasks, as discussed in chapter II below.

B. DEFINITION OF A CIVIL REGISTRATION SYSTEM AND VITAL STATISTICS SYSTEM

16. The scope and extent of civil registration and vital statistics often varies from country to country. Therefore it is important to establish a clear definition of the civil registration system and the vital statistics system and the interface between them.³

1. Civil registration system

17. Civil registration is primarily carried out for the value of the legal documents. One distinguishes a computerized civil registration system as the electronic registration and updating of the civil information linked to individuals of the country in the events of live birth, death, marriage, divorce, foetal death, annulment, judicial separation, adoption, legitimation and recognition (see annex I below for the United Nations definitions of these events).

18. Civil registration should not be mistaken for population registration, which is present in many countries. Population registration covers a wider range of events, such as immigration (first-time registration) and change of address, together with some (or all) of the events of civil registration, including change of name (see annex II below for standard definitions of population event registration).

19. A civil registration system must be able to:

- (a) Add, change, correct and enquire about data and events relating to individuals. Especially for statistical reasons, it is very important for the system to differentiate the actions of adding or changing an event from that of correcting erroneous data;
- (b) Check entered data for errors and correctness. Checking of computer-based information is a

³The definitions and events used in the *Handbook*, some of which are reproduced in Annex I, are taken from the *Handbook of Vital Statistics Systems and Methods*, vol. I, *Legal, Organizational and Technical Aspects, Studies in Methods*, Series F, number 35 (United Nations publication, Sales No. E.91.XVII.5).

comparatively quick process. The more extensive the checking that is implemented, the higher the quality of data recorded in the register, and thus the more reliable and accurate the resulting statistics. Extensive checking of data in the civil registration system justifies omitting the same extensive checking in the vital statistics system;

- (c) Provide data extracts for external systems, most importantly for the vital statistics system, and also for administrative purposes.

2. Vital statistics system

20. A vital statistics system processes and tabulates the vital events data recorded by the civil registration system with the purpose of creating live birth, death, infant death, foetal death, live birth and foetal death, marriage and divorce statistics (see annex III below for United Nations definitions of these statistics).

21. The data provided by the civil registration system is passed on to the vital statistics system in two ways: (a) status extract and (b) changes extract.

22. The status extract is an extract of all data related to individuals who are registered as "active" in the register at a specific time. If the civil registration system has been upgraded to a population register, a status extract typically forms the basis of a yearly count of the total population and its composition by age and sex.

23. The change extract concerns all relevant changes in the civil registration register, such as births, deaths, marriages and divorces, during a specified period of time. A change extract typically forms the basis for statistics on population changes, such as births, deaths, marriages and migrations (when a population register has been established). Change extracts must be subject to an initial processing, during which the category of change must be established for each individual. It must be decided whether a change has actually taken place or whether it was only a case of correcting wrong data. Change extracts may be tabulated and presented in monthly, quarterly or yearly tables and reports, depending on the needs and resources of the country.

C. INTERFACE BETWEEN CIVIL REGISTRATION AND VITAL STATISTICS

24. The quality of record-based computerized statistics can never be better than that of the basic data contained in civil registration records.

1. *Completeness and timeliness*

25. Two key foundations for the reliability of records are completeness and timeliness. Therefore, it is essential to ensure that relevant events are actually recorded within a reasonable period of time. The statutory time periods are usually as close as possible to the date of occurrence. Some events are more likely than others to be recorded without difficulties. Such events as birth, death and marriage are for most people more obvious to report than such events as foetal death and judicial separation. Linking registration with the issuance of required certificates may have a positive effect on the completeness of reporting.

26. When defining the events of the civil registration system, one should carefully consider statistical requirements. Events of statistical importance, such as differentiation between separation and divorce and between marriages of the church and civil marriages, should be taken care of in the civil registration system. The civil registration system then delivers the data for the statistics.

27. Even data that are not usually considered to belong to civil registration but which constitute characteristics of important interest for statistical matters should be considered for recording in the civil registration register. This can be done by designing the civil registration system to record *all* data and *all* characteristics of a civil event. In this way, the civil registration system serves not only as data entry and processing of civil registration but also as data entry (however, only as data entry) for the vital statistics system.

2. *Codification*

28. The benefit of combined data entry is to ensure that data are recorded fully, correctly and only once. For some important vital statistics information, it is not always best to record the information as part of the civil registration system. If the information needs a qualified coding process before

entering the register, other possibilities should be considered. Otherwise, the coding process could cause unacceptable delay in the general registration process. Nowadays, with the advance of technology the coding process can be aided by the use of computerization and appropriate software modules.

29. Examples of information demanding coding are causes of death, occupation and education. Chapter II below will include a discussion of software available to code information on causes of death electronically. To have information of high quality on these data requires coding by a well qualified staff with a high degree of training in the field, or the use of appropriate software by staff requiring far less technical training. This is especially the fact for the coding of cause of death. A centralized coding of the information is normally to be preferred to ensure the quality of the data. Decentralized coding of complicated information gives too many possibilities for developing different practices. However, the use of software designed for electronic coding allows standardization even in a decentralized coding situation. It can also offer on the spot editing at the initial point of data entry (for further discussion of electronic coding, see chapter II below).

30. If data on causes of death and other data are not integrated into the civil registration system but are handled in separate processes, it is important to be able to benefit from the data registered on the individual in the system and to avoid registration of the same data twice. A personal identification number in both registration processes is crucial on this point: it makes it possible to link information from the two sources. If such data as cause of death are not part of civil registration, it will be natural for the linking of information from civil registration and cause of death to be done in the vital statistics system. Where possible, total data collection at civil registration will yield greater benefits to both the civil registration and vital statistics systems.

3. *Extractions from administrative registers*

31. An administrative register, such as the civil registration register, cannot be used directly for compiling statistics. Therefore, an extraction from the civil registration register (the

administrative register) is necessary. The extract is then stored as the vital statistics register (the statistical register). The information extracted from the administrative records has to be selected and sometimes corrected before it is ready to be recorded in a statistical file. In this process, some points are to be considered, as set out below.

32. As a general rule, administrative records contain information that is not relevant for statistics. The first thing to do is to decide which data to select from the comprehensive file. It is important to be careful in the selection of data. All relevant data that are going to be used immediately must be selected. One should also consider selecting data that are likely to be of interest within the foreseeable future. Data that cannot be used directly or indirectly (i.e., for checking) should be avoided. It adds expense to process large volumes of data that are not used, and such data often cause confusion in the system.

33. Data extracts provide inputs to statistical files, which are usually organized according to the type of statistics that are the final output. There is not a one-to-one relationship between extracts from administrative files and statistical files. The data extracts from one administrative file often are the input to several statistical files. For example, data extracts on deaths of individuals under one year of age will be an input to a statistical file on crude death rates as well as to a statistical file on infant deaths, and may also be used with data on

foetal deaths for a statistical file on pregnancy outcomes.

D. IMPLEMENTATION OF COMPUTERIZED CIVIL REGISTRATION AND VITAL STATISTICS SYSTEMS

34. Introducing computerized civil registration and vital statistics is for most countries a task of considerable complexity. To overcome the hurdle without losing focus, overview and enthusiasm, it is advisable to introduce the systems in steps or phases. It is recommended that each phase be completed—including analysis, design, construction, implementation, user training and successful production—before initiating the following phase. A phase-by-phase implementation benefits the project by providing clear, comprehensive, achievable goals, and thus increases the quality of the systems. It is important, however, to always have in mind that any current phase is to be followed by a new phase in which new events are added. It is therefore advisable to have a system design and construction that anticipates and makes transparent the addition of new actions and events.

35. Countries around the world have approached the computerization of civil registration and vital statistics systems in different ways. Chapter II below gives an overview of the state of the art in computerization in several countries, mainly industrialized countries. Other modern technologies and techniques that can be used during the process of computerization are also discussed.

II. OVERVIEW OF COMPUTERIZATION AND AUTOMATION STAGES IN CIVIL REGISTRATION AND VITAL STATISTICS SYSTEMS IN VARIOUS COUNTRIES

36. In 1994, the United Nations sponsored an African workshop on strategies for accelerating the improvement of civil registration and vital statistics systems at Addis Ababa. At the workshop, an address on modern technology for civil registration and vital statistics pointed out that the development, application and implementation of automated registration programmes have in recent years moved at an accelerated pace in the United States of America. Impetus for the change can be found in the increased demands of the population for registration services, declining staff resources due to budget cuts, and technological advances that make automation a feasible option. The directions being taken vary and include systems utilizing computers, optical disk and computer-assisted microfilm. Each approach is designed to meet specific needs of the particular registration programme.⁴

37. The accelerated pace of automation has continued in many parts of the world. The directions being taken still vary, and include an increasing number of options. Which options are chosen often depends on the motivations noted above.

A. INTRODUCTION

38. The present chapter will examine the computerization and automation of various individual functions of the civil registration system. It will look at technologies and techniques available to make incremental improvements to the civil registration process. Several examples of the use of these techniques and technologies in different countries will be offered. Plans for phased implementation will be suggested.

39. The chapter takes this approach because of the different constraints that exist from country

to country and from system to system. This does not imply that a country should not take a more aggressive implementation strategy if resources permit.

B. SOME FIRST CHOICES

40. The present section will look at some approaches that offer immediate improvement in system efficiency and yet are modular in nature. A country may choose to use some of these modules while approaching a phased implementation of computerization.

1. *Automated index*

41. The Registrar of the state of Goa in India noted a problem that is one an automated index can help. The problem in Goa was not underregistration but rather that the level of registration is about 104 per cent. This occurs when births are registered at the time they are reported. The report may be close to or at some length in time from the date of birth. In subsequent years, when a request is made for a copy the date of registration has been forgotten and it is often not possible to locate the record. The birth is then put on the registry again. The registration is thus duplicated. Repetitions of this situation can lead to the overregistration noted by the Registrar of Goa.

42. An automated index offers a solution to this problem. The index need not contain all of the information from the registration record. It should contain the name(s) and surname(s) of the registrant, date of birth (month, day and year), place of birth, parents' full names and the location of the record in the registry in accordance with the numbering or ordering system that the registry is using. This describes the contents for a birth index. With appropriate adjustments to content, one can easily generate automated indexes for death, marriages and divorces. With the information on an automated index, a search programme can quickly determine that the record is registered and yield its

⁴See Vito M. Logrillo, "Modern technology for civil registration and vital statistics", paper presented at an African workshop for English-speaking countries on strategies for accelerating the improvement of civil registration and vital statistics systems, Addis Ababa, 5-9 December 1994.

location in the registry. A copy can then be issued, and one avoids registering the birth a second time.

43. In 1965, the Registration of Births, Deaths and Marriages Act of Scotland updated the predecessor 1854 Act. The Registrar General of Scotland was required to make and maintain alphabetical indexes to the registries. Originally in paper format, the indexes were in constant use. There were more than half a million accesses per year to the indexes.

44. In the mid 1980s, the General Register Office for Scotland decided to computerize the indexes for the more than 35 million records covering the years from 1855 to date. Members of the public started using the computerized index in the Spring of 1989.

45. In the summary of a 1990 paper describing the project, it was pointed out that the General Register Office for Scotland is satisfied that the decision to press ahead with computerization of the statutory indexes has been fully justified. Productivity and customer service have been improved and the benefits of having a computerized index will continue to accrue long into the future.⁵

46. It is important to keep the automated index updated with changes to records. Changes of birth name, corrections on the record to any items contained in the index, addition of a father's name and changes due to adoption require adjustments to the index (for more detail, see the *Manual for the Management, Operation and Maintenance of Civil Registration and Vital Statistics Systems* mentioned in the preface above).

47. The computerized index module can add efficiency to the process of locating records, and at the same time can lay groundwork for future automation. The information that is in the automated index need not be entered again when a larger computerized system is implemented. Addition of more information from the original record can take place when the larger system is designed.

⁵See David B. L. Brownlee, *Computerization of the Indexes to the Statutory Registers of Births, Deaths and Marriages in Scotland*, Technical Papers, No. 42 (International Institute for Vital Registration and Statistics, October 1990).

2. Microfilm

48. Microfilming civil registration records and registers offers several efficiencies. Often, the preservation of paper-based records becomes a problem because climatic conditions tend to cause deterioration of the records over time. Microfilming the records can help to preserve the original registration information until a computerized system can be fully implemented. The microfilming of records can also ease storage space problems when the number of records is very large. It is also quite easy to make several copies of a roll of microfilm, which allows one to store the microfilm in several widely separated locations. This offers protection against complete destruction of the records by a catastrophe, such as fire or flood.

49. Having a microfilm copy of the records will be helpful as a country goes through the phases of computerization of civil registration and vital statistics. During the phased implementation of computerization, it is usually necessary to maintain a back-up system to the computerized system. Many states in the United States of America have used a combination of microfilmed records and an automated index of those microfilmed records as an efficient back-up system during the phased move to a computerized civil registration system.

3. Optical disk technology

50. A newer technology that offers problem solution similar to microfilm is optical disk technology. This system digitizes the copy of the record so that it can be stored electronically, thus responding to climatic and storage problems. The digitized record is also retrievable, and with appropriately worded statutes one can issue official copies from the digitized version. This technology even allows enhancement of the images of stored records. The enhancement capability is helpful for older, faded records. An emerging technology with similar benefits is known as "computer output to laser disk (COLD)".

51. As with microfilming of records and registers, optical disk technology offers a good interim measure for the storage and preservation of records while a computerized system is being developed. It can also serve as an efficient back-up system during the later phases of the computerization development. As with microfilming, the optical disk system will need an automated index to make locating the records a productive process. It is important to

note, however, that microfilm, optical and laser disk technology offer back-up system capability. At this point in time, these systems are not designed to allow use of the data for statistical purposes in the way that the computerized system is.

4. *Numbering systems*

52. Chapter I above noted that computerization makes it more important to uniquely identify each individual and ensure that each event is recorded once and only once within the registration system. The suggestion was made that the system use a personal identification number (PIN). This PIN would be issued at the time of birth or initial registration of an individual.

53. For various reasons, the issuance of a PIN may not be possible in some countries. The present section will examine alternative numbering methods that attempt to accomplish the same objectives as the PIN, since an effective numbering system is crucial for the smooth functioning of a computerized civil registration and vital statistics system.

54. There are several considerations that affect the choice of numbering system. Are the records in loose-leaf format or are they entered into a bound register? The first situation would permit sorting of the records prior to numbering, while the bound register would preclude this. Does the system have an automated index? A yes answer to this question could possibly eliminate the necessity for presorting records and overcome some of the barriers that the bound register presents. If there is an automated index, how quickly is it available? If it takes a substantial time to produce an automated index, then some presorting becomes necessary in order to locate records in the interim. Are records filed promptly? This affects the time period that a series of numbers will cover. If there is a large percentage of records filed more than several months late, then an annual number series is negatively impacted. In such a situation, a separate number series may be needed for the late records.

55. Guiding principles for a numbering system should include a unique number for each record. For example, suppose that the system assigns a number to each birth in a year beginning with the number one and continuing sequentially to the last birth for the year. Then the record should also include as a prefix the year to which it belongs. Thus, record number 1999-10275 will be distinct from

record number 2002-10275. It should be pointed out that this number will be unique only within the particular event, i.e., birth, death, marriage, divorce etc. It will, therefore, not have the rapid matching functionality of a PIN.

56. A second principle is that the system must account for every number. This does not mean that every number must be assigned to a record. It may be convenient in some situations to assign blocks of numbers to different registration areas or different institutions. Some of the numbers might not be used. There should be a record kept of unused or voided numbers as part of the accounting.

57. In addition, the number series selected should be large enough for the volume expected. If it is anticipated that the number of events needing unique numbers will not exceed 50,000 and the number of unused or voided numbers will be small, then it is safe to select a five-digit series for the system. Larger systems might require series of six or more digits.

58. Computerization of the vital registration system can also affect the numbering system that is selected (see paras. 69-74 below).

59. Selecting a numbering system based on these principles will uniquely identify each event, as opposed to the PIN that uniquely identifies each individual. Where the PIN is not a feasible option, the alternative numbering system still offers the possibility of matching events and individuals when the systems are computerized. For example, if the number that uniquely identifies a birth is also assigned to the hospital medical record, the metabolic testing record or a hearing screening test for an infant, then the birth information can be easily matched with this additional information. It is possible also to do a match on a distinct file using such variables as name, date of event and sex. When a satisfactory match occurs using these variables, then the unique registration number can be attached to the second data set. The second data set can then use the number for matching with any other data set that already contains the unique number.

5. *Some examples from the United States of America*

Numbering of vital records

60. Several states in the United States can serve as case studies for the growing use of a PIN in

civil registration systems. For many years a social security number (SSN) was needed when first entering the workforce in the United States. The number was used to track earnings and determine rights to retirement benefits in later life.

61. Computerization of the filing of birth records made it possible to file for the SSN at the time of birth. Birth data is filed electronically by the hospital and then transmitted to the Social Security Administration. An SSN is issued immediately for the child. The SSN is required for the parents to receive a tax deduction for the child. The number that is issued to the child is also returned to the civil registration system, and is attached to the birth record of the child.

62. Federal legislation in the United States of America requires the civil registration system to collect the SSNs of parents during the birth data-collection process. These SSNs are used by the Child Support Enforcement Agency to connect parents with the child. The SSN of the decedent has been a part of the death record for many years.

63. The SSN used in the United States of America is not strictly speaking a personal identification number. Its use does, however, closely approximate the use of a PIN. In countries with a PIN, computerization could easily lead to its use in civil registration systems.

Computerized issuance of certified copies of vital records

64. In the United States of America, there are two substantially different examples of certified copy issuance from a computerized system. The state of Colorado has local areas throughout the state directly connected by modem to its central computerized database. Each of these local offices, which are spread throughout the state, is then capable of searching on-line for a birth record and generating a computer-issued copy of any of the more than two million births contained in the central computer database.

65. The state of Alabama uses a different method. Alabama has used the *optical disk technology* (see paras. 50 and 51 above) to file its birth and death records. In Alabama, the system is designed so that only staff at the state office have direct access to the files containing these images. Customers complete a record request at a local office. The local registrar checks the application to determine if the applicant is eligible to receive the copy of the record.

The local registrar then signs the application and faxes it to the state office.

66. Staff at the state office view the application on monitor, search for the record electronically, and, if it is found, hit the print button. This faxes the image to the requesting county, where it prints on safety paper with the state registrar's certification statement and signature. The local registrar adds the seal and gives the copy to the customer. If the image is not in the system (e.g., old deaths, marriages and divorces), the paper record is found, scanned into the computer and sent by fax to the county.

67. The system in Alabama was set up with state office control so that county staff would need minimal technical knowledge to use it. This minimizes the training necessary for multiple users at local offices.

68. The Alabama method offers advantages to countries in which the records may be in poor or deteriorating condition and preserving the records quickly is a need for the country. Colorado's approach is more time-consuming since it requires substantial data entry. Countries that already have a fair portion of the data entry done or countries who plan to tie the civil registration record to other computerized record systems may find the Colorado model more to their advantage.

