(2) A NATIONAL COMPUTER POLICY FOR SRI LANKA

A NATIONAL COMPUTER POLICY FOR SRI LANKA

Report of the Special Working Committee
of the Natural Resources, Energy and
Science Authority, Colombo, Sri Lanka

to

His Excellency J.R. Jayewardene,
President of Sri Lanka

April, 1983

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A NATIONAL COMPUTER POLICY FOR SRI LANKA

EXECUTIVE SUMMARY

Chapter I describes the composition and the terms of reference of the committee to formulate National Computer Policy guidelines, set up at the request of H.E. The President, by the Natural Resources, Energy & Science Authority. The task of the committee was to analyse the material already available, and to synthesise an initial set of policy measures consonant with government economic and social objectives

The challenges and opportunities created for Sri Lanka by rapid world wide developments in computers are identified In general these developments are favourable to Sri Lanka, given its geographic position, natural abilities of the population, and the current economic and political climate; although there may be some negative effects, such as the erosion of the comparative advantage of low-cost labour due to advances in robotics.

In Chapter II, the 5 main objectives of a National Computer Policy are set out and discussed in further detail. The committee felt that before formulating policy guidelines, it was important to explicitly identify the objectives of a national computer policy.

Chapter III describes the general philosophy underlying the National Computer Policy guidelines, which is to foster initiative and creativity in both public and private sectors, and to co-ordinate, encourage and guide these efforts rather than to control and regulate them. Policy guidelines are set out, regarding acquisition, utilisation and access, computer education, public sector applications, computer literacy and appreciation, self reliance and export of computer services computer related infrastructure, legal environment, and other areas related to computers.

In Chapter IV the principal recommendations regarding the organisational framework and action programme for policy implementation are discussed. The five main recommendations of the committee are :

(a) The creation of a National Computer Policy Advisory Council (COMPAC) functioning directly under H.E. The President

(b) The creation of a Central Computer Secretariat to service COMPAC;

(c) The creation of Permanent Committees under COMPAC, on ; Computer Education, Computer Applications in the Public Sector, and Telecommunication and Data Transmission;

(d) The identification of and support for Centres of Excellence;

(e) The establishment of channels of communication with the Computer Society of Sri Lanka and other groups interested or involved in the computer industry.

The organisation of the Council, the Secretariat, the committee, and other groups, as well as their role and interactions, are defined. There is also an outline of the role of the Central Computer Secretariat, and the services it is expected to perform.

REPORT OF THE NARESA SPECIAL COMMITTEE ON A NATIONAL COMPUTER POLICY FOR SRI LANKA

CHAPTER I - INTRODUCTION

1.1 Background

At the request of H.E. the President, the Natural Resources, Energy and Science Authority (NARESA) set up a special working Committee in November 1982, to formulate National Computer Policy guidelines and recommend a practical framework and action programme for implementing such policies. The Committee was directed to produce its report by April 1983 and consisted of the following members :-

Dr. Mohan Munasinghe, (Chairman)	NARESA
Mr. R.B. Ekanayake	Bank of Ceylon
Dr. N.W.N. Jayasiri	National Institute of Business Management
Mr. Ajit Kanagasundram	Central Bank
Prof. S. Karunaratne	University of Moratuwa
Prof. V.K. Samaranayake	University of Colombo
Mr. N.U. Yapa, (Secretary)	NARESA

The Committee met eight times between 1982.11.29 and 1983.04.28 at NARESA.

The Committee reviewed existing information on the subject of a National Computer Policy, in particular the recent Sri Lanka Computer study by a UNDP - ILO team, the legal framework of and background information on the National Computer Board of Singapore, and information on computer policy in other countries such as India and the U.K. Relevant persons were also interviewed during its deliberations. However, given the limited time available to produce its report, and the significant amount of relevant material already available, the committee was not expected to research afresh the problems and constraints faced in the development of computing in Sri Lanka or produce a detailed plan with quantitative targets to be achieved. Therefore, the committee concentrated on synthesising and developing an initial set of policy measures and solutions from existing information sources, formulating policy guidelines consistent with the broad economic, social and political development programmes of the government, and recommending a practical institutional framework and action programme for implementing policy.

In carrying out its mandate, the committee has at all times been fully cognisant of the importance given to computing, robotics and communications in the next phase of national development, as reflected in the following extract from a speech by H.E. the President at the opening of Parliament on 9th February, 1983.

"We must look to the future. The foundations for spiritual and material progress according to contemporary world conditions have been laid. Where does the future lead us to?"

The Government has considered that too. We hope to lead our youth into the technological age, complete with robots and computers Already plans are being prepared for the establishment of centres of education and for the assembly and manufacture of the necessary equipment."

The information revolution, which has been compared in terms of its likely impact on contemporary society to the industrial revolution of the last century, has been underway for the past quarter century in the industrialised countries. This process has gathered momentum in the past few years, largely due to the dramatic fall in the cost of computer equipment as a result of advances in solid state technology and the mass production of micro-electronic devices. A few statistics illustrates this trend. Computer hardware that would have filled a room 35 years ago would now fit into a silicon chip the size of a pea, while power requirements have also declined correspondingly. Reliability of operation and ease of maintenance have improved substantially while nominal costs have declined by a factor of more than 100 over this same period. The cost decreases are even more dramatic if the normal effects of inflation over the last 35 years were netted out. Comparable reductions in cost and improvements in both hardware and software capability are anticipated in the coming decades. It is not surprising, therefore, that in Japan alone nearly half a million computer systems are being installed each year, while world wide sales of personal computers now approach US $ 5 billion per annum. Governments of developed countries such as Japan and France, and newly industrialising countries like Singapore have recognised the potential of computers and set up special organisations and programmes to promote their development and use.

1.2 Relevance for Sri Lanka

In the context of rapid world wide developments, in the computer field, this committee has identified some of the challenges faced by and opportunities created for Sri Lanka in the next phase of its development :

(a) The information processing revolution and developments in robotics will cause fundamental changes in the way goods are both produced and traded in the world economy. These changes will have a significant impact on Sri Lanka, especially in light of the relatively small size of our economy, and the "liberalised" or "open" economy concept to which the government is committed

(b) The use of computers in the analysis of scientific data and technological applications is now a routine and integral part of scientific method. It is essential that the scientific community in Sri Lanka be given ready access to computer technology, if they are to achieve the full extent of their potential contribution to the development of the country. There are specific areas of application such as the maximum utilization of readily obtainable satellite data on Sri Lanka, where an immediate impact can be made in fields like agriculture, forestry and coastal conservation.