Electronic reporting

69. Section C.1 below will discuss software that allows the electronic reporting of birth data. An example of how this can be done is operating in New York State. New York has set up a network that allows hospitals to dial in using a modem on a personal computer and send the data via electronic mail. The hospital first enters the data into its computerized birth software, which in turn creates an output report file on the computer. The data are then encrypted so that they cannot be read during transmission, since they are considered to be highly confidential information. The encrypted file is compressed to reduce its size and thereby the time required to transmit the file over the telephone line. The resulting file is finally transformed into readable characters so that there will be no distortion in the transmission. That file is placed inside an electronic mail "pouch" which is sent to the Department of Health. At the Department, those steps are reversed, and the data are processed and stored as if they had been key entered at the main office.

To further enhance the operation, New York is now taking steps to begin a new process of collecting the data using a World Wide Web browser application on the Internet.

Automated cause of death coding

70. The World Health Organization (WHO) has made comparability of cause of death data possible worldwide through the development and revisions of the *International Statistical Classification of Diseases and Related Health Problems (ICD)*.⁶ Assigning the codes of the classification and applying the associated rules to select the underlying cause of death when multiple causes are listed are not easy tasks. Long periods of training are necessary to develop nosologists who can accomplish the work. This problem led to the development in the late 1960s and early 1970s of the Automated Classification of Medical Entities (ACME). The National Center for Health Statistics of the United States of America pioneered the evolution of ACME software.

71. For each cause listed on the record, the user enters both the ICD code for that cause of death and its location on the record into the ACME system. Using this information, the software applies the ICD rules and selects the underlying cause of death. Other advantages of ACME are that the software can track the assumptions made during the selection of the underlying cause, and can capture all the causes electronically, making possible multiple cause of death analysis. Although use of ACME does not require a trained nosologist, the skill and medical knowledge level needed remains very high.

72. In response to this, NCHS produced a pre-processor known as the Mortality Medical Indexing, Classification and Retrieval System (MICAR). This pre-processor allows entry of the causes of death without coding. A subsequent software development, called Super Micar, permits the entry of causes of death, an abbreviation or a code for frequently used entries. This version of the software brings entry of cause of death within the skills of a mid-to-high-level clerical employee.⁷

73. The programmes originally written for these software products required the use of main-frame computers that were beyond the resources of

many civil registration systems; however, they can now be used on personal computers. As noted by one authority, in the past, only a few countries could afford to produce multiple cause tabulations such as they were. With the adoption of the automated coding system, however, all countries will expect to generate, as a by-product, multiple cause data. It is time that serious study is given to the development of a useful body of multiple cause statistics.⁸

6. Implications of first choices

74. The choice between an automated index, or combining microfilm or optical disk storage with an automated index, or using a PIN or an alternative event numbering system, offers measures of efficiency to a system. Such choices can be the first steps of the initial phase of computerization. Whether to select these interim efficiencies is a system and country-dependent decision. If the resources are present, this phase may be skipped in lieu of more aggressive steps toward the computerization of civil registration and vital statistics.

C. AVAILABLE SOFTWARE

75. Such places as Belize and the Canary Islands have considered proposals to implement the electronic recording of birth events. The use that can be made of the electronic birth record, the electronic death record and electronic coding software as a phase in computerizing a civil registration system is examined below.

1. Electronic birth record

76. A number of vendors offer software that will allow reporting the birth record by electronic means. The software is generally loaded to a personal computer. Several screens ask the operator to enter the record information for the birth. Edits are built into the software so that questionable entries are queried on the spot. For example, if a mother's age is entered as 53, the software might be set to consider this age outside the normal range. A query would ask the operator if the entry is correct.

77. When a sufficient number of records have been loaded into the software, they may be printed onto paper and also loaded onto a diskette in electronic form. Alternatively, the records may be

⁶Tenth revision (Geneva, World Health Organization, 1992).

⁷See Robert A. Israel, *Automation of Mortality Data Coding and Processing in the United States of America*, Technical Papers, No. 50 (International Institute for Vital Registration and Statistics, June 1992).

⁸See Iwao M. Moriyama, Ph.D., "Cause of death coding revisited", *International Institute for Vital Registration and Statistics Chronicle*, No. 108 (May 1997).

sent by telephone modem directly to the main database. If the system is Internet-based, the records will have already been captured by the central server.

78. Capturing birth records electronically works with particular efficiency when a large percentage of the births occur in hospitals. Applications of the software have also been made where data are collected at a number of regional registries for electronic shipment to a central registry.

79. The software can be tailored to the needs of individual users. It can be designed to assign the birth record number automatically. It can also automatically complete information that is specific to a site. For example, the hospital location, the physician's address or the local registrar's information can be entered once and then automatically affixed to each record.

80. The software can also offer report generators. If the package is being used at a specific hospital, reports can be generated by type of delivery by physician for that hospital.

81. Usually the software generates a paper copy of the record, as well as downloading the information electronically. The paper copy may or may not be necessary, depending on the back-up structure for the total system.

2. *Electronic death record*

82. The electronic death record is similar to the electronic birth record in that the reporting takes place electronically. It is different from the electronic birth record in that there are usually several reporting sources for the information. The family (or in some countries a funeral director) reports the demographic information about the decedent through a registrar. If the death occurs in an institution, this report may be initiated at the institution. For natural deaths, the cause of death will be reported by a physician, while the report might come from a coroner or medical examiner in cases of traumatic deaths.

83. The multiple sources of death reporting have affected the design of electronic death reporting systems. An Internet design with the multiple sources reporting to a central server has proven most feasible. A second result of having multiple sources is a need for communication among the various reporters.

84. One must examine the system to determine a hierarchy of who reports what and when it is reported. For example, the registrar may be assigned top authority for demographic reporting. The coroner may be given the ultimate decision-making authority on cause and manner of death for traumatic causes. If the report of death is initiated by the physician, it is then the physician's responsibility to notify the registrar that the record needs demographic data. According to the system and local circumstances, the notification can be done by e-mail, fax or telephone. If electronic communication is not possible, then printed forms can be used.

D. PHASED APPROACH TO THE COMPUTERIZATION OF CIVIL REGISTRATION AND VITAL STATISTICS SYSTEMS

85. At the close of chapter I, it was suggested that the computerization of civil registration and vital statistics systems could best be accomplished in phases. One suggested scenario for phased computerization would tie the phases to types of events, beginning with basic civil (vital) events and—if a country so wishes—culminating in a population registry system. Tables 1-3 outline such a phased approach.

Table 1. Phase 1 of the computerization of civil registration and vital statistics systems^a

<i>Basic civil (vital) events</i>	<i>Basic vital statistics</i>
Live birth	Live birth
Death	Death, infant death
Marriage	Marriage
Divorce	Divorce
Change of name	

^aWhen implementing phase 1 the possibility of introducing computerized issuance of certificates could be considered.

Table 2. Phase 2 of the computerization of civil registration and vital statistics systems

<i>Other essential civil (vital) events</i>	<i>Other essential vital statistics</i>
Foetal death	Foetal death, live birth and foetal death
Annulment	
Judicial separation	
Adoption	
Legitimization	
Recognition	

Table 3. Phase 3 of the computerization of civil registration and vital statistics systems^a

<i>Population events</i>	<i>Population statistics</i>
Immigration (first-time registration)	Immigration
Change of address	Migration, emigration
Change of name	
Granting/withdrawal of citizenship	
Issuance of ID-cards, passports etc.	

^aIn phase 3, the basic civil registration system changes into a more advanced population registration system; the possibility of issuing more reliable ID-cards, passports etc. based on the database increases.

86. Chapter II has discussed automated indexes, microfilm, optical disk technology, numbering systems, software modules, such as ACME,

Super Micar, electronic birth reporting and electronic death reporting. These make up an array of choices from which different countries may wish to choose during phased computerization, depending on current system status and available resources. Automated indexes for the basic civil events of phase 1 can allow more efficient use of a current paper-based system while a computerized system is going through design and testing. Electronic reporting modules for basic civil events can be incorporated into the design of phase 1 computerization of the civil registration system. ACME and Super Micar modules can be used in phase 1 of the basic vital statistics computerization. Back-up systems, such as microfilm and optical disk, will be useful throughout all phases until a separate computer back-up system is in place. Any of the array of computerized parts of the system can be considered as a sub-phase of the three major phases that are outlined in the tables.

III. OVERVIEW OF MAJOR DECISIONS AND PROBLEM AREAS OF COMPUTERIZATION

A. INTRODUCTION

87. The introduction into government administration of major administrative computerized systems, such as civil registration and vital statistics, is a complex and costly process. It may take several years to complete.

88. Because of the complexity and time span involved, it is highly recommended that the very first steps are to provide an overview of the entire civil registration and vital statistics system as it currently exists, to outline a conversion process to be used and to enumerate the major decisions needed to be made. In major computerization projects, there are a number of dependencies that must be taken into account right from the start of the project. This may be done by documenting the main activities at a very high level, thus providing a kind of checklist to be used in the process.

89. A synopsis is set out below of the topics that are dealt with in more detail in other chapters of the present *Handbook*. The purpose of the present chapter is to provide an example of a checklist covering the most vital questions of the computerization process.

B. MAJOR DECISIONS

90. The checklist of items presented below offers nine major decision points for consideration. These decision points are effective whether one is designing a plan to computerize the entire system or a plan to computerize a portion of the system. One can also apply the checklist to a plan for eventual computerization of the entire system even when resources limit immediate implementation to only a portion of the system. This type of planning will make the additions of new actions and events transparent, as recommended in chapter I above.

1. *Defining the framework of civil registration and vital statistics systems*

91. The first decision is to define the civil events that should be included in the computerized systems and to prioritize the inclusion of events, if a phased implementation is preferred. Chapter I can be used as a resource when defining the system framework.

92. A phased implementation means that some events and/or system functions are implemented prior to others. Consequently, the application software must be designed in a modular way that makes it possible to supplement the system without having to start the development from scratch, when additional events or functionality are added. Chapter II above outlines several modules for consideration, and offers an example of a three-phase implementation plan.

2. *Defining the unique key to be used in the civil registration system*

93. To create the interface between the civil registration system and the vital statistics system and to match the civil events information from the registers, a unique number must be assigned to each event or to each individual. In this connection, a major decision will be whether to appoint the unique number of the civil registration system as the national unique identification for the individual. If the country plans to follow a phased system that leads to the civil registration system changing into a population registration system, then use of the unique number for each individual is the option to select. Even if the decision is to not use the number as a PIN, the assignment of the unique number to each individual will make civil registration data more efficient in statistical matches.

94. The long-term perspective and benefits for such a decision is that by appointing a universal number the interface is not only between civil registration and vital statistics but also is clearly defined for a number of other administrative systems. For the individual, the use of a universal unique

identification number facilitates identification with all public agencies, and the individual will only need to remember this one number.

95. The design and use of a personal identification number might in some countries create problems of a psychological, cultural or political nature. For this reason, each country must consider the issue very carefully. Chapter IV below gives a number of examples of the use of personal identification numbers, and chapter II above offers alternative numbering systems that a country could use if the decision is not to use a personal identification number.

3. Defining the objectives and purposes of computerization

96. Computerization will from the start of advance planning until the final implementation and operation of the systems influence a number of agencies and their staff. To make the project work smoothly without obstruction, it is recommended to define as clearly as possible at an early stage the purposes of computerization and the benefits that should occur. A full understanding by all active partners of the objectives and strategies will ease the process significantly.

97. Experience shows that if there is not cooperation among the agencies involved, the establishment of the necessary legal and administrative framework will be delayed or even never take place. The computerized system will consequently not function according to plan, and only minor benefits will be obtained from the investment.

4. Establishing the organization that will handle computerization

98. The introduction of computerized systems will influence the organizational structures of the agencies that have been responsible for the systems before computerization. The new requirements for management and staff may not be within their usual expertise. It may be necessary to provide training and external expertise.

99. Procedures may have to be changed completely in order to support the computerized systems. The consequence of this may be the disappearance of some manual functions and the introduction of new ways of working.

100. It is advisable to involve all active partners in the process of making the necessary changes to organizational structures. The overall responsibility should be assigned to a single authority, and the delegation of competencies and responsibilities should be transparent to all partners to avoid obstruction of the computerization by development of an unofficial organization. Experience shows that one should place great effort into getting the right organization to manage the computerization and eventually the operation of the systems.

5. Deciding on overall development strategy and operational strategy

101. The most difficult and time-consuming part of advance planning will usually be the establishment of the legal and administrative framework for the computerized systems. However, experience indicates that one should conclude the advance planning and implementation of the required framework before implementing the electronic data-processing system.

102. It is also important to realize that the responsible agency must perform extra tasks due to computerization in addition to its usual work. There may be a need for extra resources and external consultant assistance to speed up the process.

103. Part of the advance planning will be to decide the development strategy as well as the operational strategy. The system development may take place in the existing organization. This would require supplementing the organization with a computer centre, system developers and other information technology specialists. An alternative possibility is to call for outside contractors to develop all or part of the application system software.

104. The choice of solution will naturally depend on the specific conditions of each country. A decision concerning the future operation of the systems must also be made. Here, too, an in-house solution or a call for external contractors may be chosen.

6. Hardware configuration and procurement

105. The hardware requirements will depend on the size of the population as well as the strategies chosen from among those listed above. It is important to stress that decisions on hardware procurement should not be made before the above strategies are quite clear and agreement has been reached.

7. *Inviting external contracts*

106. The invitation to external vendors is usually a time-consuming activity. It may be advisable to draw on external expertise to define the terms of reference of the bid proposal and to assist in evaluating the proposed solutions.

8. *Choosing a conversion/initialization strategy*

107. Before the computerized system becomes fully operational, it is important to initialize any already existing information about the population's status and family links contained in the registers. One should determine:

- (a) If existing information is stored electronically and hence available for conversion;
- (b) If data about the population status and family links should be newly collected and manually entered;
- (c) If records already on file with agencies contain the necessary information (then the collection process may be skipped and only the manual entry carried out);
- (d) If a combination of the above is present.

108. Listing the consequences of conversion and/or collection and initialization, and consequently deciding on one of them, is a difficult and complex matter. It is important to make the decision a part of advance planning. However, the physical performance of the task should wait until just before operation of the newly computerized system. Even then, the actual performance of the task is likely to be both time-consuming and labour-intensive. It is the necessity for actual and up-to-date information that makes it important to postpone this task until the last minute. Otherwise, the converted or collected data must be kept updated until operation commences.

9. *System functionality*

109. The main decisions on system functionality (described in chapter VIII below) include:

- (a) Events and tabulations to be included;
- (b) Definition of the logical entities and their data items;
- (c) Functions to be included;
- (d) Validation rules, business rules and procedures;
- (e) Utilities to be included, notably security requirements.

IV. PURPOSE OF COMPUTERIZATION

A. INTRODUCTION

110. The decision to computerize the civil registration and vital statistics of a country involves and influences a number of agencies and their daily work. It must also be realized that the planning and implementation of computerized systems is time-consuming and requires many human resources and substantial financial resources.

111. This heavy commitment of resources calls forth two strong suggestions. First, as chapter V of the present *Handbook* recommends, the final decision about computerization should be based on a thorough analysis, and should be documented in a master plan forming the basis for decision-making.

112. Second, it is suggested that when computerization is initially being considered, the very first step is to define as clearly as possible the purpose of the investment and the benefits that will justify the project.

B. IMPROVEMENT OF CIVIL REGISTRATION DATA

113. One of the main purposes of computerization will usually be to enhance the quality of civil registration data and consequently the quality of the vital statistics based on these data. The quality of data may be measured according to:

- (a) Completeness;
- (b) Correctness;
- (c) Availability.

114. Computerization alone does not ensure more complete and accurate data. It may facilitate the registration of data, but it is equally important to improve reporting procedures. This can only be done as part of the establishment of a legal and administrative framework that supports the computerization process.

115. Improvement of the correctness or reliability of data collected is a clear benefit of computerization. A civil registration system will contain as

built-in functions validation rules and automated checks of data that will ensure that most erroneous registrations are detected during the registration process and may be corrected immediately. This will not eliminate errors due to misunderstanding or erroneously filled in manual forms that are used by the operators to register the data, but comprehensive error procedures and training of the data operators will reduce the error rate compared to a manual system. Computerization of civil registration can indicate which areas of the country may have problems of completeness and timeliness in registering events.

116. The correctness of data is also influenced by the use of the data by other than the civil registration agencies. The fact that the same data are used for vital statistics introduces at least one more validation and control.

117. Another vital purpose of computerization is to make the registered data available not only to vital statistics but also to other public agencies that are using the information in their administration. For instance, social welfare agencies will need up-to-date information on births and deaths to administer child allowances and pensions. As soon as the first phase of the civil registration system (as defined in chapter II above) is implemented, this data can be made available to other agencies. The preparation of electoral rolls will need information on deaths to update those files on a continuous basis.

118. If a country chooses to implement the third phase of computerization, the civil registration system will change into a population system and the use of the data may be expanded to the whole public sector. Experience in countries that choose this phase suggests that information about residents' addresses and migration is especially vital to most public agencies.

C. COORDINATION AND INTEGRATION

119. Considerable coordination and integration benefits are achieved if the computerization of civil registration is accompanied by legislation that

places the responsibility for the collection, continuous updating and storage of personal information with one central agency. In countries without a computerized civil registration system, each public agency using personal data in its work will have to register and maintain this data based on reporting by the individual. The correctness and completeness of the registered data will vary considerably, even though many resources are being used to maintain the data.

120. The coordination and integration benefits can be seen in many countries when computerization of civil registration takes place. In Seychelles, for example (see annex VII below for more details), the civil status records were computerized in 1989. This computerization began with the establishment of a National population database (NPD). The NPD was set up using variables from the 1987 Census. The NPD is a population register which was linked to the identity card system that was made compulsory in June 1995. In a paper presented at an African Workshop for French-speaking countries on strategies for accelerating the improvement of civil registration and vital statistics systems, held at Rabat from 4 to 8 December 1995, it was pointed out that the main uses of the NPD are:

- (a) Production of population records and estimates;
- (b) Production of alphabetical indexes of vital statistics;
- (c) Issue of national identity cards;
- (d) Compilation of social security pension records;
- (e) Furnishing of specific statistical data to government agencies;
- (f) Compilation of electoral roll or voter's register;
- (g) Facilitating the creation of other related databases, using the PIN as the main identifier.

D. UNIQUE REGISTRATION NUMBER

121. In order to secure the identification of individual records, a unique personal registration number should be allocated to each record at birth or at first time of registration. The registration number is unique to the record and thus functions as identification of each. The unique registration number is the key to the computerized system.

Seychelles

122. Seychelles offers an example of a computerized civil registration system that uses a unique PIN as the computerized key for each individual. As indicated in chapter II, sect. B.4 above, the use of such a number may be counter to the psychological, cultural or political atmosphere in particular countries. As chapter II describes, alternative numbering systems can be used in such countries. The unique registration number can be a simple randomly picked number of 8, 10 or 12 digits (depending on the size of the population) generated by the computer and not denoting any personal information. Alternatively, the number can be a sequentially assigned number within a specific year, or could be subdivided groups of sequential numbers allotted to specific institutions or geographic areas. The number can be used as a unique identifier for the record and not linked as a personal identifier for the individual. However, it should be noted that the efficiency of a computerized civil registration system significantly diminishes if no PIN is used.

South Africa

123. An identity number is used in South Africa, where it is associated with the birth certificate. The identity number is required for matriculation exams, and is also used to establish a single file of vital events and other events for individuals.⁹

Denmark, Finland, Norway, Sweden

124. Personal identification codes in these four countries are generally associated with population registers. With the advent of electronic data processing in civil registration in 1968, Denmark introduced a PIN, which is assigned automatically at birth or when the person joins the system as an immigrant.¹⁰

125. The population system in Finland uses a personal identity code for all persons permanently resident in Finland and for all Finnish citizens

⁹See "Current status of civil registration and vital statistics systems in South Africa", paper presented at an African workshop for English-speaking countries on accelerating the improvement of civil registration and vital statistics systems, Addis Ababa, 5-9 December 1994.

¹⁰See "Danish experience with the computerization of the civil registration system", paper presented at an African workshop for French-speaking countries on accelerating the improvement of civil registration and vital statistics systems, Rabat, 4-8 December 1995.

living abroad. The personal number is a combination of the date of birth and a distinguishing number.¹¹

126. In Norway, the Population Register came under the authority of the Directorate of Taxes in 1991. The Register uses the national identification number that was introduced in 1964. The number is composed of the date of birth in combination with three distinguishing digits and check digits.¹²

127. In Sweden, the Population Registration Centre is under the Swedish Taxboard Administration. Also, a PIN is issued that is comprised of the date of birth, in combination with a three-digit distinguishing number and a verification digit.¹³

128. If the attitudes of the country are in accord, the number may also be generated using specific personal information of the individual, as illustrated below.

1. *Person identification number, using specific personal information*

129. Expanding the use of unique registration numbers to the entire public administration achieves outstanding benefits. The expansion makes possible communication among all relevant agencies exchanging civil information, and helps to avoid duplicate registration and errors with respect to a person's identity.

130. In some countries, the registration number consists of 10 digits: 6 digits for the person's date of birth (i.e., two for day, two for month and two for year), a serial number of three digits, and a single check digit, which is computed automatically on the basis of the other digits by means of an algorithm. For example, Sweden computes a check digit using an algorithm.¹³

131. The PIN in Sweden consists of three parts. The date of birth makes up the first six digits,

¹¹See "Population registration system and vital statistics in Finland", paper presented at an African workshop for French-speaking countries on accelerating the improvement of civil registration and vital statistics systems, Rabat, 4-8 December 1995.

¹²See "Role and status of civil registration (population registration) and vital statistics systems in Norway", paper presented at an African workshop for French-speaking countries on accelerating the improvement of civil registration and vital statistics systems, Rabat, 4-8 December 1995.

¹³See "Population registration in Sweden", paper presented at an African workshop for French-speaking countries on accelerating the improvement of civil registration and vital statistics systems, Rabat, 4-8 December 1995.

followed by a hyphen and a birth number of three digits (when a person reaches age 100 the hyphen changes to a plus sign), and then the check digit. A "modulus 10" method is used to determine the check digit, with magnitudes of 1 and 2. The figure is added to the birth number according to the following rules:

1. The digits in the year, month and day of birth and the birth number are multiplied alternately by 2 and 1.
2. Then add together the figures in the products. Note that a 12 is counted as 1+2.
3. The unit digit in the sum of the digits is deducted from the number 10.
4. The remaining digit is a verification or check digit. When the remainder is 10, the check digit will be 0.

132. Consider the example of an individual born on 14 October 1937 with the birth number 663. The PIN is 371014-663#, where the # sign represents the check digit. Thus:

$$3 \ 7 \ 1 \ 0 \ 1 \ 4 \ - \ 6 \ 6 \ 3 \ \#$$

$$\underline{2 \ 1 \ 2 \ 1 \ 2 \ 1} \ - \ \underline{2 \ 1 \ 2}$$

$$6 \ 7 \ 2 \ 0 \ 2 \ 4 \ 1+2 \ 6 \ 6 = 36$$

$$10 - 6 = 4$$

4 is the check digit

133. In many countries, the check digit is used to indicate the sex of the individual. For example, an even digit to indicate a female and an odd digit to indicate a male. This is, however, no longer recommended. First of all, experts warn against using identification numbers that hold too much personal information. Second, using the check digit as a sex code indicator invalidates too many serial numbers. If the computer generates an odd check digit for a female, the serial number must be dismissed and the next number in line tried instead. This process must continue until a serial number is found that produces an even check digit.

134. It should be noted that the numbering system here needs to be centrally generated. This implies that if there are local registration offices, they must use another numbering system for administrative purposes until numbers are received from the central office for placement on the records.

2. *Person identification number, using specific personal and demographic information*

135. If the unique registration number is assigned in a decentralized manner, e.g., in a local region, it must be ensured that the same number is used only once and not assigned in two different regions. That can be accomplished by denoting a digit, which refers to the specific region, for each number that is assigned. The digit must then be unique for each region.

136. The level of decentralization determines the level of demographic information necessary. If the PIN is assigned, e.g., at the municipality level (with no on-line access to other municipalities in the region and therefore no knowledge of other numbers assigned), both a region digit and a municipal digit should be included. However, as indicated previously, it is advisable to avoid identification numbers that give too much personal information. Where the number can be assigned centrally, this is more easily avoided.

E. OTHER BENEFITS

137. There are other benefits to be obtained from the computerization of civil registration. Some examples are provided below.

1. *Automated issuance of certificate copies*

138. The computerized civil registration system should include all data for the basic certificates that are issued in connection with vital civil events, and should have the ability to print out copies of these certificates. Such copies are required by many public agencies for identification and other purposes, and are often difficult to acquire since they may be filed in central files far from the residence of the individual. Chapter II, section B.5, above gave two examples of how this has been accomplished in the states of Colorado and Alabama in the United States of America.

2. *Security of computerized civil registration data*

139. The discussion concerning the security of paper documents generally centres around controlled storage conditions for paper, microfilm copy storage and storage of extra document copies in remote locations. Computerization of civil registration data offers a different set of problems, as well

as different possibilities for taking effective countermeasures to protect against the loss of information in catastrophic situations.

140. Back-up copies of computerized data are essential. Data can be backed up on a daily basis, so that only a portion of one day's work will be lost if equipment fails during the processing of data to the main file. The main file can be backed up on a weekly or monthly basis, at which point the daily back-ups covering that weekly or monthly period are no longer needed and can be overwritten. Stored back-up files should be refreshed periodically to avoid deterioration. It is also vital to be vigilant of changes in technology that might render files unreadable by updated hardware or software. The media used—tape, disk, CD ROM—will vary according to the size of the files involved.

141. Choice of back-up media may also vary according to the type of replacement security strategy selected. One must consider the possibility of catastrophic destruction, such as by fire, flood, earthquake or nuclear devastation. Remote storage is the appropriate response to such danger. Both the remote storage facility available and the size of the files involved will be considerations in determining the media selected.

142. One may also wish to have contingency procedures in place for file copies in case of war. A procedure might be activated to destroy all copies except a special security copy that would be shipped to a friendly country. This process is of vital importance when the civil registration system has been developed into a population register that can be misused by occupation powers.

143. Along with security of the civil registration system, one must also consider the confidentiality of the data. The population should not, as a general rule, have access to the civil registration or vital statistics registers, nor to the equipment operating the system. Normal office protection mechanisms such as door locks and password protection of data, should be in place. Legislation should make provisions to control who has right of access to copies of individual information, and the registration authorities must enforce those rules.

3. *Misuse by administrators of the civil registration/vital statistics register*

144. A major threat to the computerized civil register is the risk of misuse by the entrusted

administrative staff. Means for ensuring the commitment and responsibility of the staff should be established, such as reasonable salaries and modern management procedures. In addition, reasonable control measures should be established to enable management to carry out auditing procedures. These procedures involve a comprehensive logging utility, ensuring that all changes and inquiries to the civil register are recorded to provide information about time, unique registration, number of the accessed civil information and operator identification. Based on such a log, management is able to carry out subsequent investigations, both randomly and on any suspicious events.

4. *Operator access restriction*

145. The management will usually prefer to grant different levels of access to different categories of operator staff. It is normal to grant enquiry access to a larger part of the staff, while a more limited number of operators are able to update the database. Access rights will be distributed by means of passwords for each operator. The safe administration of passwords is best taken care of by the database management system, which today represents state-of-the-art protection of sensitive data.

5. *Introducing the population register*

146. If the psychological, cultural and political atmosphere of a country allows, and its resources are available, then a decision to implement phase 3 of computerization will increase the benefits considerably since the system will now include demographic data that may be used by a number of public agencies for infrastructure planning purposes. In addition, it will make possible the use of the register for more administrative purposes, such as the printing of electoral rolls and the issuance of identity cards, passports, family booklets etc. with a high degree of reliability.

F. COORDINATION AND INTEGRATION OF VITAL STATISTICS DATA

147. In accordance with the United Nations recommendation, every member nation is to carry out a national census at least every 10 years. The result of the census is vital to infrastructure planning and the measurement of a wide range of public programmes. Especially when it has reached the phase

of a population register, the civil registration database will contain a significant part of the census data. Combined with other computerized administrative registers, such as dwelling and housing registers, the final accomplishment will be fully automated census performance. The computerization of civil registration is the very first step to accomplish this goal.

148. Not only vital statistics but also research projects often target special groups of people that have to be chosen according to already defined criteria. Implementation of phase 3 will make selecting these groups easier. One can use computerized civil registration and vital statistics systems to extract the defined target group for the specific research project. This would be useful, for example, in clinical and medical research.

149. If the system has migrated to a population register, it is particularly important to install safeguards to assure appropriate research use of the data. Even if the system has not reached phase 3, if it contains sensitive data the suggestions set out below should be considered.

150. Identifiable record-level data can be released if the researcher agrees in writing that there will be no follow-back to the individual, family members or medical personnel mentioned in the record. Agreement should also be reached that study results will be published in aggregate form with no identifiers attached. According to the nature of the data being used, there should also be some agreement concerning the minimum cell size of data to be released. The written agreement should also include a schedule for destruction or return of the individual record-level data.

151. In some research studies, it will be necessary to use the individual record-level data to follow back to the registrant or immediate family. In such cases, it would be normal research procedure to have the study protocol reviewed by a human subjects committee. Another safeguard often used in such instances is to have the civil registration or vital statistics agency contact the registrant prior to release of the data. A letter explaining the proposed use of the data asks the registrant to return a notice if he or she does not wish the record released. This "negative consent" procedure is often recommended by human subjects committees.

V. PROJECT PHASES

152. A country may be planning to implement fully the three-phase computerization project described in chapter II above. Resources may instead allow only a plan to implement phase 1 of the computerization. Or circumstances may dictate a project that comprises computerization of only some functions of the civil registration system. Whatever the situation, the present chapter outlines the phases that the project will experience.

153. In the mid 1980s Scotland undertook a project to computerize the indexes to its birth, death and marriage registers.¹⁴ This project will be used to illustrate the phases listed throughout the present chapter. More recently, computerization has been expanded to other areas of the registration system (for further details on computerization in Scotland, see annex VIII below).

A. INTRODUCTION

154. It is of vital importance to plan the computerization project very carefully at all stages in the process, particularly at the introductory analytical stages. Mistakes can be very costly, and are best avoided by putting great effort into the early stages of the project.

155. A common experience is that the most difficult and time-consuming task in connection with the implementation of major administrative electronic data-processing systems is preparing the legislative, organizational and administrative surroundings that will support the introduction and operation of the system. To make the system work and to obtain the benefits of computerization, the Government must agree upon comprehensive legislation and procedures that clearly define the competencies and responsibilities of all active partners in the process. The budget and resources for advance

planning must be approved, as well as the estimated costs for the entire system implementation and operation.

156. An organization must be established that can manage all the advance planning activities, as well as the operation of the computerized system after implementation. Recommendations regarding the organizational structure of civil registration and vital statistics are given in chapter VI below. The project phases are described below; the description is designed to cover the computerization of civil registration and vital statistics.

B. ADVANCE PLANNING: FEASIBILITY STUDY

157. A study providing a thorough analysis of all aspects of the computerization process and recommendations regarding the strategy and time schedule for the entire computerization project usually makes up the first step to take in introducing major computerized systems. The recommendations of the feasibility study will be the basis of government decisions on the scope and strategies of the computerization. The study report will also serve as a guide and checklist for the active partners of computerization throughout the project phases (see annex IV below for a sample table of contents of a feasibility study preceding the introduction of a computerized civil registration system, which may also apply to computerization of vital statistics). The main topics of such a study are briefly examined below.

1. *Systems in place*

158. Prior to deciding on the requirements for a computerized system, it is advisable to describe the manual system in place. Advantages as well as possible weaknesses should be listed. In this connection, it should be emphasized that computerization will not solve any problems due to bureaucratic, inflexible or defective reporting and registration procedures, including problems of completeness, accuracy and timeliness.

¹⁴See David B. L. Brownlee, *Computerization of the Indexes to the Statutory Registers of Births, Deaths and Marriages in Scotland*, Technical Papers, No. 42 (International Institute for Vital Registration and Statistics, October 1990).

159. Consequently, much attention should be paid to the legislative and administrative procedures governing the systems in place and their enforcement, as well as conducting campaigns to educate the population. This will improve the framework under which the computerized system must function.

160. In the Scotland project, the General Register Office for Scotland examined the paper index system that was in place prior to computerization. It found two major problems: heavy use of the indexes was causing deterioration, and the demand for access was steadily increasing.

2. Framework of the computerized system

161. The overall system concept should be examined. The degree of centralization or decentralization of data and responsibilities must be decided upon as one of the first steps. This decision is of vital importance because it will determine the organizational structure, the security needs and the requirements for the system software and hardware. It might be advisable to work with different system concepts over time. For instance, many countries would start with a centralized system concept, under which all data based on manually completed forms are converted or registered and stored in a central database containing information on the entire population. A centralized concept requires less hardware, software and training, and is easier to manage.

162. When this system has been operating satisfactorily for a reasonable period of time, the next step may be to decentralize. The registration of new events and changes to already registered events might be placed with local registration offices, to which civil events are reported either by the residents themselves or directly by the agencies that perform the civil events.

163. Depending on the size of the country and the financial means and telecommunication facilities available, further decentralization may be planned, resulting in a fully distributed system concept. Such a system will operate with decentralized databases in addition to the decentralized updating.

164. It should be noted, however, that complexity increases considerably with decentralization, and so do the costs. The advantage of decentralization is better and faster service to the public. In very large and populous countries,

decentralization to regions or provinces may in addition be necessary to handle the data properly. An Internet model in which data are fed to a centralized server will prove efficient in the decentralized situation. If, instead, the model is based on multiple copies of software located at the remote sites, change becomes cumbersome: every change requires replacement or updating of each of the multiple copies.

165. The feasibility study for the project in Scotland included the use of microforms, photocopying and computerization. As a result of the study, serious drawbacks were uncovered relative to the use of microforms and photocopies. The computerized index was selected as the most effective solution when all parameters were considered. Although this limited computerization is for the purpose of assisting registration administration and the search process, it does illustrate the use of the feasibility study as a project phase.

3. Organization and management

166. Organizational structures should be analysed to assess whether they are in accord with the computerized system concept. Any necessary changes and amendments to laws and administrative procedures should be proposed by the agency that is responsible for the computerized system.

4. Legislation

167. An important topic of the feasibility study is the careful analysis of the legislation and administrative procedures in place and the proposed changes and amendments. At a minimum, the following areas should be analysed:

- (a) The data items to be registered, and—if possible—samples of the registration forms;
- (b) The reporting of civil events/compilation of vital statistics;
- (c) The maintenance of information;
- (d) The security of information;
- (e) The use of a national unique PIN;
- (f) The legal validity of computer produced certificates;
- (g) The access to civil information by other public authorities.

168. In this connection, it must be noted that the line between legislation and practical problems relating to the introduction of computerized civil

registration and vital statistics systems is extremely difficult to draw. It is fully dependent upon each country's specific legal practice.

5. *Mechanics of the future system*

169. This part of the *Handbook* will describe in detail the functional and other requirements that the computerized system must meet, as well as the hardware and software configurations needed to operate the system. It will also deal with recommendations concerning the initial data collection or computerized conversion necessary to initialize the computerized civil registration database with population status data.

6. *Master plan for implementation*

170. Based on the above analysis, the study should result in an overall plan and time schedule for system implementation and operation. The recommended staffing of the project and the needs for training will be included in the plan. An estimate of the total costs and a financial plan should also be part of the study. The feasibility study and its recommendations may now serve as the basis for the final decision on development and implementation strategy.

171. The General Register Office for Scotland constructed a sound business case for the Scotland project, and was able to obtain finance from the Treasury; in 1986, the project was set in motion. The nature and time-scale of the project led to a decision to split the project into four smaller sub-projects. The four sub-projects were (a) procurement of computer hardware and software, (b) data conversion, (c) design and development of an on-line index retrieval system and (d) accommodation matters concerning hardware location, power supplies etc.

C. BID AND CONTRACT

172. Due to the confidential and private nature of the personal information to be handled, some countries may prefer to establish their own computer centre to be responsible for system development and operation. Others may decide to call for bids and leave all or part of the development and operation to other governmental bureaus or private contractors.

173. Often, the invitation for bids is performed in two steps. First, bidders are invited to work out a so-called "expression of interest", which is an overall description of the proposed solution and the qualifications and experience of the system provider. This phase gives the civil registration agency the ability to evaluate the overall capabilities of the proposals, and to reduce the number of competitors when the final bid is issued. In the long run, the two-step procedure may save considerable time.

174. To ensure that the proposed system meets the needs of the users, overall requirements for the systems as described in the feasibility study and the system specifications should be part of the bid material.

D. SYSTEM EVALUATION AND ACQUISITION

1. *Acceptance tests*

175. When evaluating proposals, it is advisable to ensure that the system application software is documented properly. This will facilitate the maintenance and operation of the system after delivery. As a minimum, documentation should include:

- (a) A system specification, a data description and a user's manual;
- (b) An installation manual that includes technical requirements, basic software requirements for the system and procedures for installation;
- (c) An operation manual.

176. Acceptance procedures for the system software should be agreed upon and included as part of the contract. It is advisable to require that the contractor arrange a thorough demonstration of all functions, screens and utilities, as well as a performance test showing response time. It may also be agreed that final acceptance will be based on a more lengthy test, such as a pilot installation of the system.

2. *Contract*

177. When preparing the contract for the delivery of the system, the following general topics should be considered and agreed upon:

- (a) A detailed time-schedule for the deliverables, including milestones;
- (b) A payment schedule and payment terms based on the above time-schedule;

- (c) Clearly defined termination conditions in case of failure of the contractor to deliver;
- (d) Penalties;
- (e) Provisions defining the license and copyrights regarding application software and system documentation;
- (f) A comprehensive warranty period, during which the deliverer is obliged to correct errors free of charge;
- (g) A service or maintenance period obliging the deliverer to update the basic software and the system software when new software versions are introduced.

178. The Scotland project used an open procurement procedure. An "operational requirement" was sent to interested contractors, and four were eventually shortlisted, with a contract awarded to the successful bidder. The contract required items covering technical specifications, response times, software and maintenance.

3. *System development*

179. It should be emphasized that even if the system development is contracted to an external provider, the basic organization will have to participate throughout the development project with its own staff and resources. The main activities of computerization projects are:

- (a) Analysis;
- (b) Design;

- (c) Construction;
- (d) Test;
- (e) End-user training;
- (f) Implementation;
- (g) Conversion/initialization;
- (h) Operation.

180. An integral and time-consuming part of these activities is doing the documentation. It is expected that the system will be in operation for several years. It is therefore of vital importance to ensure the production of quality documentation.