(c) By keeping abreast of the latest innovations in computer technology, telecommunications, and robotics, Sri Lanka could hurdle a whole stage of the economic development process. We can concentrate on industries that are knowledge-intensive and efficient in the use of scarce resources such as capital, skilled manpower, land, and energy. It will also be possible to avoid investments in industries where future developments world wide, especially in robotics, are likely to erode the advantages of our low-cost labour.

(d) Computer technology is a means, if properly used, by which the public sector can be made more efficient and responsive The size of the public sector in Sri Lanka relative to the economy as a whole, and the vast investment programme of the government, has made the performance of the public sector a critical factor in the success of the national economic effort. At present the sub-optimal performance of at least some parts of the public sector has been identified as a major constraint to the successful implementation of government policy and continued rapid growth of the economy. Computers can be used both to improve the quality of decision making at the highest levels, and to enhance the working level operational efficiency in public sector organisations, as recognised recently by the Parliamentary Committee on Public Enterprises (COPE)

(e) The type of institutions that are developed to meet the needs of administration, finance, production, and exchange of goods and services can be decentralised. The use of computers will significantly improve the flexibility of citizens to make use of their skills and talents. This will provide an additional impetus for entrepreneurial activities more in keeping with national character and temperament.

(f) By investing in the necessary physical infrastructure (especially overseas communications and education), Sri Lanka can exploit fully its comparative advantage, to become a South Asian regional centre for finance and trade, in much the same way as Singapore has assumed this role in the South-East Asian region Our assets include an open economic policy which is both attractive to foreign investors and conducive to the growth of local entrepreneurial activity in the field of computers, political acceptability among all countries in the region, and a convenient geographic location.

(g) The development of computing can help the export drive both directly and indirectly. Directly, by the export of software and (to a lesser extent) computer hardware and other goods and services embodying computer related inputs. Indirectly, by cutting down the costs and time taken for documentation and information exchange between exporters in Sri Lanka and their trading partners.

(h) Presently one of the major sources of foreign exchange earnings is the remittances of Sri Lankan expatriate workers. By a proper education and training programme, it would be possible to augment this by exporting higher level skills in the form of programmers and systems analysts, who would find employment abroad.

In drawing up an institutional framework and action programme to implement national computer policy guidelines, the committee has sought to adopt an approach emphasising promotional and co-ordinating functions, while avoiding controls and over-regulation. However, a body with certain minimum powers to advise the government in formulating and implementing policy, especially with regard to the development of human resources, is necessary. This body would provide a guiding framework within which Sri Lankan public and private sector institutions in the computer field can develop and interact fruitfully, without unnecessary duplication, wastage of scarce resources and policy conflicts.

The use of computers in Sri Lanka is in its infancy - both in terms of the number of systems installed and the level of sophistication of use. However, this committee is convinced that given the encouragement and support of the government, and a committment of resources which will be modest in terms of the national investment programme, the resulting development in computers, telecommunications, and robotics will bring about fundamental changes in the attitude of Sri Lankans and contribute significantly not only towards material progress but also the sociopolitical development and cohesiveness of the country.

CHAPTER II

OBJECTIVES OF A NATIONAL COMPUTER POLICY FOR SRI LANKA

2.1 National Computer Policy Objectives

In the process of fulfilling its mandate, this committee felt that the objectives of a national computer policy should be identified before relevant policy guidelines and an implementation programme could be defined. Accordingly, the broad objectives of a national computer policy for Sri Lanka are set out below

(a) Harness computer technology in all its aspects, for the benefit of the people of Sri Lanka, and to further the socio-economic development of the nation.

(b) Promote and guide the development of computer-related resources and their application, to anticipate and meet the future needs of the national economy.

(c) Enhance and supplement manpower resources and increase the efficiency and productivity of management and workers at all possible levels.

(d) Improve the quality of life of the people of Sri Lanka, including the job satisfaction and working conditions of employees.

(e) Increase the flexibility and dynamism of Sri Lankan society to enable it to successfully meet the challenges of the future, arising from the ever increasing pace of world-wide scientific and technological advances.

2.2 Discussion of National Computer Policy Objectives

The first objective is intended to clearly establish that computer technology in all its aspects should be treated like any other instrument of Government policy, to improve the well being of the people of Sri Lanka and contribute to the national socio-economic development effort.

The second objective is somewhat more specific. It seeks to encourage planning and systematic analysis of the national need for computers and computer-related resources. Once these requirements are established, it would be possible to meet them, so that economic growth and prosperity would not be hindered due to the lack of this vital element of modern infrastructure.

Objective three relates to sensitive issues of computerisation and automation in the context of a labour-surplus developing country such as Sri Lanka. This committee feels that it is important to recognise the role of the computer as an instrument which substitutes for and enhances man-power at the skilled level where it is most scarce, rather one that displaces surplus unskilled labour. A properly designed computer policy will create many new jobs, while enhancing the efficiency and productivity of management and workers at all levels.

The fourth objective is aimed at improving the quality of life of the people of Sri Lanka and eliminating drudgery both at home and in the work place. The advent of relatively inexpensive and versatile micro-computers will revolutionalize life styles and working habits over the next few decades, because of the greater flexibility provided by the new computer technology, e.g., the lives of Sri Lankans can be significantly improved by providing access to large amounts of information, and by improving communications.

The fifth objective is a general one. It is motivated by the recognition of the fact that for its long-run viability, any nation or society must be sufficiently resilient and dynamic to successfully meet the challenges of the future. This is particularly relevant to a small country like Sri Lanka, which has from historical times, prided itself on its ability to utilize and innovatively incorporate into its own cultural framework, the most valuable elements of ideas and technologies brought in from different parts of the world.

CHAPTER III

NATIONAL COMPUTER POLICY GUIDELINES

3.1 General Philosophy

The Committee is of the view that computer policy guidelines to achieve the above objectives should be both broad and flexible, given the wide and rapidly evolving nature of the computer field. Government policy should seek to guide, encourage and support the many public and private entities involved in the area of computers, rather than control and over-regulate, and thereby effectively stifle their activities. Furthermore, the policy guidelines indicated below are only a starting point. They should be monitored, interpreted and modified when necessary, on a continuous basis, to reflect future changes in both the national socioeconomic and political environment as well as technological trends.

3.2 Policy Guidelines

An initial set of national policy guidelines is given below, under specific headings :

(a) Acquisition

Potential users should be encouraged to treat the acquisition of a computer and/or related items as any other investment, including clearcut identification of computer needs and technical, economic and financial evaluation of the project. Government imposed regulations, rules, or financial disincentives that would restrict or delay purchasing of Computers and related items should be minimized wherever possible.