181. The General Register Office of Scotland completed the computerized index project in the early 1990s and immediately began planning for a project to store and retrieve records electronically.

E. NEXT PHASES

182. Two important phases that remain to be discussed are the establishment of project organization and the methods and activities necessary to initialize the civil registration register with existing data. The first of these phases will be covered in detail in chapter VI below. Chapter VII will devote itself to the issues surrounding the conversion of existing data to initialize the newly computerized system.

VI. ORGANIZING COMPUTERIZATION

A. INTRODUCTION

183. The geography, history and social backgrounds of countries lead to different types of organizational structures for civil registration and vital statistics. In turn, those different structures generate variations in the administrative arrangements for carrying out registration and statistical functions. The United Nations Statistics Division has made a detailed survey of the organizational structures in place in more than 100 United Nations Member States. Also, the *Handbook on Civil Registration and Vital Statistics: Management, Operation and Maintenance*, which together with the present *Handbook* is one of the series of five *Handbooks on Civil Registration and Vital Statistics Systems* (see preface above), contains substantial discussion of organizational and administrative structures. The main types of these organizational structures in relation to the computerization of civil registration are described below.

184. The decision to computerize the manual systems offers a unique opportunity for reviewing, examining and analysing the organizational infrastructures in place. Computerization also creates new responsibilities and tasks that must either be integrated within the existing organization or placed in a new organization. Because of the diversity of the organizational infrastructures in place, it is not possible to recommend one single and definite way of organizing the computerization. The following description focuses instead on the active partners and the tasks to accomplish in the process.

185. When organizing the computerization one must first decide the degree of decentralization of tasks. Second, designate the organization carrying the overall responsibility for the computerization. Finally, it is recommended that a specific project organization is established to handle the first phases of computerization, e.g., the advance planning and the system development. After system implementation, it is recommended to integrate the tasks pertaining to the system operation within the basic organization.

186. It is also recommended that the weaknesses and advantages of the organizational

structures in place be thoroughly analysed before implementing the new organization. Bear in mind that too many changes may be obstructive and thus delay the computerization process.

187. Regarding the vital statistics system, the organizational structure is not described in any detail in the present *Handbook* since the statistics agency is regarded as a user of civil data in the same way as other potential users.

B. ORGANIZATIONAL STRUCTURES OF CIVIL REGISTRATION

188. The three organizational concepts below are predominant in member countries.

1. *Principal centralized system*

189. The principal centralized system is characterized by having one centralized organization that is responsible for the legal and administrative work related to the civil registration of the entire country. The organization has the formal authority to make discretionary decisions, authorizing other agencies and executing its decisions in relation to the administration and development of civil registration. When computerizing, this agency should naturally be assigned the overall responsibility of the project.

190. The project to computerize indexes of births, deaths and marriages in Scotland was used as an example throughout chapter V above. The agency with overall responsibility for the project was the General Register Office for Scotland. This is the agency that is responsible for the vital records and service to the public throughout Scotland. The Nordic countries have been used as examples of the phase 3 evolution to population registers. They are also examples of principal centralized systems.

2. *Other centralized systems*

191. Other countries have a partly decentralized organization, in which the legal competence rests with a central agency, while the supervision and control of the registration work of the local

registration offices is placed at regional or other subnational levels.

192. This division of responsibilities and expertise makes the organization more complex. It is, however, not advisable to introduce too many changes into the existing organization unless this is absolutely necessary to accomplish the computerization. The overall responsibility should be placed with one central agency, but the organization must at the same time ensure the active participation of representatives of the supervising authorities during the entire computerization process.

193. In India, the Office of the Registrar General serves as the central agency for civil registration, with the supervision of the registration offices operated in each state in the country.

3. Decentralized systems

194. In some countries with a fully decentralized administration, there may be an authority in each region, province or state with its own civil registration laws, regulations and procedures. In the case of computerization, this authority at subnational level is the equivalent to the centralized organization mentioned in sect. B.2 above.

195. But even in the case of a fully decentralized civil registration, countries do have centralized coordinating bodies within civil registration and vital statistics that may recommend uniform procedures to be followed by the regions or provinces. It is highly recommended that such coordinating bodies are used to govern and coordinate the computerization of civil registration and vital statistics.

196. Such centralized coordination will save considerable development costs since the same system software and hardware may be implemented in all regions. It will also ensure a uniform development of the systems, which will enhance the countrywide quality of the civil registration data and of the vital statistics based on the civil registers.

197. In the United States of America, the responsibility for civil registration resides with each individual state. The National Center for Health Statistics and the National Association for Public Health Statistics and Information Systems jointly recommend laws, regulations, forms and procedures to encourage uniformity throughout the country. In this way, each state can replicate successful computerization projects developed by other states, with a minimum of alteration.

4. Local registration authorities

198. In all the organizational concepts described above, local registration units are responsible for the registration tasks. In the principal centralized concept the central organization exercises direct control over local civil registries, while in the decentralized concepts the supervision and control functions may be divided among different agencies at the central or regional levels.

C. OVERALL ORGANIZATIONAL STRUCTURES

1. Main active partners

199. As mentioned above, most civil registration organizational structures in place operate with

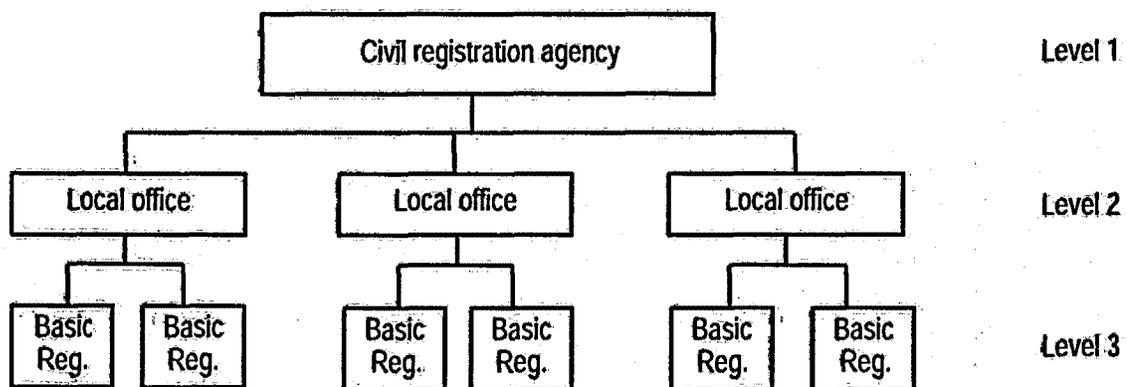


Figure VI.1. General organizational structure of civil registration systems

at least two levels of organization: a central body exercising the legal competence, and local agencies certifying the events and/or performing the registration of events based on reporting by the individual. In addition, other basic agencies performing civil events are important active partners. When introducing a computerized civil registration system, one should consider very carefully the assignment of responsibilities to these active partners.

200. The recommended organization of the main active partners is illustrated in figure VI.1.

2. *Civil registration agency*

201. The overall responsibility for computerization should be assigned to the agency that already has the legal and administrative expertise for civil registration. It should be the body that decides the degree of delegation of competencies and responsibilities to the subordinate levels, such as the General Register Office in Scotland; the Office of the Registrar General in India or the individual state-level civil registration agencies in the United States.

3. *Local civil registries*

202. It is important to define the responsibility of the local civil registries. In a manual system, these offices may be responsible for certifying and/or registering civil events, such as birth, death and marriage, that take place in the area. In cases where the offices certify the event, they will usually also be responsible for issuing the certificate pertaining to such events.

4. *Basic authorities*

203. Some vital events that form part of vital statistics are performed by other authorities or "basic authorities". In many countries, the courts would grant divorce and adoption and determine legitimization and recognition. Reporting of events may be directed either to local civil registries or to the centralized civil registration agency (or both places) for registration purposes. When computerizing, it is of great importance that the registration of events is performed only at one level, and that the reporting likewise is simplified in order to accomplish coordination and integration benefits.

5. *Individual residents*

204. In most countries, the reporting of vital events relies on the individual. When computerizing civil registration, one should consider at the same time coordinating reporting procedures and reducing the reporting responsibilities of the residents. This may be done by requiring the basic authorities to report either to the local registration offices or directly to the central civil register. In this way, the individual will also benefit from computerization. For example, hospitals/clinics should report births, deaths and foetal deaths; courts should report legal separations, annulments and divorces.

205. In some countries, certified copies of records are only issued by the central civil registry. This makes it very difficult for the individual to obtain such copies, which may be of vital importance for the individual's rights. When computerizing, it is recommended that the ability to produce certified record copies be extended to local offices. Chapter II above gave examples of how this is done in the states of Colorado and Alabama in the United States of America.

6. *Other active partners*

206. In the advance planning and system development phases of the computerization project, representatives of the statistics agencies and other potential public users of civil registration data should participate actively. It is important that they contribute to the system specification. The technical expertise offered by an internal computer centre or an external contractor must also be included in the management of the computerization project.

D. RECOMMENDATIONS CONCERNING THE GENERAL STRUCTURE OF CIVIL REGISTRATION

1. *Civil registration agency*

207. This agency carries the full responsibility of the computerization project. It must establish the legal and administrative framework for the computerization, as well as the organizational conditions for the project. It is recommended that a specific project organization is created to manage the computerization from advance planning through system operation. The organization and

responsibilities of the civil registration agency are elaborated below.

2. Local civil registries

208. A two-level general structure is recommended. This means that new functions and responsibilities will be assigned to the local offices. They will be responsible for the registration of all vital civil events and those performed by basic authorities. The functions will include:

- (a) Receiving the registration forms from the adjoined basic registration authorities and/or from individuals;
- (b) Verifying information and reporting errors to the basic authorities;
- (c) Registration of all vital events;
- (d) Filing and custody of registration acts;
- (e) Issuing of certified record copies and possibly burial/cremation permits;
- (f) Transferring information to the central site.

3. Basic authorities

209. The recommendation is that the events carried out by these authorities are reported directly to the offices performing the registration, without necessarily involving the individual concerned. In the case of birth and death, this practice can only be followed if the event takes place at a hospital or public clinic. If this is not the case, the individual must report the event to the local registrar.

210. The benefits of this organization are:

- (a) More accurate and complete information in the civil registration system;
- (b) Better service to the population.

211. The above-mentioned organizations must play an active part in computerization. Their work and responsibilities will be influenced greatly both during the process and after the implementation of the computerized system.

E. ORGANIZATIONAL STRUCTURES DURING ADVANCE PLANNING AND SYSTEM DEVELOPMENT

1. Overall structure

212. The recommendation is to establish a specific project organization dedicated to accomplishing computerization. This organization should be integrated into the existing basic organization, and should draw on the already existing expertise of the civil registration agency and the active partners described previously. The project organization will be a dynamic organization with different staffing over time, but deeply rooted within the basic organization.

2. Steering group

213. The recommendation here is that the project organization be headed by a steering group

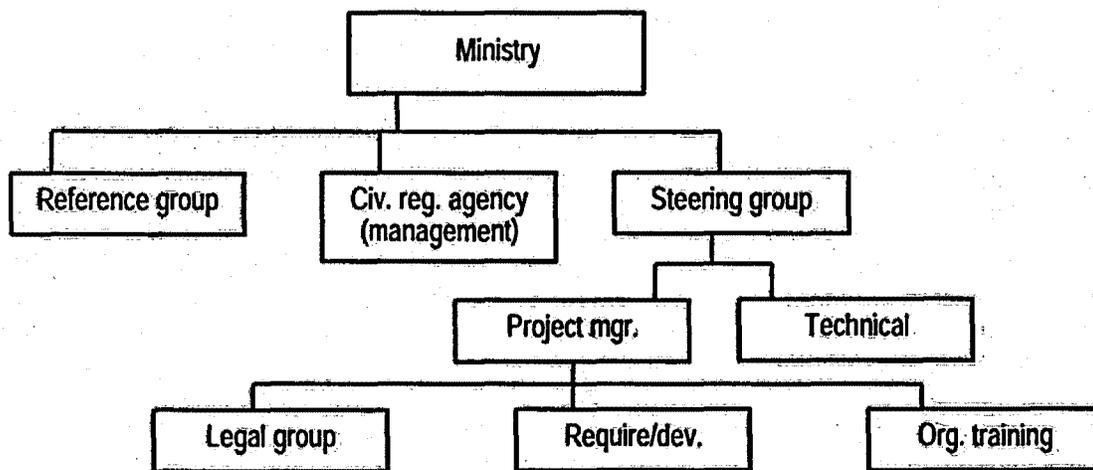


Figure VI.2. Overall structure of civil registration system

that is responsible for overall project management. This group should have representatives of the top management from the civil registration agency, the management of the computer centre or service bureau and the project manager designated to carry out the computerization project.

214. The steering group will report to the top management of the basic organization. Its major responsibilities will be:

- (a) To monitor advance planning activities and system development;
- (b) To approve and monitor activity plans and time schedules concurrently;
- (c) To propose the budget for the project;
- (d) To propose the human resources needed for the project;
- (e) To advise the basic organization on the system concept;
- (f) To advise the basic organization on system requirements.

3. Reference group

215. It is advisable to form a reference group that includes representatives of:

- (a) The basic authorities;
- (b) The local civil registries;
- (c) The vital statistics agency;
- (d) Other potential end users of data.

216. The reference group, which should be headed by the civil registration management, will act as an advisory body and contribute to the advance planning within the following main areas:

- (a) Reporting procedures;
- (b) Registration and error procedures;
- (c) Design of standard reporting forms;
- (d) Requirements regarding data contents and system keys;
- (e) Requirements regarding extracts from the database.

4. Project organization

217. Project organization is headed by the project manager, who performs the day-to-day management of the project activities and the staff. It is recommended that the main activities are divided among small projects groups as set out below.

Legal/administrative group

218. The responsibilities of this group should include:

- (a) Working out proposals for the legal and administrative framework for the system, including reporting procedures, error procedures and registration procedures;
- (b) Acting as an advisory body on all matters relating to registration of individuals;
- (c) Working out proposals for the security legislation and procedures;
- (d) Making proposals regarding the security organization centrally and locally;
- (e) Supervising the local authorities' activities in reporting civil information;
- (f) Working out proposals for standard forms in cooperation with the basic authorities and the local registration offices;
- (g) Giving advice on data-handling and data-sharing.

Requirement and development group

219. This group should be responsible for:

- (a) Proposing and documenting the system requirements;
- (b) Participating in the development of system software, including analysis, design and programming;
- (c) Testing the system;
- (d) Implementing the system centrally and locally.

Organization and training group

220. This group should assist the management in implementing the new organizational structure. This will include the following tasks:

- (a) Defining staff qualifications;
- (b) Defining rules and regulations of the organization;
- (c) Planning and executing training programmes centrally and at the local offices.

5. Basic organization

221. The civil registration agency carries the overall responsibility for the computerization project. All decisions are made by the management of

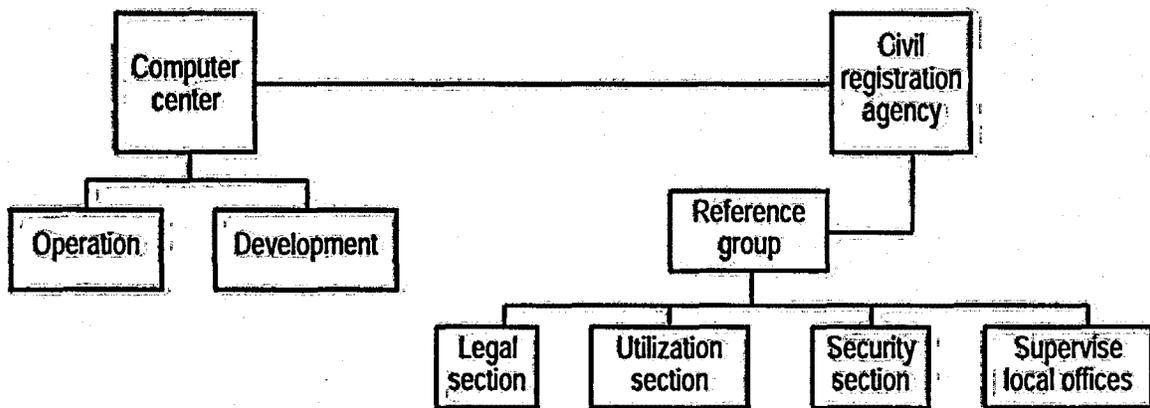


Figure VI.3. Basic organization of a computerized civil registration system

this agency, based on proposals from the reference group and the project steering group, both headed by top-level managers of the civil registration agency. Its responsibilities include:

- (a) Formulating the goals, strategies and policies for the computerization process;
- (b) Providing the financial means for system implementation and operation;
- (c) Providing the legal framework, including the civil registration acts, executive statutes and administrative procedures required for establishment, maintenance and operation of the system;
- (d) Establishing the organization required to handle computerization;
- (e) Deciding on system requirements;
- (f) Deciding on system development and system operation;
- (g) Setting guidelines for the future evolution of the system;
- (h) Informing the public about the system;
- (i) Forming relationships with potential external users of the civil data.

222. Some of the above-mentioned functions will not occur in full scale until the electronic data-processing system is in operation. It is, however, advisable to initiate the planning and organization of the tasks in the advance planning phases of computerization.

Technical group

223. When the system requirements have been decided, then management will be able to decide how system development and system operation should be organized. Some countries may prefer to leave the system development and possibly the system operation to an organization placed outside the civil registration agency. The choice might be a governmental computing centre or a private service bureau. Other countries might want to establish their own computer centre within the basic organization. In either case, the technical management and designated technical staff should participate actively in the project.

F. ORGANIZATION AFTER SYSTEM IMPLEMENTATION

224. When the system has been implemented and is operating, some of the tasks of the project organization will have been completed and some tasks will need to be taken over by the basic organization. New tasks are also created in the operational phase. A description of the organization at this stage is set out below.

1. *Computer centre*

225. If the computer centre is established as part of the basic organization as outlined above, it is important to realize that the role of the centre is to act as a service bureau and operation centre only.

The control of data remains with the civil registration agency. This means that the centre is only allowed to manipulate the data for basic operational purposes, such as back-up and recovery. It should not be allowed to inquire directly from the database.

226. The management of the computer centre should act as technical adviser to the basic organization. It should be responsible for the following main tasks:

- (a) Implement the production process, including automated operations, back-up, recovery, data set management and problem management;
- (b) Carry out the strategic/technical planning in the operation centre;
- (c) Implement and maintain hardware and basic software;
- (d) Implement physical security measures;
- (e) Provide technical assistance to local offices and other end users.

2. Reference group

227. The recommendation is to preserve this group after implementation. The group can be a forum for cooperation with all active partners regarding system maintenance and possible future system development and improvement.

3. Legal section

228. The legal section should be maintained as part of the basic organization.

4. Utilization section

229. When the system is fully implemented, other government agencies, including the vital statistics agency, will make use of the civil registration data, either via on-line access or extractions of data for various administrative purposes. Basic principles regarding the use of civil registration data must be defined. In this regard, the utilization section will carry the responsibility for:

- (a) Assessing user requirements and defining the scope of the services to be provided;
- (b) Informing potential users in general about services provided;

- (c) Defining the conditions regarding the deliverance of data.

5. Security section

230. This section should have the full responsibility for all security procedures. It should enforce their implementation, including:

- (a) Identify and register all users of the system;
- (b) Investigate all security violation attempts;
- (c) Implement security procedures to handle emergency situations (see chap. VIII, sect. C, below);
- (d) Advise the local offices regarding security;
- (e) Carry out random investigations of user access to the system.