(b) Utilization and Access

Sharing of computer hardware, software and data resources should be promoted. Computer installation should be fully utilized by permitting access to users during as many hours of the day as possible. However, it would be undesirable and impracticable for the government to attempt to compel owners of computer facilities to share their resources. Interchange of information regarding computer hardware and software resources available among different users should be promoted.

(c) Computer Education, Public Sector Applications, Computer Literacy and Appreciation of the Potential of Computers

The Government should take immediate steps to improve computer-related skills and promote their application as widely as possible, especially in the following areas : scientific analysis, higher education, industry, business and financial management, and schools. The establishment of standards for computer education should also have high priority. Particular attention should be paid to identifying and encouraging the application of computers in the public sector. Efforts should be made, as soon as possible, to ensure adequate financial incentives and job satisfaction, in order to attract and retain the services of computer personnel in Sri Lanka. Computer literacy and appreciation of the potential of computers among the general public should be increased.

(d) Self-reliance, Export of Computer Services

Efforts should be made to make the country as self-reliant as possible in computer skills, establish a sound indigenous capability to evaluate and acquire foreign computer technology when necessary, and also export computer services (both software and hardware, especially assembled products).

(e) Computer-Related Infrastructure and Legal Environment

The Government should give high priority to improving infrastructural facilities that are essential for developing computer use in Sri Lanka, including : local and overseas telecommunications services, and electricity supply. An adequate legal environment should also be created which recognizes the role of computers as well as its impact on society.

(f) Other areas related to Computers

Developments in areas related to Computers such as satellite communications, other telecommunications, and robotics should be closely monitored and adapted for application in Sri Lanka whenever appropriate, by both the Government and other interested groups.

CHAPTER IV

ORGANIZATIONAL FRAMEWORK AND ACTION PROGRAMME FOR POLICY IMPLEMENTATION

4.1 Principal Recommendations

As indicated earlier, it is the creative activity and initiatives of individuals and specific organizations which will enable Sri Lanka to best realize the benefits of computer technology However, some degree of policy guidance and coordination by Government is necessary to avoid unnecessary duplication, wastage of scarce resources and policy conflicts. The emphasis by the government in the computer area should be on promotion, encouragement and coordination, rather than control and regulation.

The committee's principal recommendations concerning an organizational framework and action programme for implementing national computer policy guidelines in Sri Lanka are first summarized (with respect to Figures 1 & 2), and then described at greater length below.

1. Create a National Computer Policy Advisory Council (COMPAC) functioning directly under H.E. the President.

2. Create a Central Computer Secretariat (CECSEC) to service the needs of COMPAC.

3. Create permanent committees of COMPAC on (a) Computer Education; (b) Computer Applications in the Public Sector; and (c) Telecommunications and Data Transmission; to advise on and promote activities in these areas.

4. Support the growth and development of several Centres of Excellence, identified in the first instance as, the Universities of Colombo, Moratuwa and Peradeniya, and the National Institute of Business Management.

5. Establish channels of communication with and draw on the contributions of the Computer Society of Sri Lanka, and other private special interest groups and companies.

4.2 National Computer Policy Advisory Council (COMPAC)

In the light of the importance of computers and related technologies for the future development of Sri Lanka, it is recommended that a body referred to hereafter as the National Computer Policy Advisory Council(or COMPAC)be set up. The principal purpose of COMPAC will be to provide a guiding framework and environment within which the many public and private sector organizations and individuals in the computer field can develop and make their contribution to the nation, without unnecessary duplication of efforts and wastage of scarce resources. This body should consist of not more than 10 members, including a Chairman. It is recommended that the members of COMPAC be senior persons drawn from among a variety of disciplines such as computers and related fields, economics, finance, education, engineering and science. They should have a broad viewpoint as well as a long-term, policy-oriented perspective.

The functions of COMPAC should be

(a) to encourage, facilitate and assist in the development and application of computers and related technologies in Sri Lanka, and also in the improvement of the infrastructural facilities necessary to promote computer development;

(b) to advise the government on national policies concerning computers and their applications, assist in the interpretation of these policies, and facilitate their implementation;

(c) to promote, coordinate and accelerate the application of computers in the public sector;

(d) to develop computer education in all its aspects and assist in advancing the skill and knowledge of persons engaged in the computer industry;

(e) to raise professional standards in computing by establishing standards in specific areas, including computer education and training, privacy of individuals and abuse of personal information, and integrity of data in computer installations.