G. ORGANIZATIONAL STRUCTURES OF VITAL STATISTICS

231. The United Nations survey mentioned in the introduction to the present chapter also describes the administrative structures of the vital statistics system in a great number of member countries. The main distinction made is between centralized compilation and decentralized compilation of the vital statistics data.

232. The introduction of a computerized civil registration system means that the collection and registration of vital statistics data will be the responsibility of the civil registration agency either at the central or subnational level. This means that computerization will also influence the statistical organization. The level of change will depend on the organization in place. The statistical treatment of data will be simplified, and the organization possibly will be reduced in size. A different type of staff will be needed. Also, the staff in place will require training. Flexibility will increase, and adjustment to centralized and decentralized concepts may occur since it is much easier to move data that are on electronic media. Elimination of redundant work may cause the need for retraining, delegation of new responsibilities and development of new skills.

VII. INITIALIZING THE CIVIL REGISTRATION REGISTER

233. The term initialization covers the one-time process of electronically storing initial register contents before the computer system becomes operational. The methods used for the initialization may be any one of:

- (a) Computerized conversion of data that already exist in an electronic medium (see paras. 241-245 below);
- (b) Using information contained on existing vital records and documents, such as birth records, marriage records and court documents. The information is manually entered into the register (see paras. 246-247 below);
- (c) Newly collecting the information from the population. The information is manually entered into the register (see paras. 248-249 below).

234. In the following text, use of the term "conversion" refers to the first method listed. Use of the term "manual entry" refers to the other two methods. The type of hardware to be used for manual entry need not be a keyboard. Data may be captured using computer-based scanning or optical character recognition.

235. Finding a suitable conversion or initialization strategy is an important task in order to ensure successful operation of the civil registration and vital statistics systems. Deciding on a strategy is a complex and difficult matter. Often, none of the suggested solutions seems attractive; even worse, the solution that at first appears the most attractive may turn out in reality to be extremely difficult to handle. It is important to face the risks, advantages and disadvantages of the strategy chosen. This can avoid unfulfilled expectations for the system on the part of managers, end-users and the population.

A. WHY INITIALIZE THE CIVIL REGISTRATION REGISTER?

236. The purpose of initialization is to establish a "current status" or a snapshot of the population. The snapshot captures the situation for the time prior to operation of the computer system. The snapshot should reflect the population's family

links, as a minimum the links between children under age and their parents. The snapshot should also reflect who are the living individuals of the population and who is married to whom.

237. Initializing with a snapshot of current status eases the complexity of the computer system as well as the manual procedures in the administration. Not initializing with current status raises issues such as:

- (a) How to report a person dead to the system, if the system does not even contain information that this person was once alive;
- (b) How to report a marriage between two persons to the system, if the system does not contain information about one or both of them;
- (c) How to report a divorce to the system, if the system does not contain information about the marriage;
- (d) How to establish family links between a newborn child and its parents, if the system does not contain information about the parents.

238. Systems have tried to solve these questions by adding complex functions to the computer system, such as the automatic or concurrent addition of persons not yet reported in the register in case they are needed as parents or spouses. In the event of death or divorce, the system could simply allow a non-reported person to be reported as dead or divorced. Addition of such functions has some attractive short-term benefits:

- (a) The time-consuming and manpower-costly task of manually entering the initial data is saved (however, if existing data of high quality are available on an electronic medium, this benefit is not realized; for further information on this question, see para. 240 below);
- (b) The civil registration system is fully operational more quickly.

239. These two benefits may appear very attractive. However, the advantages of adding such functions are outweighed by the disadvantages of not initializing:

- (a) Not initializing the register means that an individual is reported to the register only when he or she comes forward to report a vital event. Consequently, getting a complete register of the individuals will take many years, most likely decades. Even more important, as long as the civil register is not complete, the second part of the system—the vital statistics—will not be fully operational;
- (b) Almost none of the improvements and benefits described in chapter IV above can be achieved until the register is complete;
- (c) The population will be divided into two categories: those reported and those not reported.

B. HOW TO INITIALIZE THE CIVIL REGISTRATION REGISTER

240. The first thing to consider is whether existing data are available for the initialization. Such data may be contained in an existing electronic register, in which all or some part of the data needed are stored. This kind of data storage could have the potential for being converted and used for the initialization of the register. Existing information may instead be available in paper form on files or vital records and certificates stored with authorities. This kind of data storage could also have the potential of being used for the initialization of the register. If no reliable data of reasonable quality exist, data must be collected for initialization. Annex VI below describes schematically the process for determination. The process for each method is described below.

1. *Conversion of data already existing on electronic media*

241. Before relying on computerized conversion, the quality of data should be tested. "Quality data" does not necessarily mean data that are 100 per cent correct. However, the data should pass tests in three categories:

- (a) Format;
- (b) Completeness;
- (c) Integrity.

242. Data might be in a different format than the system requires, for example, date of birth stated backwards compared to the data specification of the existing data (i.e., 06.07.1970 instead of 1970.07.06). Data stated in a different format is the least severe problem of the three categories. Most

data in this category can be corrected during the conversion process.

243. Completeness of the data can suffer when a percentage of the population is not registered at all, or when mandatory data items were not filled in according to the data specification of the existing data. No more than 10 per cent of the records converted should be in this category.

244. Lack of integrity in the data is the most severe and dangerous category. Conflicting data make it difficult to separate correct data from incorrect data. If data after conversion cannot be trusted, not only are they useless but they cause more trouble than if no data were available at all. Examples of conflicting data are the same person registered twice, with each registration holding different information; a child registered with two mothers; or a child's mother holding the sex code of a male. Less than 1 per cent of the records converted should be in this category, and all integrity errors should be manually handled afterwards.

245. If the data pass the quality tests, they are suitable for conversion. If the system uses a PIN and existing data do not already make use of such a number, all records should have one assigned during the conversion process. If family links are not available, the links should be collected within the population and manually entered using a temporary application.

2. *Manual entry of information from existing vital records and documents*

246. Existing information about individuals, their status and family links may already be available on paper forms, such as birth, death, marriage, divorce or immigration certificates and court records. If the information is reliable and up to date, it is suitable for a manual entry process. A temporary application should be developed to allow either temporary or existing staff to perform this one-time manual conversion. The temporary application must validate the entered data to an extent that data could afterwards pass a computerized conversion quality test with no problem.

247. For countries using a unique PIN, if the existing paper form data do not already have such a number, then one should be assigned to all records during the manual entry process. If family links are not available, the links should be collected within

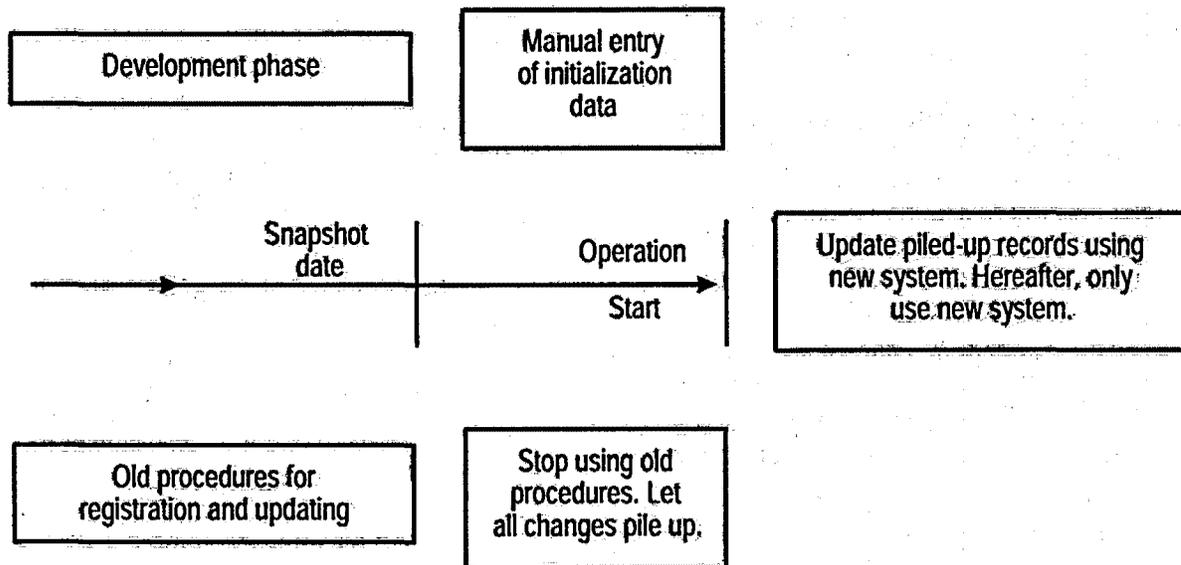


Figure VII.1. Initialization flow chart

the population and manually entered using another temporary application.

3. *Collection of information within the population and manual entering*

248. If neither electronic nor paper form data are available or suitable, all initial information must be collected from the population. If feasible in a country, a simple way is to distribute a questionnaire to all households nationwide and ask the households to fill in and return the questionnaire. The questionnaires should be filled in with information regarding the adults of the household, with their marital status and links, and the minor children of the household, with their parental links. A second way is to set up easy access to counters throughout the country where the public can report themselves, their spouses and their minor children. A third way is to conduct a population census by the canvass method through well-trained interviewers who would visit each household to carefully collect and record the above information. Of particular importance is the accuracy of spelling of names and surnames, date of birth, family relationships and civil status, and a high degree of coverage must be secured—as close as possible to 100 per cent.

249. Successful collection of the information requires that the public is fully informed, the

questionnaires are simple and easy to understand, and help is easily obtained for those who need it. It is also useful to impose strict deadlines for reporting, strong incentives for reporting, and penalties for not reporting. The incoming questionnaires should be manually entered, using a temporary application as described in the paper form method.

C. TIME-FRAME FROM INITIALIZATION TO OPERATION

250. Whether the initialization is by electronic conversion or manual entry, the period of time from conversion or initial collection and entry to when the system is fully operational should be as short as possible. The longer this period stretches out, the less current the data become. Shortening this period lessens the need for temporary maintenance of data.

251. Keying in the initial data manually in order to initialize the register is a time-consuming task. It may be preferable to use less manpower over a longer period of time, instead of much manpower over a short period of time. In countries that have a large population or have less developed communication mechanisms, it may be impossible to handle the task without stretching the time-frame. Planning the initialization period and process in advance may allow for the collection and

initialization to run as parallel phases with system development. This will, however, require some temporary software for updating records. Stretching the time-span too much is certain to cause some of the data to become outdated.

252. Choosing the short time-span avoids the need for software that performs temporary updates. It is important to realize, however, that from the moment when the data are converted or collected (time of the snapshot) to the day that the computerized system is ready for operation, the previous way of registering changes must stop. Let the changes pile up and key them in, using the new computerized system, as soon as the manual entering of the initialization data is finalized.

D. ARCHIVING PAPER-BASED FORMS

253. An issue in almost any computerized system is what to do with paper-based forms once the data from the forms have been captured in the system. There are a number of reasons to save the form and keep it archived. Having the old paper form

available is useful in case an error is detected in the registration at a later time than the data-capture time. The old form is also useful to detect or reject fraud cases if the system is expanded to population registration. The form should also be saved for the simple reason that it probably carries a signature of the individual or authorities, and therefore serves as an official document.

254. When archiving forms, it is important to do so in a systematic way that ensures easy retrieval of the form. Consider developing within the civil registration system a small archiving module to keep track of the forms. Microfilm or optical disk technology might also be considered. Be careful to decide whether the archived forms need to be maintained as a second system set. If it is a second system set, keeping the archived set updated is very important, although it may be expensive and time-consuming. For guidelines on archival methods for vital records, readers should consult the *Handbook on Civil Registration and Vital Statistics Systems: Policies and Protocols for the Release and Archiving of Individual Records* (see preface above).

VIII. SYSTEM FUNCTIONALITY AND REQUIREMENTS

A. SOFTWARE REQUIREMENTS, FUNCTIONALITY AND DESIGN

255. Defining system functionality requires making decisions and describing the following issues:

- (a) Events and tabulations to be included;
- (b) Logical entities and their data items;
- (c) Functions to be included;
- (d) Validation rules, business rules and procedures;
- (e) Utilities to be included.

256. The most difficult part of defining system functionality is to find the fine balance that incorporates the intention of the legislation, the reason for computerization and the administrative procedures involved in system functionality. The following is recommended:

- (a) Do not attempt to use the computer system design to solve mistakes made in the legislation; seek instead to amend the legislation;
- (b) Neither should mistakes, bureaucratic rules or inadequate administrative procedures decide system functionality; rather, correct mistakes, rules or inadequacies first;
- (c) Otherwise, system functionality should reflect both legislation and administrative procedures.

1. *Events and tabulations*

257. Chapter II above has already defined the events and tabulations to be included in the civil registration and vital statistics systems. A phased implementation is strongly suggested.

2. *Logical data entities and their data items*

258. Annex V below suggests the logical entities most likely to exist in the civil registration system. For reasons of design and performance, the names, number and contents of the physical data items may change. The physical implementation of the entities—their data items, keys and indexes—is to be determined by the chief database administrator and the chief designer of the project during the

development phase, and is not a topic for the present *Handbook*.

259. As a general rule, there is a logical entity for each event. One might also consider adding an extra "person" entity. The "person" entity could hold data items not directly linked to any specific event but to the person in general.

260. The data items listed for each entity are without technical items, such as "timestamp", "user-ID for last update" etc. The data items suggested do, however, include items that are needed specifically for vital statistics reasons but are not needed for civil registration purposes.

3. *On-line functions and functionality*

261. For each event, it should be possible to perform three on-line actions: update, enquiry and enquiry for historical information.

Update considerations

262. The update function covers registration of a new event occurring to a citizen. It also covers maintenance of an already registered event. Maintenance involves both changing data due to a new situation in the event and correcting erroneous data that were wrongly registered or entered. Especially for statistical reasons, it is very important for the system to differentiate the actions of adding or changing an event from that of correcting erroneous data: in the first case, one is adding new data to the statistical extract; in the second, one is removing erroneous data and replacing the data with correct data.

263. When designing the update functionality, it is necessary to decide in which situations to store historical information. As a minimum, it is advisable to store historical information for all events in the change category. Historical data may also be stored in the correction situation. This offers the advantage of always being able to trace an event from start to end.

264. All data entered in the update function should be thoroughly checked and validated (see

sect. A4 below for further description of validations and business rules).

Enquiry and historical enquiry considerations

265. For all events, it should be possible to enquire about currently valid data, as well as to enquire about previously valid data, displaying both the contents of the previously valid data and the period for which it was valid.

Search considerations

266. To allow the end-user to find a specific individual in the system in a situation where the PIN is unknown to the user, a search function on the logical entity "person" may be developed. The search should be performed on-line by entering other information known that fully or partly identifies the individual. This could be one or more of the item's name, birth record number, father's PIN, mother's PIN, spouse's PIN, marriage record number etc.

4. Validations, business rules and procedures

267. In all update functions, it is important to validate data carefully before they are stored in the database. By validation is meant checking that data are entered in correct format. For example, if the format of date of birth is defined as YYYYMMDD on the database, it must be ensured that a date is entered that way. YYYY is not useful if it contains 0235, as that would make the person more than a thousand years old. MM must be between 1 and 12 and DD between 1 and 31. Most software automatically checks dates, including when 29/2 is valid etc.

268. "Business rules" is a more extensive kind of checking. It cross-validates. For example, if same-sex marriage is not allowed in the country, the system might check that the personal identification numbers of marrying parties are not of the same sex.

269. "Procedures" validate the registration formalities. When registering a divorce, one would check for a marriage between the divorcing parties at some point. If such a marriage is not found, there might be an error in the entered parties' identification or in the registration of the original marriage.

5. Civil registration and vital statistics interface and other utilities

270. When the civil register database has been established and a thorough updating procedure has

ensured a high and constantly increasing data quality, requests for reports and other output will come from the potential users of civil registration information. Two different types of extraction should be introduced, as described below.

Status extraction

271. Status extraction is defined as an extract of the database at a certain point in time. This is the most common and the easiest form of extraction.

272. Mistakes will occur in the registration system. It is, therefore, advisable to check the validity of extracted data. Checking for errors in a computerized system is a relatively quick and inexpensive process that helps to ensure the quality of the statistical data. To ensure the consistency of the data concerning one person or one event, some probability checks are recommended. Such edits might check that the age of the woman giving birth is in the fertile age, that the age of the bride is the age at which marriage is usual, that marital status for a bride or groom is in accord with the law and so on. The program should be able to correct data as well. Some corrections can be made automatically, but in other situations it will be necessary to review the individual cases.

Change extraction

273. The second type of extraction enumerates the daily changes to the civil database as they are registered by the updating system. This kind of extraction is an important resource for the vital statistics system. The volume of information is much smaller than for status extraction, since only changes to the civil database are processed.

Coding processes

274. As mentioned above (see para. 29), some data in the vital statistics system require complicated coding systems. Cause of death, occupation and education are typical examples. It is important to ensure a high and stable quality of the coding throughout the country, and this is best done in more or less centralized coding processes. To ensure wide comparability, it is advisable to use the codes recommended by the international organizations: the World Health Organization for codes for causes of death, the International Labour Organization for codes for occupation and industry, and the United Nations Educational, Scientific and Cultural Organization for codes for education.

275. To facilitate the coding process, the computerized code books can be used together with a scanning process for the forms. These solutions, however, demand that the forms used are of high quality and require special equipment for reading. A less technically demanding solution is to record the information from the forms and use the computerized code book. One might also consider automated cause of death coding, as discussed in chapter II, sect. C.3, above.

276. Whatever solution is used, there will always be cases that cannot be automatically coded. Some mechanism to provide manual coding needs to be in place.

B. HARDWARE REQUIREMENTS

277. Deciding on computer hardware and other equipment should chronologically be the last decision to be made. It is advisable to invest in hardware depending on the defined system functionality requirements, not the reverse. But since limits on the overall budget usually imply limits on the hardware budget, hardware considerations should be a part of planning the system.

278. Advising on specific hardware or suggesting a hardware configuration model is beyond the scope of the present *Handbook*. Too many variables, each with several sub-variables, make the decision on hardware a science of its own. Among the major variables to be considered are:

- (a) The chosen system concept:
 - (i) Centralized mainframe solution;
 - (ii) Centralized client/server solution;
 - (iii) Decentralized client/server solution;
- (b) The telecommunication infrastructure available in the country;
- (c) The vendor's global market share;
- (d) The vendor's presence in the country;
- (e) The vendor's ability to provide technical support and training.

279. Policies in different countries set different requirements for when the hardware purchase calls for a bid process. It is recommended that independent experts in the matters of bid offers and purchases be consulted if expertise is not available within the organization.

C. SECURITY SYSTEM REQUIREMENTS

280. The civil registration and vital statistics registers must be protected from several security dangers, such as physical damage and misuse of information. Before defining security requirements, a few facts should be stated. The fact that gathering and processing civil information constitutes an enormous investment of man-hours demands that the information must be protected against loss and damage. The civil information itself is, on the other hand, not particularly sensitive from a national security point of view. Misuse of personal information is serious enough to be corrected and punished by the authorities, but would not normally create a specific crisis in the society.