FIGURE 1. PROPOSED ORGANIZATION OF THE COMPUTER SECTOR IN SRI LANKA

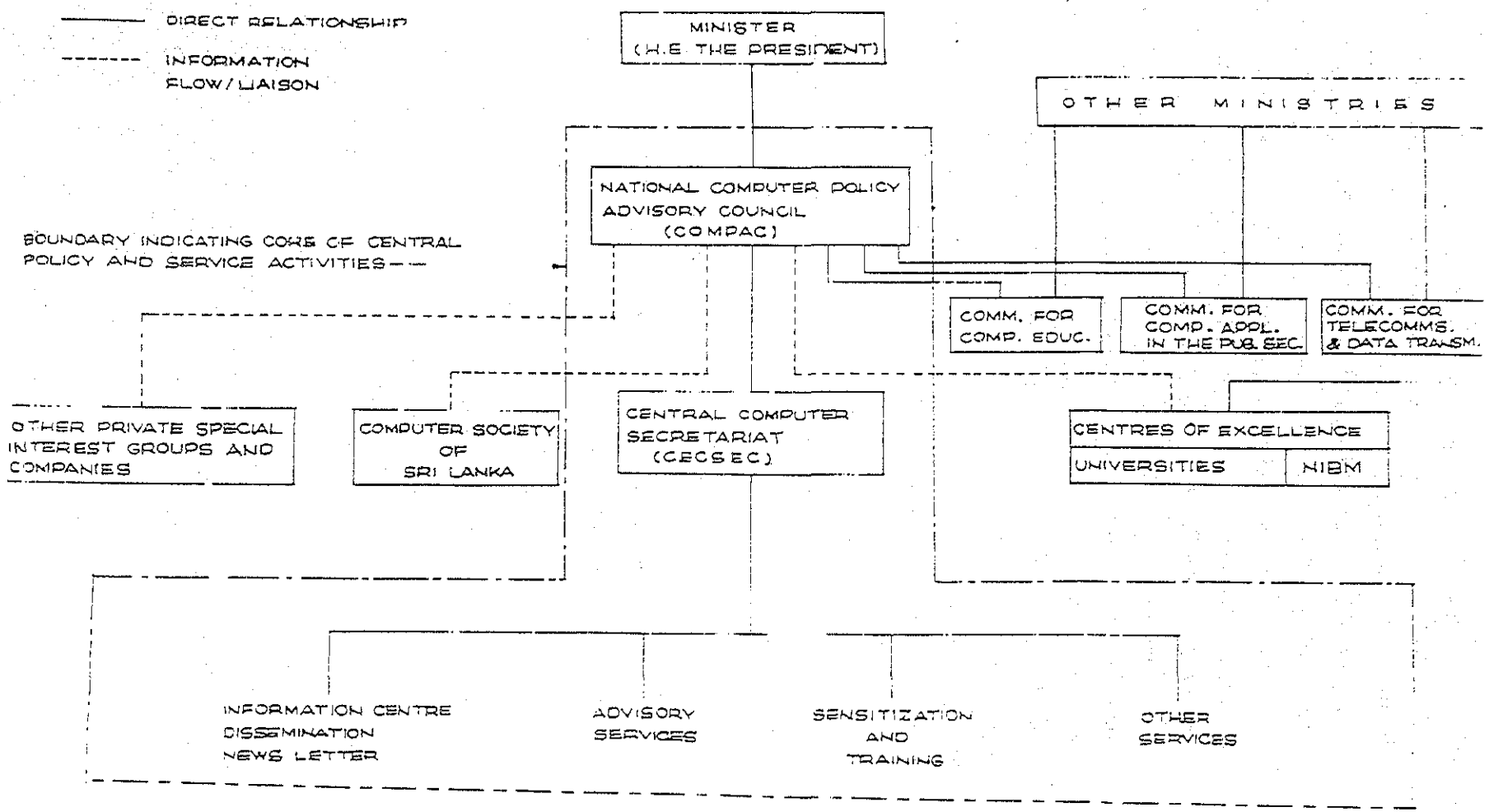
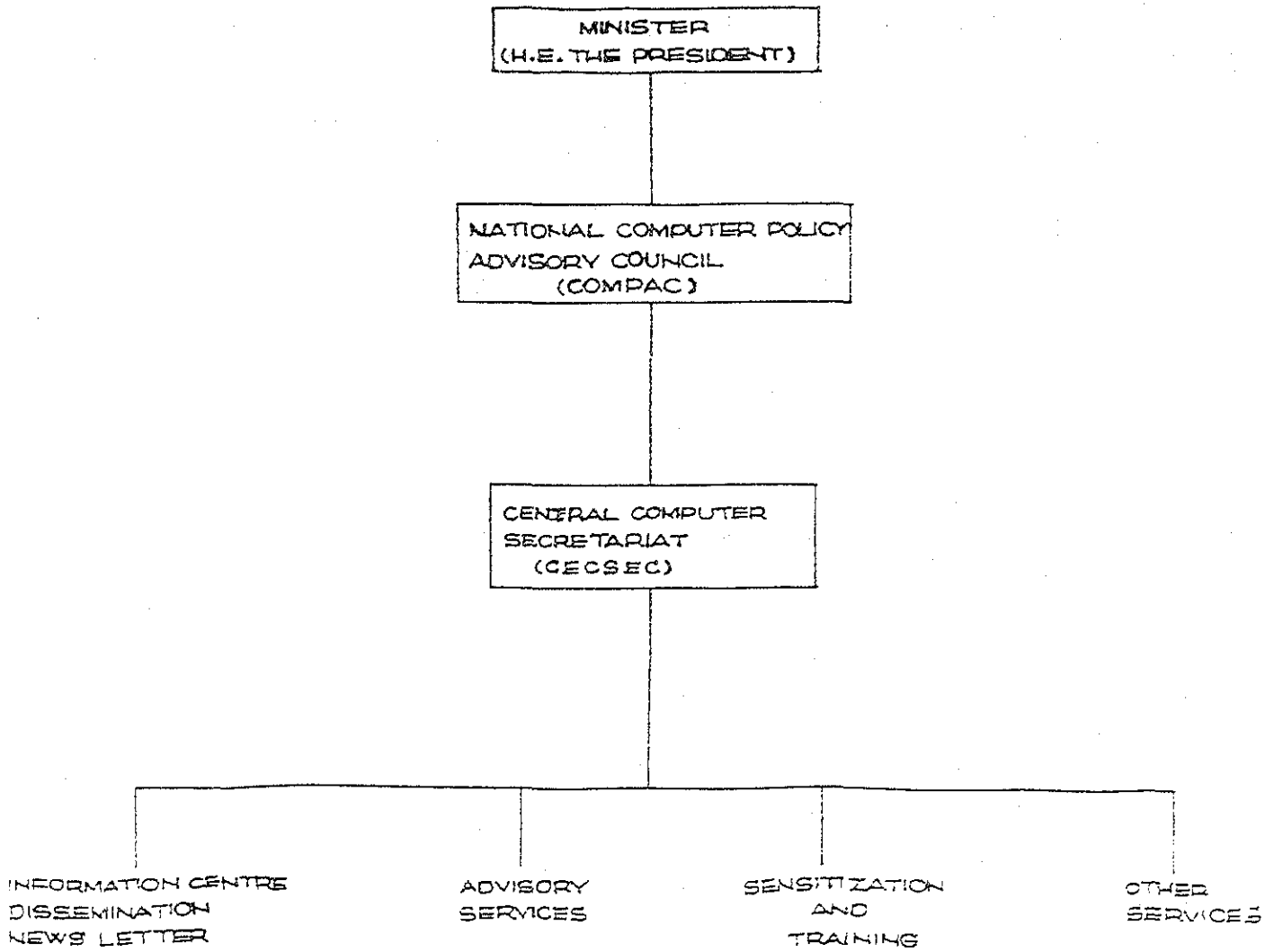


FIGURE 2. CORE OF CENTRAL POLICY AND SERVICE ACTIVITIES



(f) to promote research in the areas of computers and related technologies, and assist in monitoring and adapting developments in these areas for use in Sri Lanka.

(g) to contribute to the improvement of the quality of life of the people of Sri Lanka, especially through improvements in the job satisfaction and working conditions of employees.

(h) to make the nation as self-reliant as possible in computer skills, establish a sound indigenous capability to evaluate and acquire the necessary foreign computer technology, and promote the export of computer services.

(i) to increase the flexibility and dynamism of Sri Lankan society to enable it to successfully meet the challenges of the future, arising from the ever-increasing pace of worldwide scientific and technological advances;

4.3 Central Computer Secretariat (CECSEC)

To carry out its advisory and service functions, COMPAC should have a central computer secretariat (CECSEC) consisting of full-time staff members. While COMPAC would be entirely policy-oriented, the principal function of CECSEC would be to act as a service arm of COMPAC. CECSEC should be headed by a full-time Manager. In view of the importance of separating the policy activities of COMPAC from the service functions of CECSEC, it is recommended that the Manager of CECSEC not be a Council Member of COMPAC. However, in order to facilitate communications and interaction between COMPAC and CECSEC, the Manager could also act as the Secretary to COMPAC.

The substantive work of CECSEC should be carried out by the Manager, assisted by 3 to 4 professionals and about 3 supporting secretarial and clerical staff, all recruited on a full-time basis. Initially, the service functions given below have been identified as high priority areas for CECSEC (see Figure 2). Other activities could be added on, according to future needs, at the discretion of COMPAC.

(a) Computer Information Centre, Information Exchange, Newsletter

There should be a permanent computer information centre containing books, periodicals, and other current reports and documents on computers and related fields. Reading and photocopying facilities would be made available to interested persons. However, in order to provide the necessary service without an excessive organizational effort, it is recommended that no lending activities be undertaken (i.e., only reference facilities be provided), at least in the start-up period. The information centre would also function as focal point for the exchange and dissemination of information among COMPAC, Sri Lanka bodies such as the Centres of Excellence (described below) and the Sri Lanka Computer Society, as well as foreign sources. It is also recommended that CECSEC regularly circulate a newsletter to interested individuals and institutions in Sri Lanka, on recent developments in computers and related areas that have taken place locally and abroad.

(b) Advisory Services

CECSEC should provide advice on computer-related matters to COMPAC as well as other public and private sector institutions or individuals referred to CECSEC by COMPAC. Such services would be provided only on request, and should not be viewed as a mandatory requirement by potential users of this facility.

The chief objective would be to provide basic information and advice on acquisition and use of computers. Many of the simpler queries could be handled, directly by CECSEC staff. However, given that CECSEC would not have a large in-house staff, it is envisaged that more complex problems be referred by CECSEC to other competent individuals or institutions (such as the Centres of Excellence).

(c) Sensitization and Training

Areas of sensitization and training relating to computers, such as increasing computer literacy and appreciation among the general public or senior government and private sector decision makers, which may not have a high priority for other organizations, should be covered by CECSEC. Again, the emphasis would be on ensuring that this work is organized and carried out, preferably by outside organizations (on a contractual basis if necessary), rather than attempting to build up a large in-house capability within CECSEC.

(d) Other Services

It is anticipated that to assist in its deliberations, COMPAC itself will generate many requests for information which would have to be serviced by CECSEC. Some of this information would be readily available and of a general nature (e.g., finding out the import duties and tariffs applicable to computer products). At the same time, other specific areas such as developments in robotics and telecommunications, or safeguarding privacy and abuse of personal data, are likely to require more effort, including literature reviews and data analyses by research assistants and other trained staff.

4.4 Permanent Committees of COMPAC

COMPAC should initially set up permanent committees covering three priority areas in which the government has a legitimate right to play a more active role : (a) computer education; (b) computer applications in the public sector; and (c) telecommunications and data transmission. Further committees could be set up by COMPAC, as the need arises, to study issues in areas such as privacy safeguards and abuse of personal information, and exports of computer services.

(a) Committee on Computer Education

A committee consisting of not more than 8 persons is recommended. At least one member of the Committee should be also a member of COMPAC, while the others would be drawn from relevant Ministries including Higher Education and Education, as well as other departments and organizations.

The principal function of this committee would be to coordinate activities, and avoid policy conflicts and duplication of effort In the first instance, the committee should give high priority to improving computer related skills and promoting their application in the following areas : scientific analysis, higher education, industry, business and financial management, and schools. Standards of computer education should also be established and applied (preferably in collaboration with the Computer Society of Sri Lanka - see below)

Manpower planning to meet future needs in the computer area, and providing adequate financial incentives and attractive working conditions in order to retain the services of computer personnel, are also topics that need to be studied early

(b) Committee on Computer Applications in the Public Sector

This committee of COMPAC should also consist of not more than 8 persons, with at least one representative from COMPAC, and other members drawn from relevant Ministries and public sector agencies.

The committee should place greatest emphasis on its promotional role in encouraging the use of computers in the public sector. In particular, it should encourage the better use of existing computer facilities, identify and anticipate the future computing needs of government organizations, and advise and assist such organizations on matters concerning computer applications.

(c) Committee on Telecommunications and Data Transmission

The existing poor quality of telecommunications constitutes a serious handicap to the development of computers and their applications in Sri Lanka. Upgrading this vital element of infrastructure to facilitate future computer developments, including the use of portable terminals, local and wide-area networks, and links with overseas computer facilities, should be the priority task of this committee. As in the case of the other committees, a maximum of 8 persons is recommended with at least one COMPAC representative.

(d) Other Future Committees

Other committees could be established by COMPAC, to meet future requirements. Given the vast data handling capabilities of computers and the increasing potential for misuse of computerised data, the establishment of safeguards to protect the privacy of individuals and the integrity of data is an important issue to be studied. Similarly, promotion of the export of computer services should be pursued, in view of the relatively high levels of education in Sri Lanka, unemployment among graduates, entrepreneurial talents of Sri Lankans, and our ability to absorb high technology skills.

4.5 Centres of Excellence

The Government should identify and give priority to the development of several Centres of Excellence having potential in the computer area, initially including the Universities of Colombo, Moratuwa and Peradeniya, and the National Institute of Business Management (NIBM). While the 3 universities would concentrate their efforts on use of computers in scientific work and higher education, the NIBM would be better placed to develop the business application and data processing areas. New Centres of Excellence in the public and private sectors may be identified in the future, including those that are developing at the other universities.

COMPAC would help to support the growth and development of these Centres, by channelling extra resources or providing other incentives and encouragement to them,(e.g., in the case of the Universities, by supplementing the normal University funding mechanism). In particular, it is recommended that private computer firms and vendors as well as foreign governments and international organisations be approached to provide the latest hardware and software, maintain equipment and support the operation of the Centres, and train local staff. The Sri Lanka government would provide counterpart funds for local staff, buildings, and other facilities. Scholarship schemes for promising computer students could be set up under this framework. Avenues should also be found to retain and encourage the return from abroad of skilled computer scientists.

A certain degree of healthy competition among the Centres of Excellence would be important to bring out the best in them. At the same time COMPAC should seek to enhance the flow of information among them, to avoid excessive or wasteful duplication of efforts.

4.6 Computer Society of Sri Lanka, Private Special Interest Groups and Companies

The Computer Society of Sri Lanka (CSSL), and private special interest groups and companies can make a valuable contribution to the development of computers and their application in Sri Lanka.

The Computer Society is the principal vehicle by which COMPAC could maintain contact with individuals interested in computers. CSSL should also be encouraged to help establish and maintain standards of professional education and conduct in the computer field.