281. It should also be realized that security mechanisms can be very costly if carried to the extreme. It is, therefore, important to weigh cost and benefits carefully when introducing a satisfactory level of security. The security set-up described below is recommended as being at a rational level without being too costly to implement.

1. Physical damage

282. Regular daily, weekly and monthly back-ups of the registers must be made and stored in a location remote from the computer site. This effectively secures the register from damage by fire, flood or other catastrophe that might damage the computer equipment.

2. War

283. Contingency procedures should be made to ensure that all versions of the registers are destroyed in case of war, except for a special security copy that should be shipped to a friendly country. This procedure is of particular importance when the civil registration system has been developed into a population register that can be misused by occupying powers. Such procedures are difficult to carry out in a tense crisis situation. They should, therefore, be practised regularly to be effective.

3. Misuse of information

284. As a general rule, the population should not have direct access to the civil registration and vital statistics registers, nor to the equipment operating the system. Normal office mechanisms, such

as door locks and password protection of data, should offer sufficient security.

4. *Misuse by administrators of the civil registration and vital statistics register*

285. The greatest threat to the computerized civil register is the risk of misuse by entrusted administrative staff. Means to ensure the commitment and responsibility of the staff should be taken, such as ensuring reasonable salaries and modern management procedures. In addition, reasonable controls should be established to enable management to carry out audit procedures. These procedures should include a comprehensive logging system that ensures that all changes and enquiries made to the civil register are recorded. The log should also track time, the PIN of the accessed civil information and operator identification. Based on such a log, management can carry out subsequent investigations at random or on any particular events that seem suspicious.

5. *Operator access restriction*

286. Management should grant different levels of access to different categories of operator staff. It would be normal for a larger part of the staff to have enquiry access, while only a limited number of operators should be able to update the database. Access rights can be distributed by means of passwords for each operator. A database management system should control the safe administration of the passwords.

D. FUNCTIONALITY OF THE VITAL STATISTICS SYSTEM.

287. The requirements of vital statistics systems have been dealt with in great detail by the previously mentioned United Nations publications (see also list of references at the end of the present *Handbook*). The main requirements for system functionality are outlined below.

1. *Error search programs*

288. An extra check and validation of the data received from the civil registration register may be advisable. The program should have the ability to correct data as well. Errors may occur because of

errors in the extraction program and/or errors in the receiving program.

2. *Storage of data*

289. One needs to make decisions concerning the storage of statistical data. Depending on the planned use of the data, they may be stored in a database or as separate files.

3. *Tools for analysis of data*

290. A number of tools are available on the market. It is recommended that one select simple tools during the first period of computerization. Attention should be given to printing utilities and security. The same security level as described above for civil registration data is recommended.

E. SUMMARY

291. The present *Handbook* has examined the goals and purposes of civil registration and looked at the interface between civil registration and the vital statistics system. It has considered computerization and automation of the civil registration system as a whole or in stages. The issue of a country's use of a personal identification number as a citizen identifier has been considered to be beyond the scope of the present *Handbook*. The *Handbook* has, however, considered the effects of numbering systems on civil registration and subsequently on vital statistics and other uses of civil registration data.

292. The *Handbook* included in its presentation a consideration of the differences in structure of civil registration from country to country, and the effect of such differences on the computerization of civil registration. Illustrations from the systems of a number of countries were used in the analysis.

293. Finally, the *Handbook* has provided model organization structures for planning, implementing and maintaining computerization. The use of a phased approach and the importance of initializing the computerized system with population status data were key elements in the *Handbook's* presentation. It is anticipated that the concepts presented in the text and in the annexes below will be helpful in easing the process of computerization of countries' civil registration systems.

Annex I DEFINITION OF CIVIL EVENTS^a

Live birth

Live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which after such separation breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live-born. All live-born infants should be registered and counted as such, irrespective of gestational age or whether alive or dead at the time of registration, and if they die at any time following birth, they should also be registered and counted as a death.

Death

Death is the permanent disappearance of all evidence of life at any time after live birth has taken place (post-natal cessation of vital functions without capability of resuscitation). This definition therefore excludes foetal death.

Marriage

Marriage is the act, ceremony or process by which the legal relationship of husband and wife is constituted. The legality of the union may be established by civil, religious or other means, as recognized by the laws of each country.

Divorce

Divorce is a final dissolution of a marriage, that is, the separation of husband and wife which confers on the parties the right to remarriage under civil, religious and/or other provisions, according to the laws of each country.

Foetal death

Foetal death is death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of preg-

nancy. The death is indicated by the fact that after such separation, the foetus does not breathe or show any evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles.

Annulment

Annulment is the invalidation or voiding of a marriage by a competent authority, according to the laws of each country, which confers on the parties the status of never having been married to each other.

Judicial separation

Judicial separation is the disunion of married persons, according to the laws of each country, without conferring on the parties the right to remarry.

Adoption

Adoption is the legal and voluntary taking and treating of the child of other parents as one's own, in so far as provided by the laws of each country.

Legitimation

Legitimation is the formal investing of a person with the status and rights of legitimacy, according to the laws of each country.

Recognition

Recognition is the legal acknowledgement, either voluntarily or compulsorily, of the maternity or paternity of an illegitimate child.

^aBased on the definition of civil events contained in the *Handbook of Vital Statistics Systems and Methods*, vol. I, *Legal, Organizational and Technical Aspects*, Studies in Methods, Series F, No. 35 (United Nations publication, Sales No. E.91.KVII.5).

Annex II
DEFINITION OF STANDARD POPULATION EVENT REGISTRATION

Immigration (first-time registration)

Immigration is the temporary or permanent settlement of a foreigner in the country. Immigration registration is the recording of the immigration and the immigrant, inclusive of the issuance of a personal identification number.

Change of address

Change of address is a citizen's permanent relocation from one address to another. Change of address registration is the recording of the relocation and the new permanent address.

Change of name

Change of name is a citizen's change of name due to legal, religious or other events. Change of name registration is the recording of the change and the new name.

Granting/withdrawal of citizenship

Granting/withdrawal of citizenship is the public authority's granting/withdrawal of a citizen's citizenship. Granting/withdrawal of citizenship registration is the recording of the granting/withdrawal and citizen it concerns.

Annex III
DEFINITION OF RECOMMENDED VITAL STATISTICS TABULATIONS

Live births

1. Live birth by place of occurrence
2. Live birth by attendant of birth
3. Live birth by month of occurrence
4. Live birth cross-classified by sex and legitimacy
5. Live birth by age of mother
6. Live birth by age of father
7. Live birth cross-classified by age of mother and live-birth order
8. Legitimate live birth by duration of marriage
9. Live birth cross-classified by live-birth order and interval since last previous live birth to mother
10. Live birth by birth weight
11. Live birth by place of usual residence of the mother
12. Live birth by date of registration (in some countries, late registration is a sizeable portion of registration)
13. Live births cross-classified by educational attainment of the mother

Deaths

14. Deaths by place of occurrence
15. Deaths by place of usual residence of decedent
16. Deaths by month of occurrence
17. Deaths cross-classified by sex and age
18. Deaths cross-classified by month of occurrence and selected causes of death
19. Deaths cross-classified by age and cause of death, for each sex
20. Deaths cross-classified by type of certification and cause of death

Infant deaths (deaths under one year of age)

21. Infant deaths by place of occurrence
22. Infant deaths by place of residence of mother

23. Infant deaths cross-classified by age and sex
24. Infant deaths cross-classified by age and month of occurrence
25. Infant deaths cross-classified by selected causes of death and sex

Foetal deaths

26. Foetal death by place of occurrence
27. Foetal death by sex and gestational age
28. Late foetal deaths cross-classified by sex and legitimacy status of foetus
29. Late foetal deaths cross-classified by age of woman and legitimacy status of foetus, for each sex
30. Late foetal deaths cross-classified by age of woman and total birth order

Live birth and foetal deaths

31. Confinements cross-classified by type of birth and status of issue (live-born or born dead)

Marriages

32. Marriages by month of occurrence
33. Marriages by place of usual residence of groom
34. Marriages cross-classified by age of bride and age of groom
35. Marriages cross-classified by previous marital status of bride and previous marital status of groom
36. Marriages cross-classified by literacy status (or educational attainment) of bride and groom
37. Marriages by occupation of groom
38. Marriages by type of marriage

Divorces

39. Divorces by place of occurrence
40. Divorces by place of usual residence of husband

41. Divorces cross-classified by age of wife and age of husband
42. Divorces cross-classified by duration of marriage and age of divorcees, tabulated separately for husband and wife
43. Divorces cross-classified by number of dependent children and duration of marriage
44. Divorces cross-classified by literacy status (or educational attainment) of divorcees
45. Divorces cross-classified by occupation and husband and occupation of wife
46. Divorces cross-classified by number of previous marriages of husband and number of previous marriages of wife

Annex IV
SAMPLE TABLE OF CONTENTS FOR CIVIL REGISTRATION
FEASIBILITY STUDY

CONTENTS

Executive summary

Preface

- I. *Current situation***
 - A. Description of the civil registration system in place
 - B. Weaknesses and problem areas
- II. *Framework of the computerized system***
 - A. Overall system concept
 - B. Organization and management
 - C. Security
 - D. Legislation on civil registration
- III. *Mechanics of the future system***
 - A. General statement of solution
 - B. Hardware and software considerations
 - C. Initializing the civil registration database
- IV. *Next steps***
 - A. Master plan for the implementation
 - B. Standards
 - C. Training
 - D. Risk analysis
 - E. Extensions to the system (next phases)

Annexes

- I. Functional requirement definition**
- II. Civil registration legislation**

Annex V
LOGICAL ENTITIES AND THEIR DATA ITEMS
IN THE CIVIL REGISTRATION SYSTEM

<i>Entity</i>			<i>Data items</i>
<u>Person</u>			
	▲	★	PIN
	▲	★	Status (alive, dead, disappeared etc.)
	▲	★	Marital status (single, married, widowed etc.)
	▲	★	Sex (female or male)
		★	Name ^a
	▲	★	Mother's PIN
	▲	★	Father's PIN
	●		Address ^a
	●		Postal code ^a
	●		State code/country code
<u>Birth</u>			
	▲	★	PIN
	▲	★	Date of birth
	▲	★	Place of birth
		★	Date of registration
	▲		Attendant at birth
	▲		Weight at birth
	▲		Legitimacy status
	▲		Place of usual residence of mother
		★	Birth certificate number
<u>Death</u>			
	▲	★	PIN
	▲	★	Date of death
	▲	★	Place of death
		★	Date of registration
	▲		Cause of death
	▲		Certifier

- ★ Civil registration data item
- ▲ Vital statistics data item
- Population registration data item

^aThe structure of name and address varies all over the world; local requirements must be applied.

Entity

Data items

Death

- ▲ ★ Death certificate number
- ▲ Place of usual residence of deceased
- ▲ Place of usual residence of mother (death under one year of age)

Foetal death

- ▲ ★ Mother's PIN
- ▲ ★ Date of foetal delivery
- ▲ ★ Place of foetal delivery
- ▲ ★ Date of registration
- ▲ ★ Sex of foetus
- ▲ ★ Gestational age of foetus
- ▲ Legitimacy status of foetus

Marriage

- ▲ ★ Wife's PIN
- ▲ ★ Husband's PIN
- ▲ ★ Date of marriage
- ▲ ★ Place of marriage
- ▲ ★ Date of registration
- ▲ ★ Type of marriage (civil, religious etc.)
- ▲ Literacy status or educational attainment of bride
- ▲ Literacy status or educational attainment of groom
- ▲ Occupation of groom
- ▲ ★ Marriage certificate number

Divorce

- ▲ ★ Wife's PIN
- ▲ ★ Husband's PIN
- ▲ ★ Date of divorce
- ▲ ★ Place of divorce
- ▲ ★ Date of registration
- ▲ Usual residence of husband
- ▲ Number of dependent children
- ▲ Occupation of bride
- ▲ Occupation of groom

Annulment

- ★ Female's PIN
- ★ Male's PIN

- ★ Civil registration data item
- ▲ Vital statistics data item
- Population registration data item

Entity

Data items

Annulment

- ★ Date of annulment
- ★ Place of annulment
- ★ Date of registration
- ★ Certifying authority

Judicial separation

- ★ Female's PIN
- ★ Male's PIN
- ★ Date of separation
- ★ Place of separation
- ★ Date of registration
- ★ Certifying authority

Adoption

- ★ PIN
- ★ Date of adoption
- ★ Place of adoption
- ★ Date of registration
- ★ Adopting mother's PIN
- ★ Adopting father's PIN

Legitimation

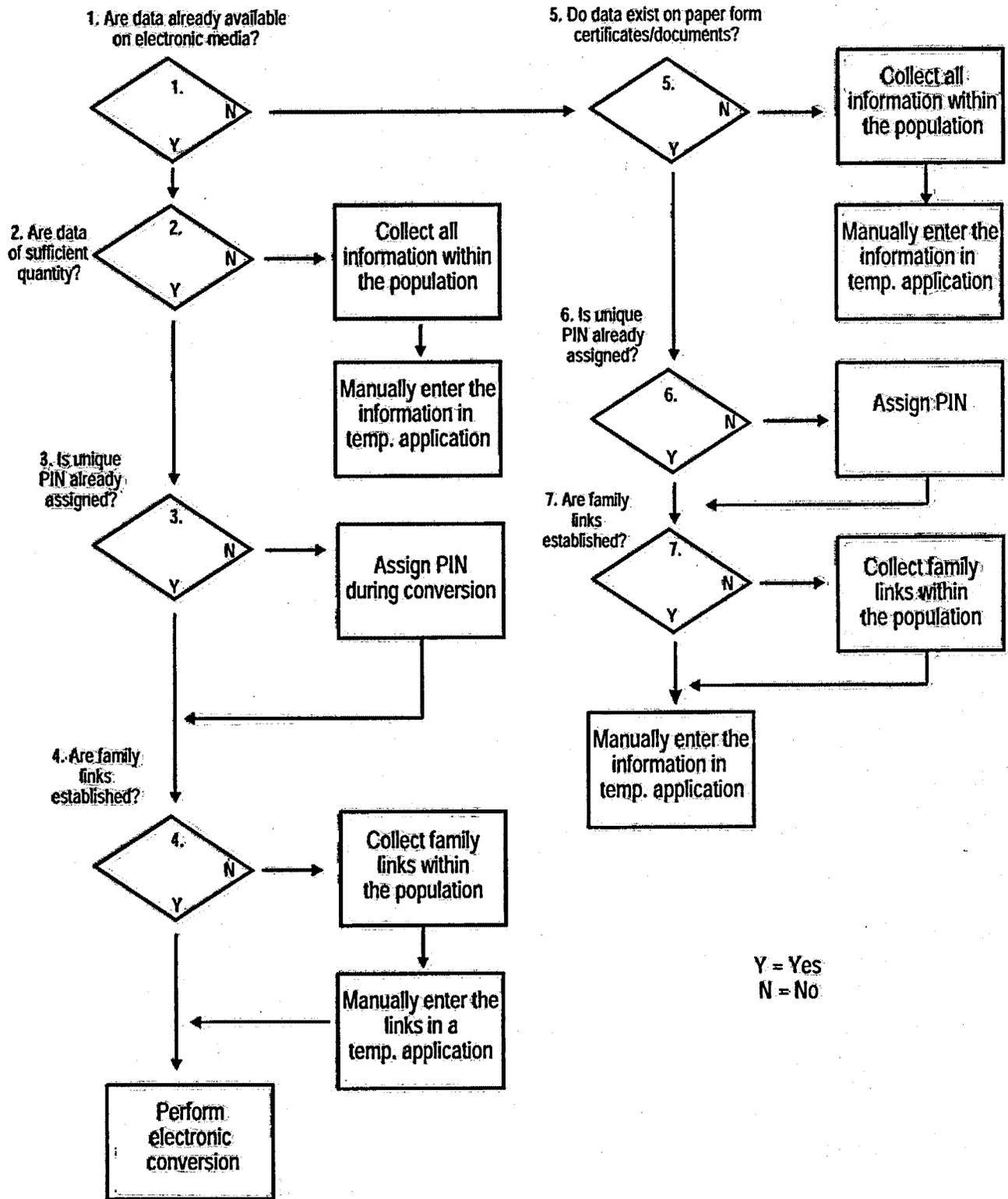
- ★ PIN
- ★ Date of legitimation
- ★ Place of legitimation
- ★ Date of registration
- ★ Type of legitimacy
- ★ Issuing authority

Recognition

- ★ PIN
- ★ Date of recognition
- ★ Place of recognition
- ★ Date of registration
- ★ Reason of recognition (voluntary or compulsory)
- ★ Type of recognition (maternity or paternity)
- ★ Maternity/paternity PINs

- ★ Civil registration data item
- ▲ Vital statistics data item
- Population registration data item

Annex VI DECISION PROCESS FOR CHOICE OF INITIALIZATION METHOD



Annex VII

CASE STUDY: COMPUTERIZATION OF THE CIVIL STATUS AND VITAL STATISTICS SYSTEMS OF SEYCHELLES AND THEIR INTEGRATION WITH THE NATIONAL POPULATION DATABASE^a

I. Introduction

1. The Civil Status records were computerized in 1989; subsequent to the setting up of the National Population Database (NPD) in 1988. At the same time, the national identity number (NIN) system was introduced. The latter was made compulsory in June 1995.

2. Currently, two sets of records are maintained in respect of the Civil Status. The manual record is maintained in accordance with the Civil Status Act and the computerized record for use by the NPD. This dual system protects source data against possible destruction, and is a double check on the source of the statistical data.

3. The NPD, which is the population register, was set up using variables from the 1997 census under special administrative procedures. It is amended on a daily basis from occurrences registered by the Department of Civil Status and validated periodically through national censuses and surveys. Since its inception, validation was done in August 1994, and is currently being updated by means of a population census.

4. Administration of the NPD and the NIN was transferred from the Management System Division in the Ministry of Administration and Manpower to the Department of Civil Status in January 1994. The Department of Civil Status falls under the portfolio of the Electoral Commissioner, who is also the Chief Officer of the Department of Civil Status.

II. Interface of the civil registration system with the vital statistics system and the National Population Database

5. As noted above, the three systems are inter-linked. They are operated using one database to economically facilitate and control the registration

and statistical records. The system uses the NIN as the main identifier. The Civil Status and NIN units are both on-line with the NPD. In addition, the Statistics Section of the Management Information System Division is also linked to the NPD for purposes of producing population statistics.

6. The structure of the NPD and its uses is shown in appendix I.

7. Births, deaths and changes of name with regard to the requirements of the Civil Status Act are input or flagged by the Department of Civil Status.

8. Input for the NIN is carried out by the NIN Office.

9. The Electoral Commissioner uses the NPD data for the annual production of the register of voters and for the review of electoral boundaries that is carried out every three years.

10. Movement of residents in and out of country is flagged using data provided by the immigration authorities.

11. The Social Security Fund obtains data from the NPD concerning pensioners' qualification for pension and the electoral area of their residence.

12. The NPD operates on a live system that is updated on a daily basis. It provides up-to-date information on occurrences to an individual.

III. Specification of hardware

13. The following hardware is employed:

AS/400 Model F10 - 8Mb940/F10

400cps Twinax Printer 4230/102

Colour Workstation 3487/CAE

PC-Support AS/400 Ver 25738/PC1

AS/400 Appl Dev Utilities 5738/PW1

AS/400 Query/4005738/QU1

AS/400 RPG/4005738/RG1

AS/400 V25738/SS1

^aPaper contributed by G.P. Ah-Shung, Electoral Commissioner and Chief Officer of the Civil Status of the Government of Seychelles, October 1997.