Dialogue between COMPAC and private special interest groups and companies should be maintained to determine their needs, and establish a national environment in which their contribution would be best harnessed both in the application of computers in Sri Lanka, as well as for the exports of computer services abroad.

FINAL OBSERVATIONS

This Committee has sought to fulfil its mandate by identifying the objectives of a national computer policy for Sri Lanka, setting out an initial set of policy guidelines to meet these objectives, and recommending an organizational framework and action programme for implementing policy.

A central theme we have sought to convey in our report is the need for preserving the delicate balance between the two extremes of control and over-regulation which could stifle the growth of computer technology in Sri Lanka on the one hand, and excessive freedom and anarchy leading to wasteful duplication and conflicts, on the other.

Although Sri Lanka is in the early stages of computer development, this committee is confident that with appropriate policies that would encourage, promote and guide the computer community in Sri Lanka, the development and use of computer technology will make a very significant contribution to the well-being and quality of life of our citizens, over the coming decades and beyond.

ACKNOWLEDGEMENTS

The Committee wishes to express its gratitude to the Director-General and staff of NARESA for having provided all the infrastructural facilities and services required to complete its deliberations.
Thanks are also extended to the Bank of Ceylon, Central Bank, National Institute of Business Management and the Universities of Colombo and Moratuwa, for the release of their staff officers to serve on the Committee.

(3) COMPUTER AND INFORMATION TECHNOLOGY COUNCIL (CINTEC) ACTIVITIES FOR THE YEAR－1985

COMPUTER AND INFORMATION TECHNOLOGY COUNCIL (CINTEC)
ACTIVITIES FOR THE YEAR - 1985

1. INTRODUCTION :

CINTEC was established by Parliament Act No. 10 of 1984 in April 1984 and Prof. Mohan Munasinghe was appointed its first Chairman. Although CINTEC was involved in several activities during the year 1984, it became functional in November 1984 when office space was obtained at the BMICH and a modest budget of Rs. 250,000/= was allocated. Hence most of the preliminary work regarding the establishment of CINTEC as an operational organization took place in 1985.

2. COUNCIL :

The Council consisting of 10 members (Annex 1) was appointed by H.E. the President in April 1985 and the first meeting of the Council was held on 23.04.1985. The Council meets once a month and has met on 8 occasions in 1985. Prof. Mohan Munasinghe resigned from the post of Chairman in July 1985, but continues as a member and Chairman Emeritus. Prof. V.K. Samaranayake was appointed Acting Chairman with effect from 23 July 1985.

3. WORKING COMMITTEES :

CINTEC has established the following statutory working committees (Annex II).

1. Committee on Computer Education (COCE)
2. Committee on Computer Applications in the Public Sector (CAPS)
3. Committee on Computer Telecommunication (CTEL)

The Committee on Computer Education and Committee for Computer Applications in the Public Sector had one meeting each. The Committee on Computer Education is looking into ways and means of improving the quality of courses in computer studies available in the country and also helping the Ministry of Education with their computer studies programme. Arrangements have been made to hold a one day seminar for senior educational administrators in 1986.

The Committee for Computer Applications in Public Sector have identified certain key public sector organizations for computer awareness and have also identified groups of public sector organizations which could pool their resources in moving towards computerization. It has also proposed using the media for providing computer literacy.

The following non-statutory committees were also appointed and are functioning :

1. Committee for recommending standards for the use of Sinhala and Tamil Script in Computer Technology
2. Committee on Law and Computers.

4. WORKING GROUPS :

Following the successful conclusion of the seminar on Microcomputers in Developing Countries held last year CINTEC formed three working groups on computer applications in agriculture, computer applications in energy and computer applications in health. The agriculture working group has held two meetings and the energy working group has held one meeting. Their membership is given in Annex III. It was felt that the health sector does not have a sufficient number of active research workers to form a working group immediately and steps are being taken to initially hold a seminar on computer applications in the health sector so as to facilitate the formation of a working group.

4.1 The Working Group on Computer Applications in Agriculture :
A Workshop on Computer Applications in Agriculture was held on 22nd May 1985 and was attended by 10 members. The Workshop produced several recommendations relating to computer use in agriculture and also formulated several project proposals.

CINTEC co-sponsored with the University of Colombo a 4 week course on statistical and computer applications in agriculture for researchers from Sri Lankan Institutes in November - December 1985. 30 participants drawn from a wide variety of organizations involved in agriculture research attended this very successful workshop where the participants were exposed to several microcomputers and statistical software. On 7th December, the participants joined the Working Group on Computer Applications in Agriculture to attend a one day Workshop.

4.2 The Working Group on Computer Applications in Energy :

The Workshop on Computer Applications in Energy was held on 19th June 1985 and was attended by 10 members and project proposals in this area are expected to be submitted.

5. Senior Executive Seminar on Computer Applications in the Public Sector (SESCAPS) :

A seminar for Senior Executives on Computer

Applications in the Public Sector was held on 26th April 1985 and was attended by about 150 senior executives including Secretaries of Ministries. This one day seminar helped in providing computer awareness to senior executives and it is expected that similar seminars would be conducted in specific areas relating to computer applications.

6. PUBLICATIONS :

The Proceedings of the First International Symposium on Computer Applications in Developing Countries held in November 1984 sponsored jointly by CINTEC and National Academy of Sciences, USA, was published during 1985 as "Microcomputers for Development - Issues and Policy". The editing and printing of this publication was done entirely in Sri Lanka and a publication of high quality was produced.

The proceedings of the Senior Executive Seminar on Computer Applications in the Public Sector is with the printer and would be released in early 1986, as a publication entitled "Computer Applications for Senior Managers".

7. CENTRES OF EXCELLENCE :

CINTEC has identified the Universities of Colombo, Moratuwa, Peradeniya, the Arthur Clarke Centre for Modern Technologies and the National Institute of Business Management as Centres of Excellence in Computing. It is taking every effort towards developing these institutes so that they may satisfy the need of the country in specialized computer studies and applications.

8. SPECIAL INTEREST GROUPS :

8.1 CINTEC has successfully formed an ad-hoc vendor group which will meet once a month. (Annex IV) This group while acting as a communication link between CINTEC and vendors also looks in to ways and means of promoting computer use in Sri Lanka.

8.2 CINTEC has taken steps to have close links with Computer Society of Sri Lanka and offered its assistance in holding the 1986 annual session of the Computer Society, by sponsoring guest lecturers of a high quality who could disseminate knowledge on the state-of-the-art in the fast changing discipline of computer science, as well as by extending the sessions from one day to three days (the sessions held in early 1986 was a tremendous success).

9. OTHER ACTIVITIES :

9.1 CINTEC has continued to support the project proposal submitted to the Japanese Government for the establishment of an Institute of Computer Technology at the University of Colombo. This project is expected to be implemented in the near future.

9.2 CINTEC has appointed a committee to formulate guidelines for acquisition of computers including an initial feasibility study, preparation of specifications and finally evaluation. CINTEC also maintains a roster of experts who could be called upon to evaluate tenders relating to purchase of computers and providing advice on a consultancy basis.

9.3 CINTEC has launched on a study of the computer situation in Sri Lanka and has embarked on establishing a data bank on information relating to computers and computer use.

9.4 CINTEC has taken steps to establish a central library on computers with its own funding as well as foreign assistance. A positive response has already been received from the British Council.

9.5 CINTEC would also be awarding research grants for research activities relating to computer science or for the computational aspects of research relating to other areas through the facilities available at NARESA.

9.6 CINTEC would also be providing computing facilities at its secretariat for research workers who do not have access to microcomputers.

9.7 CINTEC has taken steps to disseminate information relating to computers through a news letter to be published with the assistance of the vendor group.

10. CINTEC has established a secretariat which is functioning smoothly with a staff of 7 and its gradually building up its resources. CINTEC is working on the philosophy that it would make use of other organizations such as NARESA in its activities instead of duplication of resources, while playing the role of being the apex organization for computer related activities in the country. It is also negotiating with NARESA to obtain part of its new building to house the CINTEC Secretariat.

ANNEX I

COMPUTER AND INFORMATION TECHNOLOGY COUNCIL OF SRI LANKA

Members of the Council

1.	Prof. V.K. Samaranayake	- Acting Chairman CINTEC and Head/Dept. of Statistics and Computer Science, University of Colombo
2.	Mr. C. Gunasingham	- Additional Secretary to H.E. the President
3.	Dr. R.P. Jayewardene	- Director-General, Natural Resources, Energy and Science Authority of Sri Lanka
4.	Mr. G. Cumaranatunga	- Deputy Secretary to the Treasury
5.	Mr. Akiel Mohamed	- Director, External Resources Department
6.	Mr. K.K. Gunawardene	- Director, Department of Telecommunications
7.	Mr. R.B. Ekanayake	- President, Computer Society of Sri Lanka and Director, Information Technology, Bank of Ceylon
8.	Dr. N.W.N. Jayasiri	- Director, Management Information Systems, National Institute of Business Management.
9.	Dr. A.S. Induruwa	- Head, Department of Computer Science, University of Moratuwa
10.	Prof. Mohan Munasinghe	- Emeritus Chairman, presently at World Bank, Washington

ANNEX II

STATUTORY WORKING COMMITTEES OF CINTEC

A. Committee on Computer Education (COCE)

1. Prof. V.K. Samaranayake, (Chairman), CINTEC Member, Head/Department of Statistics and Computer Science, University of Colombo
2. Dr. A.S. Induruwa, CINTEC Member, Head/Computer Section, University of Moratuwa
3. Dr. N.W.N. Jayasiri, CINTEC Member, NIBM
4. Mr. L.S.A. Fernando, Merchant Bank of Sri Lanka

B. Committee on Computer Applications in the Public Sector (CAPS)

1. Mr. R.B. Ekanayake (Chairman), CINTEC Member, Head of Computer Division, Bank of Ceylon
2. Mr. C. Gunasingham, CINTEC Member, Additional Secretary Presidential Secretariat
3. Mr. B. Ranasinghe, Data Processing Manager, Ceylon Petroleum Corporation
4. Mr. P. Amarasinghe, Director, Data Processing Department, Central Bank of Ceylon

C. Committee on Telecommunications and Data Transfer

1. Mr. K.K. Gunawardene (Chairman), CINTEC Member, Director, Telecommunications
2. Mr. Manicavasagar, Deputy Director/Telecommunications

(Additional Members to be coopted)

D. Committee on Recommending Standards for the use of Sinhala and Tamil Script in Computer Technology

1. Prof. V.K. Samaranayake (Chairman), CINTEC Acting, Chairman, Head/Dept. of Statistics and Computer Science, University of Colombo

2. Mr. N. Nanayakkara, Government Printer

3. Prof. G. Wijewardena, Professor of Sinhala, University of Colombo

4. Prof. J.B. Dissanayake, Professor of Sinhala, University of Colombo

5. Dr. A. Kandiah, Open University

6. Mr. S.G. Samarasinghe, Ministry of post and Telecommunication

E. Committee on Law and Computers

1. Prof. V.K. Samaranayake, Chairman, Acting Chairman,CINTEC, Head/Dept. of Statistics and Computers Science, University of Colombo

2. Mr. Sunil de Silva, Additional Solicitor-General, Attorney-General's Department

3. Mr. Upawansa Yapa, Deputy Solicitor-General, Attorney-General's Department

4. Mr. M.D. Somaweera, Assistant Registrar of Patents

5. Dr. Rohan Samarajeewa

Annex III

LIST OF MEMBERS OF THE WORKING GROUP ON AGRICULTURE

Prof. V.K. Samaranayake,	University of Colombo, Chairman
Mr. P. Maddugoda,	Forest Department
Mr. W.R.M.S. Wickremasinghe	- do -
Mr. A.P. Mallawatantri	Ministry of Plan Implementation
Dr. W.D. Joshua	Irrigation Department
Mr. A.R. Dassanayake	- do -
Mr. S.A.P.K. Samaranayake	- do -
Mr. Sarath Peiris	Coconut Research Board
Mr. K.S. Palipana	- do -
Mr. E.R.N. Gunawardena	University of Peradeniya
Miss E.J. Solomon	Royal Botanic Gardens
Dr. A.P. Gurusinghe	Dept. of Minor Export Crups
Mr. A.L. Gunasekara	Central Agriculture Research Institute
Dr. A. de S. Liyanage	Rubber Research Institute
Dr. Miss S. Abeysekera	University of Colombo
Dr. Kevin Seneviratne	- do -
Mr. T. Thevadasan	Tea Research Institute
Mr. G.A.C. de Silva	Dept. of Agriculture
Mr. A.T. Suraweera	Rubber Control Department
Mr. S.T.F. Silva	Sri Lanka Tea Board
Dr. S. Sivasubramanium	Batticaloa University College
Mr. P.Umaharan	- do -
Mr. P.M. Jayathillaka Banda	Dept. of Meteorology
Mr. R. Vithana	Dept. of Census and Statistics
Mr. S.T. Herath	Surveyor General's Dept.
Mr. H.S.De S. Jayathilake	- do -
Miss T. Sanmugam	Agrarian Research & Training Institute
Prof. K.K. Pathirana	University of Ruhuna
Mr. P.S. Atukorala	Rubber Control Dept.
Mr. K.A.G.B. Amaratunga	Rubber Research Institute
Mr. K.H. Dharmasena	Faculty of Agriculture
Mr. D. Dharmadasa	Dept. of Biochemistry
Mr. D.M.A.P.Dissanayake	Rubber Research Institute
Mr. A.M.U. Dissanayake	Dept. of Census & Statistics
Miss W.M.U. Fernando	Cococnut Research Institute
Mr. W.V. Jayasena	University of Peradeniya
Miss. D. Jayasinghe	Rubber Research Institute
Miss G. Jayasinghe	FAO Project
Mr. K.B.A. Karunasekera	Rubber Research Institute
Kr. A.O. Kodituwakku	Dept of Animal Production and Health
Mr. P.M. Muthukuda	CISIR
Mr. R. Mathavan	Dept of Minor Export Crops
Mr. D.T. Mathes	Coconut Research Institute
Dr. R.B. Mapa	University of Peradeniya
Mr. K.E.A. Perera	Rubber Control Dept