Dell Optiplex 466tMXV 8 Mb RAM, 320 Mb HDD

1.2mB & 1.44 Mb FDD

Tape Backup

All users are equipped with monitor or PC, laser printer, AS/400 NDF.

IV. Specification of software

14. The NPD employs its own specific software program designed to suit the requirements of the Civil Status, the Statistics Office of the Government, the NIN system and the Departments of Immigration and Social Security.

V. Scope of the national population database

15. The NPD is a live system that records the personal data of living individuals residing or working in Seychelles. It helps to track the various occurrences regarding the individual (birth, death, marriage, change of name, naturalization, migration etc.).

16. The system is on-line. Data are processed immediately after each occurrence. The NPD is a common database, with information shared among authorized users with authorized access. As such, the NPD is used for:

- (a) Population records and estimates;
- (b) Alphabetical indexes of vital statistics/civil status;
- (c) Issuance of national identity cards;
- (d) Compilation of social security pension records;
- (e) Compilation of the Electoral Register;
- (f) Creation of other databases, using the NIN as the main identifier;
- (g) Copies of Acts of Civil Status for public use.

VI. The number system and the generation of data

A. GENERATION OF NATIONAL IDENTITY NUMBER

17. The national identity number is generated by the computer using the registration number. The number is composed of the year of registration, folio number, place of registration and sex. In the case of expatriates working in Seychelles, a sequence number is used instead of the folio number. These functions are performed by the ID Card Of-

fice, using an S/56 terminal. Thus, the NIN is generated immediately.

B. ADDITION OF BIRTH

18. When a birth is registered at the Department of Civil Status, the NIN is generated and recorded on the birth record. Data entry is done daily in batch mode (data from branch offices of the Civil Status are processed on a weekly basis). A proof list is printed and checked against the original register. After correction (if any), a final list is printed and verified as correct by an officer. The data are then uploaded into the NPD. When the NIN card is issued, the parent or guardian of the child is requested to certify that the information on the card is correct.

C. ADDITION OF APPLICANT

19. Applicants are categorized as follows:

- (a) Seychellois who do not hold an NIN;
- (b) Foreign-born Seychellois not registered with the Civil Status;
- (c) Expatriates resident in Seychelles;
- (d) Foreigners employed in Seychelles;
- (e) Seychellois by naturalization or registration.

20. Separate procedures are followed for each of the above categories. Before processing an application, a check is carried out on the NPD to ensure that the applicant has not already been issued a card. The application must be supported by documentation pertaining to the status and identity of the applicant to the satisfaction of the processing officer.

D. CHANGE OF NAME

21. This can occur in the following cases:

- (a) Marriage;
- (b) Divorce;
- (c) Adoption;
- (d) Acknowledgement of a child;
- (e) By application and gazette notification.

22. Before processing the change of name, the NPD is checked to find out whether the applicant holds an NIN. If not, the same procedure as for the addition of an applicant is followed.

E. MIGRATION MOVEMENT

23. The immigration authorities maintain their own database on the movement of residents in and

out of Seychelles. The NPD is flagged daily using these data. Validation of the data is carried out periodically by the Statistics Unit of the Management Information Systems Division.

F. DEATH

24. When a death is registered at the Civil Status, a data entry form is completed. This is used as the input to the NPD after verification using a proof list.

G. NATURALIZATION

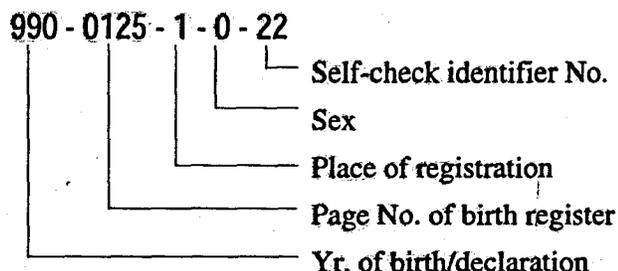
25. When an expatriate is naturalized, a new NIN is generated by the Civil Status. The new number is recorded in the person's birth certificate or passport. The old card is destroyed. The Civil Status enters the new NIN and the old NIN. The NPD is automatically updated. After a proof list is checked, a label is printed for the new NIN.

VII. Database maintenance

A. NATIONAL IDENTITY NUMBER GENERATION FOR BIRTH

26. The NIN is generated from a nine-digit folio number allocated when declaring birth.

Example:



Code for sex

- 0 - Female
- 1 - Male

Place of registration code

- 1 - Victoria
- 2 - Anse Royale
- 3 - Praslin
- 4 - La Digue
- 5 - Seychellois by descent
- 6 - Seychellois by naturalization
- 7 - Expatriates
- 8 - Diplomats
- 9 - Not elsewhere classified

B. ADDING BIRTHS AND APPLICANTS TO THE DATABASE

27. To add a new NIN and its relative particulars to the database, the NIN must be generated and stored in the systems file. This will allow a double check of the NIN before it is finally allocated. Validation is required of:

- (a) Duplicate NIN;
- (b) All compulsory fields;
- (c) Date of birth.

C. FLAGGING OF DEPARTURES AND ARRIVALS

28. Data collected from the Immigration Division are used to update the migration status of an individual on the database. Access is made through the NIN. Validation is required of:

- (a) NIN existence;
- (b) Present migration status;
- (c) Migration date.

D. CHANGE OF NAME

29. Change of name involves the change of surname and / or names of a person as a result of a legal procedure under the Civil Status Act. The new name overrides the present one in the database. Both sets of names (old and new) are then stored in a log file for future reference. Access is made by the NIN. Validation is required of:

- (a) NIN existence;
- (b) All compulsory fields;
- (c) Date of change.

E. DEATH

30. The program allows for the flagging of a person as "dead" in the database, and stores the death transaction in a log file for future reference. Access is made by the NIN. Validation is required of:

- (a) NIN existence;
- (b) All compulsory fields;
- (c) Declaration date.

F. PROOF LISTING

31. Proof lists are taken at the end of the day's transaction inputs. These lists are checked against

the source input documents for input errors, which are corrected immediately. Proof checks are normally carried out by a person other than the keyboard operator who did the actual posting of source documents.

VIII. Database and transaction screen inquiries

32. The system provides an inquiry program on each update application. The revised and updated application control, file maintenance, authorized update, inquiry and report functions are described in appendix II. The main database inquiry by the NIN will define if a person has the following status:

A - In the country

E - Not in the country

N - Naturalized

C - Change of name

D - Dead

M - Has migration movements.

33. Further details on a status (if present) can be viewed by selecting "Operation" on the inquiry menu.

IX. Data fields

34. Appendix III contains the list of data fields.

X. Application form: national identity number

35. Appendix III contains a sample of the application form for an NIN.

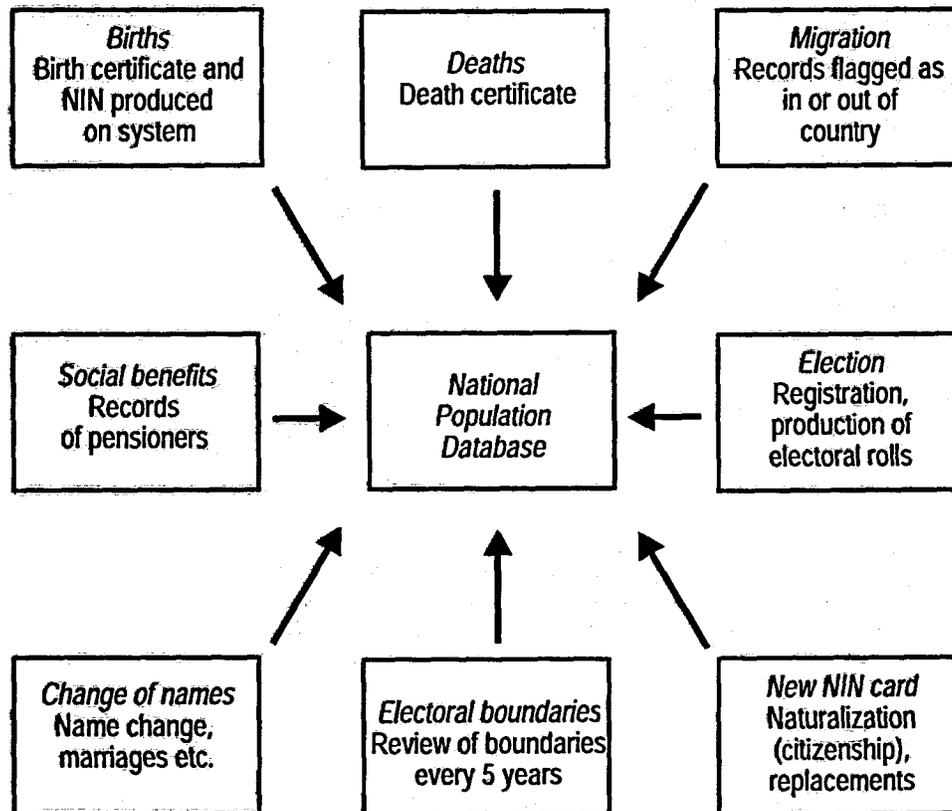
XI. Production of the Electoral Register

36. The NPD is the main database used in the production of the Electoral Register. Each entry in the NPD bears the electoral district in which the individual resides or is registered as a voter. The Register is updated annually (January) to make changes, such as:

(a) Addition of persons to the Register who attain the age for registration as a voter (18 years);

(b) Amendments on account of change in electoral area, movement of a voter to another electoral area, claims and objections, change of name, migration status, deaths, change of status on account of naturalization or registration as a citizen.

Appendix I
STRUCTURE OF THE NATIONAL POPULATION DATABASE



Appendix II NATIONAL POPULATION DATABASE USER GUIDE*

Application Control Menu (Main Menu)

Picture 1 shows the first menu which appears when you first log on the system.

```
MPDNST                                8/87/97
      NATIONAL POPULATION DATABASE
      Application Control Menu

Select one of the following:

      1: File Maintenance - menu
      2: Authorized Update functions - menu
      3: Inquiries - menu
      4: Reports - menu
      24: Sign-off

Selection or command:
=> _____

F12-Exit  F10-Prompt  F8-Retrieve  F12-Cancel
```

Picture 1: Application Control Menu.

This is the main menu and four sub-menus are listed under it. To get access to system programs the user must first get access to the main menu and then navigate through the four sub-menus.

- To access a sub-menu, type the number next to the menu name on the command prompt then hit the ENTER key. Programs available under the chosen menu will be displayed.
- To run a program from a menu, type the number next to the program description on the command prompt and hit the ENTER key.
- To step back to the previous menu press the F12 key.

File Maintenance Menu

By choosing option 1 from the Application Control menu the File Maintenance menu will be displayed. Picture 2 shows this menu.

```
MPDNMAINT                             NATIONAL POPULATION DATABASE
                                      File Maintenance Menu

Select one of the following:

Main functions:
  1: Check Digit Generation
  2: Add Birth and New Applicant
  3: Add Extra Birth Details
  4: Register I.D card issue

Main file Maintenance:
  5: Maintain Raster file           6: Maintain Death file
  7: Maintain Extra birth detail    8: Maintain Nationality file
  9: Maintain District/Location file

F12: Back to Main Menu           24: Signoff

Selection or command:
=> _____

F12-Exit  F10-Prompt  F8-Retrieve  F12-Cancel
```

Picture 2: File Maintenance Menu.

*This user guide is designed to introduce the restructured NPD to its users, and to help establish whether the changes that were required have been implemented; compiled by Jude Adeline, 1997.

From the File Maintenance menu the user has the option of choosing functions which has to do with the manipulation of the main NPD files and operations. Below is a description of what each option/function does.

1. Check Digit Generation :: Let the user input the ID of the person and then generate a check digit to create an NIN which can afterwards be used to add that person to the NPD.
2. Add Birth and New Applicant :: Allows the user to add any birth or applicant to the NPD.
3. Add Extra Birth Details :: If a birth has been posted this option will let the user input the extra birth information for the baby.
4. Register I.D card issues :: Allow the user to register the issue of an I.D card to a person. This includes New cards, Lost cards or Changes made to the persons NPD information.
5. Maintain Master file :: Allow user to edit master file records.
6. Maintain Extra Birth details :: Allow user to edit extra birth details.
7. Maintain death file :: Allow the user to maintain death information.
8. Maintain district/location file :: Allow the user to maintain sub-district and district informations.
9. Maintain Nationality file :: Allow the user to maintain the Nationality and country file.

Authorised Update Functions

Option 2 from the Application Control menu will display the Authorised Update Menu shown in Picture 3.

```

NPDAUTH
          NATIONAL POPULATION DATABASE
          Update Functions
Select one of the following:

      1: Change Name or Surname      4: Change NIN in master file
      2: Register Death              5: Input Marriage details
      3: Allocate cause of death     6: Delete NPD record

      F2: Return Main Menu          24: Signoff
Selection or command:
=====
F2-Exit  F3-Prompt  F4-Retrieve  F5-Cancel
  
```

Picture 3: Update Functions Menu

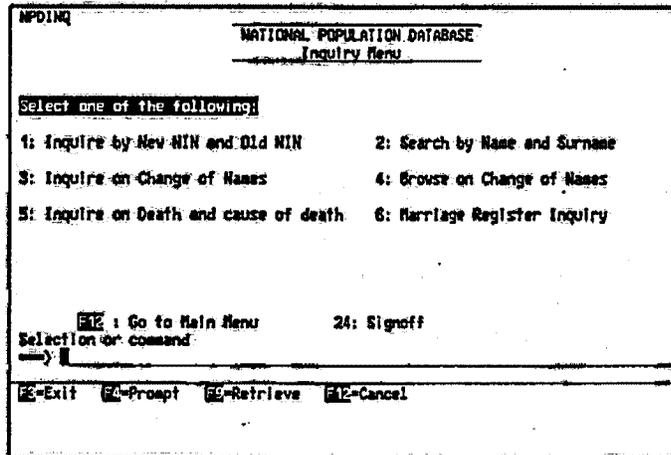
As can be seen from the picture there are six options under this menu, below is a description of what each option offers.

1. Change Name or Surname :: Allow the record of a change of name occurred and at the same time update the corresponding record in the master file.
2. Register Deaths :: Register deaths and additional information and at the same time flags the corresponding record in the master file if the person has an NIN.
3. Allocate cause of death :: Allow the input of cause of death.

- 4. Change NIN in master file :: Allow the change of an NIN in the master file if the NIN is wrong or if a person has had a change of NIN.
- 5. Input Marriage details :: Allow the input of marriage information.
- 6. Delete NPD record :: This option has been included to allow the deletion of a record which for a reason or another is not needed in the master file. Only certain user will be able to use this option.

Inquiries

Picture 4 shows the Inquiry menu which is accessed by choosing Option 3 from the main menu.



Picture 4: Inquiry Menu

The options under this menu are used for on-screen inquiries on certain NPD information or files. These are described below.

- 1. Inquiry by New and Old NIN :: This option is used to display the information about a person as it is in the master file. Both the present NIN or the old NIN of that person can be used to obtain these information.
- 2. Search by Name and Surname :: This is basically a browse screen where eighteen records are displayed at a time and the user can use the name, surname or NIN of a person to position to a desired record.
- 3. Inquire on Change of Names :: Also a browse program displaying twelve records at a time showing the change of names. This option will run a version designed for earlier workstation screens which are only able to display 80 by 24 columns.
- 4. Browse on Change of Names :: This is the same as option 3 except that it has been design for later workstation screens with the ability of displaying 132 by 80 columns.
- 5. Inquire on Death and Cause of Death :: Also a browse program to inquire on deaths and causes of death.
- 6. Marriage Register Inquiry :: A browse program to inquire on marriage information.

Reports

Option 4 from the main menu will display the Reports menu which will give the user a variety of printable reports. Picture 5 shows the Report menu.

```
NPDRP:                                     8/87/97
      NATIONAL POPULATION DATABASE
      Report Control Menu

Select one of the following:

1: Print Birth list           2: Print District list
3: Print Nationality list    4: Print Sub-District list
5: Print selected records from Master file  6: Print Master Register
7: Print Master Register excl deaths        8: Weekly Death Report

24: Sign-Off                 F12: Main Menu
Selection or command key:

E=Exit  P=Prompt  R=Retrieve  C=Cancel
```

Picture 5: Report Menu

The options are described below.

- | | | |
|-----------------------------------|----|---|
| 1. Print Birth List | :: | Gives the user the option of inputting a range of date for which births in this range are printed. |
| 2. Print District List | :: | Print a list of available district codes and their description. |
| 3. Print Nationality List | :: | Print a list of country codes, the country description and the nationality description. |
| 4. Print Sub-District list | :: | Print a list of subdistrict, their corresponding district and the description. |
| 5. Print Selected records | :: | Gives the user an option of month and date and generate a report of records from the master file whose birth date is in that range. |
| 6. Print Master Register | :: | Print the whole NPD master file. |
| 7. Print Master Reg. excl. Deaths | :: | Print NPD master file excluding person flagged as dead. |
| 8. Weekly Death Report | :: | Print a weekly report of death information. |

NOTE: I hope this short guide will help you to get a start on the NPD and please don't hesitate to make any suggestion and ask questions.

Appendix III
LIST OF DATA FIELDS IN THE NATIONAL POPULATION DATABASE

Main database file

National identity number
Surname
Other names
Surname at birth
Date of birth
Nationality
Mother's maiden surname
Mother's name
Old NIN
NIN procurement type
Status 1 (in/out of the country)
Status 2 (name change)
Status 3 (naturalized)
Status 4 (death)
Status 5 (migration movement)
General remarks

Migration file

National identity number
Type of movement
Movement date
Sequence number
Last movement date
General remarks

Change of name file

National identity number
Previous surname
Previous other names
New surname
New other names
Change date
Sequence number
Official gazette No.
Reason for change

Death file

National identity number
Registration number
Place of registration
Place of death
Cause of death
Declaration of date
General remarks

Appendix IV
SEYCHELLES NATIONAL IDENTITY CARD
(S.S. Act 10/95)

APPLICATION FORM (NEW/RENEWAL)

PLEASE WRITE IN PRINTED FORMAT.		DATE	SERIAL No.
---------------------------------	--	------	------------

- 1 Present Surname: _____
- 2 Other Names: _____
- 3 Maiden Surname: _____
- 4 Date of Birth: ___/___/19___ Sex: _____ District: _____
- 5 Place of Birth Registration: _____ Nationality: _____
- 6 Mother's Maiden Surname: _____
- 7 Mother's First Name: _____
- 8 Date Arrived in Seychelles: ___/___/19___ (IF APPLICABLE)
- 9 a) Residential Address: _____
- b) Employment Address: _____
- 10 Telephone Number: _____

Signature of Applicant: _____

For Official Use only

N.I.N.

Status: _____

Remarks: _____

Collection Date: ___/___/19___ Registration Officer: _____

Application Check by: _____ I.D. Card Check by: _____

N.I.N.

Delivered to: _____

Mr/Mrs/Miss _____

SIGNATURE _____ DATE: ___/___/19___

RENEWAL APPLICATION FEE PAID: R _____ Cr. No. _____ DATE: ___/___/19___

- NOTE: 1 9(a) STATE PERMANENT RESIDENCE.
2. Application for new NIN must be supported by Birth certificate, passport, GOP, certificate of registration or naturalisation, residence permit as may be requested by the Registration officer.

Annex VIII
CASE STUDY: COMPUTERIZATION OF THE
CIVIL REGISTRATION SYSTEM IN SCOTLAND^a

**I. General Register Office
for Scotland**

A. DUTIES AND RESPONSIBILITIES

1. The General Register Office for Scotland administers the registration of such events as births, deaths, marriages, divorces and adoptions, and is responsible for the statutes relating to the formalities of marriage and conduct of civil marriage. The Office takes the decennial census of Scotland's population, and prepares and publishes demographic and other statistics for central and local government, for medical research and for the private sector. It also makes available to customers public records about individuals, and maintains for the Scottish Office the National Health Service Central Register. The Office is headed by the Registrar General for Scotland, James Meldrum.

2. The Registrar General has a statutory duty to report each year on various statistical matters. This annual report is then laid before Parliament by the Secretary of State for Scotland. It contains detailed tables on births, deaths (including information on cause of death), marriages, divorces and population estimates. The annual report is supplemented by a short vital events return, which the Office publishes every four weeks. In addition to the range of standard statistics (including Scottish census statistics) available, the General Register Office produces other statistical output to order.

B. REGISTRATION

1. General

3. Scotland is an integral part of the United Kingdom of Great Britain and Northern Ireland. Its history is reflected in the fact that it has its own legal system, separate from those of England and

Wales, and of Northern Ireland. Civil registration is therefore governed by different Acts of Parliament.

4. Scotland's population in 1993 was approximately 5.1 million persons. In that year, some 360 registration districts registered approximately 161,000 events (63,000 births, 64,000 deaths and 33,000 marriages).

2. Legislation

5. The main laws relating to registration and marriage are:

- (a) Registration of Births, Deaths and Marriages (Scotland) Act 1965;
- (b) Marriage (Scotland) Act 1977.

6. Under the 1965 Act, the relevant United Kingdom Government Minister appoints a Registrar General, who has statutory authority to prescribe forms and to set fees, subject to the approval of the United Kingdom Parliament. He also has authority to give instructions and directions to registrars on the exercise of their functions.

3. Organization

7. Responsibility for the operation of civil registration is divided between the Registrar General and 32 local councils, who employ a total of 360 registrars in local offices.

8. The Registrar General employs three examiners, who inspect the work of the registrars. The control of registration is administrative, not judicial. A member of the public who is unhappy with a decision of the Registrar General can, in theory, appeal to a court, or can make a complaint, via a Member of Parliament, to the Parliamentary Commissioner for Administration (the Ombudsman).

4. Registers

9. Registrars maintain and preserve registers of births, stillbirths, deaths and marriages. They also conduct all civil marriages. All births, stillbirths, deaths and marriages (both civil and religious) oc-

^aPaper contributed by David B. L. Brownlee, General Register Office for Scotland, November 1997.

curing in Scotland must be recorded in these registers. Copies of the registers are held centrally by the Registrar General.

10. The Registrar General maintains registers of adoptions and divorces notified to him by Scottish courts. Where a court makes an adoption order, the Registrar General annotates the entry in the register of births, as well as making a separate entry in the adoption register. The information necessary to link the two entries is kept confidential. Where a court makes a divorce order, the entry in the register of marriages is annotated to show the marriage is ended.

11. The items included in the main registers are:

- (a) *Birth*: forenames and surname, sex, date and time of birth, place of birth, mother's forenames and surname, mother's maiden surname, mother's usual residence, father's forenames and surname, father's occupation, date and place of parents' marriage, signature of informant, date of registration, signature of registrar;
- (b) *Death*: forenames and surname, sex, occupation, marital status, date of birth, age, time, date and place of death, cause of death, usual residence, forenames, surname and occupation of spouses, forenames, surname and occupation of father, forenames, surname and maiden surname of mother, signature of informant, date of registration, signature of registrar;
- (c) *Marriage*: forenames and surname, sex, occupation, marital status, date of birth, place of birth, usual residence, forenames, surname and occupation of father, forenames, surname and maiden surname of mother (above details for each of the two parties to the marriage); name of person solemnizing the marriage, name and address of each of two witnesses, date of registration, signature of registrar.

12. The general rule is that once made a register entry remains unchanged. However, the Registrar General maintains a register of corrections etc. in which amendments to the other registers can be entered. Some changes are possible:

- (a) An error of fact in any register entry may be corrected;
- (b) Birth entry where the parents subsequently marry may be cancelled and replaced;
- (c) Marriage entry may be cancelled if a court declares the marriage was void.

13. There are some cases in which an entry is made in the register of corrections and a marginal note beside the original entry gives a reference to this, including cases in which:

- (a) A court has made an order of parentage;
- (b) The subject of the entry has changed his or her name;
- (c) Further information about a death has become available.

5. Documents issued from the registers

14. There is a statutory requirement for various officials to be notified of certain events (e.g., births to local public health authorities, deaths to local tax authorities). Otherwise, information is given by way of official extracts. In most but not all cases, the extract reproduces the information in the register as amended by any entry in the register of corrections. Except in the case of stillbirths (for which the permission of the Registrar General is required), anyone may purchase an extract on payment of the relevant fee. Extracts from the registers are accepted in courts as evidence of the events to which they relate.

6. Consultation of registers

15. Any member of the public, on payment of a fee, has a statutory right of access to the indexes to the registers (now held on computer) and, on payment of a further fee, can buy an extract of an entry in the registers. Members of the public paying for access to the indexes to the registers are generally also allowed, by an administrative decision of the Registrar General, to inspect the registers.

II. Collection and retention of vital events in Scotland

A. LOCAL REGISTRATION OFFICE COMPUTERIZATION PROJECT

1. Introduction

16. The project commenced in September 1988. It was possible to draw on the experience of colleagues in England and Wales who had just completed a pilot project to computerize the system of birth and death registration at an office in England. However, the differences between the Scottish registration system and that used in England and Wales made it necessary to produce a fresh design.

2. Technology used

17. IBM-compatible personal computers using a text-based user interface and IBM Quietwriter printers were chosen. Offices with more than one registration point have their computers networked together, using either *Novell Netware* or *LAN Manager*. The software is written in *CA-Clipper*—originally a compiler for the *dBase3* database programming language but now, in version 5, greatly extended. A number of third-party products for the *Clipper* programming environment were also used.

3. Development method

18. There was a nearby local registration office which served as a trial site. Most of the initial analysis work was based on the registration practices and procedures operating at this office. Other registration offices were visited to see how offices of different size approached their work. A *Novell* network was installed in the head office at New Register House, Edinburgh, with an identical network installed at the local office trial site.

B. THE SCOTTISH REGISTRATION SOFTWARE SYSTEM

19. A summary of how the Scottish Registration Software system works is set out below.

20. The draft registration entry, along with all supporting statistical information, is assembled on a screen that can be seen and checked by both the informant and the registrar. The register entry is printed, and if necessary reprinted until correct. The informant signs the register page and a textual copy of his or her signature is entered into the computer, after which the electronic record of the register page, the statistical information and the appropriate index entries are created. Copies of the register page (extracts) can then be printed and issued to the informant.

21. In the case of death registrations, the information shown on the medical certificate is copied to the database as uncoded text.

22. Corrections that can be made by the local registrar shortly after an event is registered result in a clean copy of the register entry being kept in the computerized system, along with the date of correction. This enables certificates to be printed directly from the computer system. The paper register entry is manually amended in the same way as before computerization. Amendments to be

made more than a week after registration require the authority of the Registrar General, and are made through the Register of Corrections Etc., which is a separate paper register. In computerized offices, references to entries in the Register of Corrections Etc. are added to the computer register entry as well as to the original paper register; at present, certificates from entries that are subject to that Register are not allowed to be printed through the computer system.

23. Statistical information collected at the time of registration is stored in a separate computer file from the register entry. After an event is registered, the registrar prints out a computer-generated "form of particulars" that includes statistical as well as register page information. That document is analogous to the draft entry used in non-computerized offices, and is forwarded on a weekly basis to the General Register Office for use in compiling national statistics and the national index to the statutory registers.

24. As events are registered, individual registration offices slowly build up a database of register entries and their indexes. Computerized local offices can issue certificates at any time after registration for events that were registered at their office.

C. MAIN BENEFITS OF THE SCOTTISH REGISTRATION SOFTWARE SYSTEM

25. Among the benefits of the Scottish Registration Software system are:

- (a) Fewer errors: the informant watches the information being assembled;
- (b) The registration process is quicker: the informant rarely has to return later;
- (c) An up-to-date index is available;
- (d) Local offices have on-line access to the national index to the registers;
- (e) Registrars have fewer repetitive typing duties, and can concentrate on providing a high-quality service to the public.

D. PROBLEMS ENCOUNTERED AND SOLUTIONS CHOSEN

26. The preprinted register entries and extracts were redesigned for computer printing. Subsequently, in trials at the pilot site, it was discovered that the tolerances between different identical printers could be significant for closely spaced text. Later, there were more significant alignment difficulties when the preprinted forms were reprinted.

The solution chosen was to design a version of the Scottish Registration Software that uses a *Hewlett Packard Laserjet IIIP* printer to print the outlines of register pages and certificates at the same time as the textual content.

27. It was fortunate to have an enthusiastic local registration office in Edinburgh as a pilot site: it is very important to involve the users fully; otherwise the registration software is unlikely to meet all their needs.

28. The significant changes brought about by computerization require careful attention to training and support. A General Register Office development team trains the staff of the first computerized office in each area/region/local authority on their premises. This tests the equipment in addition to training the staff. The Office has also produced an extensive user manual.

E. OPPORTUNITIES FOR THE FUTURE

29. Installing computer equipment in registration offices allows staff to use it for other purposes. Most local offices are using word-processing software, and some have spreadsheets for ordinary office administration uses. In many dual-purpose offices (i.e., offices where other functions in addition to civil registration are carried out), equipment is going to be used for other administrative tasks. Some local government authorities are likely to link their offices with each other as part of wider projects to provide electronic mail.

30. Also under development is a computer system for the examiners—the General Register Office officials who inspect the work of local registration offices. This software provides them with facilities to view and amend entries in the computerized system at the local office they are visiting. It also includes the ability to view and amend the supporting statistical information.

F. GENERAL REGISTER OFFICE VITAL EVENTS AND ELECTRONIC REGISTER

1. Background

31. The General Register Office Vital Events and Electronic Register project was initiated in February 1992, as a consequence of the recommendations of an information systems strategy study report on registration and vital statistics prepared by Office staff and published in October 1990. The project covered development of systems and procedures that would change the way that business was

conducted in the three key areas which maintained and used registration and vital events information:

- (a) Local registration offices: for the initial collection of the information and its ongoing maintenance;
- (b) Vital events branch: for the reception of the information, its coding and validation, and the production of analyses and tabular output;
- (c) Registration branch: for the ongoing maintenance of the information and its use for registration purposes.

2. System introduction

32. The first major system to come from the project was the cumulative analysis database of all vital events from 1974 to the present. This enabled the General Register Office statisticians to produce time-series statistics from their desktops. The second major system was introduced in January 1996, when all events were registered in the new format, and were coded and edited on-line (including automatic cause of death coding to ICD9 standard) in the vital events branch.

3. Current position

33. The initial aim—to integrate the registration and vital events (i.e., records and statistical) requirements within a single system held on one database—had to be abandoned some months into live running because it was found that the diverse requirements and differing timescales for statistical processing and civil registration were not sustainable in a single system. A dual system is now in operation, whereby a direct copy of the information held in computerized local offices is held on a registration information database, meeting the requirements of the registration branch. A trimmed-down version of the original database, containing only the information required for the production of statistics and other record-based output, is available for the vital events branch.

G. DESCRIPTION OF THE CURRENT VITAL EVENTS SYSTEM

34. The purpose of the vital events system is to process the data received from local registration offices into an acceptable format for the production of statistical reports, for customer enquiries and for the long-term retention (and accessibility) of the data.

35. There are two methods by which vital events can be recorded at the local registration office; the

traditional manual completion of forms of particulars, or electronically via a PC. Since the introduction of the computerized system, over the past few years the number of manual registrations has steadily decreased and now accounts for less than 20 per cent of all recorded events.

36. Records are forwarded weekly from local registration offices, either on floppy disk (from computerized offices) or on paper forms of particulars. Information received on floppy disk is loaded onto the registration information database to create the central electronic register. Extracts of the relevant information for vital events are then forwarded to the vital events database, where they are merged with the information keyed in from the manual forms. Once cleaned, they are available for the production of statistics.

H. OVERVIEW

37. Broadly speaking, the system has three main phases, as described below.

1. Data load

38. This phase accepts the data from local offices via the registration branch, carries out initial vetting (on the data capture database) and loads the data onto the main processing database, known as the "Volatile". This is undertaken via a PC, which has a disk loader attached so that several disks can be processed without manual intervention (this PC is also used for the production of the weekly output.)

39. Once the data are loaded, there is some initial vetting done, and a record reconciliation is also carried out. The items checked for at this stage are:

- (a) *Invalid record keys*: not allowed on the vital events database;
- (b) *Duplicate entries*: based on the record key; again, these are not allowed on the vital events database;
- (c) *Missing entries*: can be genuine, where a registrar has missed an entry, or can be by error—all must be investigated.

2. Coding and editing

40. This process prepares the data for transfer to the main long-term storage database, known as the "Historical".

41. Once the data are loaded onto the vital events database, they are available for database staff to carry out the coding and editing processes. Although the system is *Windows*-based, which allows the operators a good deal of flexibility in processing, an underlying system of batch control has been implemented. This mixture of interactive and batch working has proved useful for recovery and diagnostic purposes, for allocating work and for signing off blocks of records to meet particular deadlines.

42. The amount of work required to ensure that a record is "clean", i.e., that all the relevant information has been correctly recorded and collected, varies from event to event. The birth application requires the operator to work with four separate screens of information, whereas to verify a death event requires 11 separate screens of information.

3. Production of output

43. Output is produced either as tables of statistics or as files of individual records to meet particular customer requirements. The actual amount of output varies from year to year, but is approximately as follows, per year:

	Tables	Record-based
Weekly	—	20
Quarterly	6	23
Mid-year	24	—
Provisional annual	6	—
Annual	71	30

This summary does not include individual customer requests which are, on the whole, met by using one or a combination of the standard reporting tools used by the General Register Office—*Quanvert*, *GQL*, *SPSS* or *Excel*.

44. Output is of two distinct qualities—provisional and final. Provisional output is issued throughout the relevant processing year on the understanding that it is subject to change. Only when all outstanding queries encountered in the coding and editing phase have been cleared are the data considered as final. At this point, the records are transferred to the historical analysis database, with geographical information relating to the event being added, e.g., council area, parliamentary constituency, health board area etc. These records are now frozen, with no further amendments being added. This ensures consistency in the production of information from these records. It is from this

base that the statistics for the annual report and annual record-based output are produced.

I. TECHNICAL SUMMARY

45. The vital events database is a *CA-Ingres* relational database held on a *Sequent* Unix server, accessed using *TCP/IP* over a *Novell* network from a *Windows PC* platform.

46. The main processing environment was created using the *Open Road* package supplied by *Computer Associates*. Statistical output is generated using either the *SAS* package or *ReportWriter*. Cause of death coding is accomplished as part of the coding and editing phase, using the Automatic Cause of Death software supplied by the National Center for Health Statistics, North Carolina. A complete list of the development and reporting tools is as follows:

Development tool	Data load	Coding and editing	Production of output
Open Road	X	X	
SAS			X
SQL	X	X	X
ReportWriter			X
Cobol	X		
C++		X	
Visual Basic			X
GQL			X
ACOD		X	
GB Address		X	
Unix	X		X
Quanvert			X

III. Indexes on the Internet

A. BACKGROUND

47. The General Register Office has signed a contract with a third-party supplier to undertake a joint venture whereby computerized index data currently stored by the Office at New Register House will be made accessible via the Internet.

48. From early 1998, a fully searchable index of Scottish birth and marriage records from 1553 to 1897, deaths from 1855 to 1897 and census records for 1881 to 1891 will be placed on the World Wide Web, with "pay-per-view" access. The index, which contains over 30 million names, is currently accessible at New Register House, Edinburgh, and in some local registration offices throughout Scot-

land. It is one of the world's largest databases of genealogical information. It will be one of the largest information resources to be placed on the Web, and a pioneering electronic commercial application.

49. An index to deaths before 1855 is not yet available in machine-readable form. Public access via the Internet will only be allowed to records that are over 100 years old.

B. CHARGING FOR THE SERVICE

50. Visitors to New Register House currently have to pay a fee to visit the search rooms (currently £17). This allows unlimited access to the computer index, and allows users to view the microfilm and microfiche records (statutory registers, open census records and old parish records).

51. To view the index data on the Web, it was necessary to define a fee structure that was fair to the searcher and was of the same order of cost as the New Register House fees but did not allow unlimited access to the indexes. If the Web fee allowed unlimited access, there was a real risk that some customers would download index data in bulk; this had to be prevented. The scheme adopted will require users to pre-pay, by credit card, a standard access fee that allows access to a limited amount of data. A fair method for limiting the amount of data has been specified, given that customers searching common surnames will inevitably retrieve more names than those searching the less common ones. The fact that a customer might wish to log on, do some searching, log off, then log on again, or that the connection might be lost in the middle of a retrieval, was also taken into consideration. The maximum duration for the validity of the standard access fee is 24 hours. This gets round any problems caused by loss of connection during a search. Customers should not be able to complain that they paid their money but could not retrieve data.

C. ORDERING EXTRACTS

52. If the customer wishes to order an extract of a register entry, this can be done on-line, again by making a credit card payment. The system automatically transfers the request to the General Register Office to fulfil the order and mail the certificate to the customer.

D. TECHNICAL ASPECTS

53. The Web server, holding the database and the application software, will be an *IBM RS/6000 43P Model 140*, with an initial configuration 64

mbyte of RAM, 2.1 GB system HDD and 2 x 4.5 GB HDD for the database (there are over 3 GB of "raw" data), and running under AIX. The database management system will be DB2.

54. The server will be installed in New Register House alongside the General Register Office AS/400 machine, on which the in-house index databases currently reside. The Web server will be connected via leased line (initially 64kbits/s) to the IBM Global Network, via a PC front-end containing a software firewall (to ensure protection of the General Register Office data and of the back-end credit card authorization subsystem).

55. Credit card details will be transferred from the customer's Web browser in encrypted form using SSL. Authorization will be effected in real time, using the APACS 30 protocol and a dial-up link to the acquiring bank. Typically, authorization time should be about 5 to 6 seconds.

E. ELECTRONIC COMMERCE RAMIFICATIONS

56. The application will be one of the world's first "pay-per-view" database applications on the Web. The system deals with the complete transaction:

- (a) Secure pay-to-view charging mechanism, secure transfer of credit card details to server and secure link to acquiring bank for real-time authorization;
- (b) Web-form-based electronic data interchange packaged seamlessly into the application, with standardized interface for credit card details, database search criteria, and order details for items for "off-line" delivery;
- (c) Controlled access to the data to avoid bulk downloading attempts;
- (d) Mechanism to ensure that user cannot claim "data not received";
- (e) Accounting system to allocate revenues between the service provider and the data owner.

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