Mr. S.G. Peiris	Coconut Research Institute
Mr. K.A.D.W. Senaratne	University of Ruhuna
Mr. T.B. Samarakoon	Land & Water Use Division
Dr. S. Somasiri	- do -
Mr. P. Sarukkali	Paddy Marketing Board
Mr. S. De Silva	Rubber Research Institute
Mr. H. Talgaswattha	- do -
Mrs. P. Uluwita	M.R.I.
Dr. M.R.T. Wickramaratne	Coconut Research Institute
Mr. A.S.D. De Zoysa	Dept of Agriculture
Mr. G. Wadasinghe	IRI, Ratnapura

List of Institutions involved in the Working Group on Agriculture

1. Forest Dept
2. National Fertilizer Secretariat, Ministry of Plan Implementation
3. Irrigation Dept
4. Coconut Research Board
5. Paddy Marketing Board
6. Faculty of Agriculture, University of Peradeniya
7. FAO Fertilizer Project, Royal Botanic Gardens
8. Dept of Minor Export Crops
9. Central Agricultural Research Institute
10. Rubber Research Institute
11. Dept of Statistics & Computer Science, University of Colombo
12. Tea Research Institute
13. Dept of Agriculture
14. Rubber Control Dept
15. Sri Lanka Tea Board
16. Faculty of Agriculture, Batticaloa University College
17. Dept of Meteorology
18. Dept of Census and Statistics
19. Surveyor General's Office
20. Agrarian Research & Training Institute

List of Members of the Working Group on Energy

1.	Mr. Bandu Ranasinghe	- Ceylon Petroleum Corporation
2.	Mr. M.C.A. Alles	- University of Peradeniya
3.	Mr. D.S. Wijesundara	- - do -
4.	Mr. K.B.N. Ratnayake	- - do -
5.	Dr. Nimal Vijaindu	- Ceylon Electricity Board
6.	Mr. T.M. Herat	- - do -
7.	Mr. K.V.N. Kithsiri	- - do -
8.	Mr. Shavindranath Fernando	- - do -
9.	Mr. M.N.S. Perera	- - do -
10.	Mr. C. Ratnayake	- - do -
11.	Dr. A.S. Indurusa	- University of Moratuwa
12.	Dr. P. Dias	- - do -
13.	Mr. A. Abeywardene	- CINTEC

Annex IV

LIST OF THE AD HOC VENDOR GROUP

01. INTERNATIONAL COMPUTERS (CEYLON) LTD
20, Sir C. A. Gardinar Mawatha
(P.O. Box 305)
Colombo 2 — Tel. 34161

02. DATATECH LTD.
50, Ward Place,
Colombo 7 — Tel. 597798

03. METROPOLITAN AGENCIES LTD.
209/9, Union Place,
Colombo 2 — Tel. 597266

04. BC COMPUTERS LTD.
26, Flower Road,
Colombo 7 — Tel. 575303, 575302, 574590

05. IBM WORLD TRADE CORPORATION
House of Technology
Navam Mawatha
Colombo 2

06. COMPUTERLINK LTD.
294, Union Place
Colombo 2 — Tel. 28641/2 ,546055,546876

07. NCR (LANKA) LTD.
7, York Arcade Road
Colombo 1 — Tel. 21623

08. BARTLEET ELECTRONICS LTD.
11/1, Greenpath
Colombo 3 — Tel. 575699, 575700

09. THE HI-FI CENTRE
85, Rosmead Place
Colombo 7 — Tel. 595047, 598856

10. INFORMATICS (PRIVATE) LTD.
65, Walukarama Road
Colombo 3 — Tel. 575545, 575549

11. OFFICE EQUIPMENT LTD.
55, Iceland Building
Colombo 3 — Tel. 27659, 26301

12. CEYLON BUSINESS APPLIANCES LTD.
First Floor,Iceland Building
Colombo 3 — Tel. 26547,34947

13. FENTONS COMPUTERS (PVT) LTD.
350, Union Place
Colombo 2 NEC Tel. 25181, 32611,540517

14. DATASERVE LTD.
377, Darley Road PC
Colombo 10 NEC Tel. 93673, 595395

15. DATALINK LTD.
37, Queen's Street
Colombo 1

16. DMS ELECTRONICS LTD. WANG
106, Kynsey Road コマトーレ
Colombo 8 SCRIP Tel. 597855, 597854

17. AMARAN COMPUTERS LTD.
498, R.A. de Mel Mawatha
Colombo 3 AI (IBMコンパチ) Tel. 500639

18. JAGATH ROBOTICS (PVT) LTD
238/5, Havelock Road
Colombo 5 Tel. 583470

19. ミンタカ

20. ホンコン製

(4) NIBM'S EXISTING DIPLOMA PROGRAMME IN COMPUTER SYSTEM DESIGN

Appendix I

NIBM'S EXISTING

DIPLOMA PROGGRAMME IN COMPUTER SYSTEM DESIGN

DETAILED SYLLABUS

MODULE 1

INTRODUCTION TO COMPUTING — 90 hours

1. Computer Classification
   - Type, Generation, Size

2. Historical Development of Computers

3. Functional Units of a Computer
   - Functions of Input, Memory, Control, Arithmetic and Logic and Output units

4. Input Output Devices
   - Operational characteristics, transfer speeds, advantages and disadvantages of each type of device

5. Software
   - Programming Languages; high level, low level
   - System software; Operating system, Compilers, Utilities

6. File Organisation
   - Indexed, Sequential, Indexed-Sequential
   - Access Mode random, sequential, dynamic

7. Telecommunication and Data Transmission

8. Representation of Information within a Computer
   - Relationship between binary, Octal, and hexadecimal numbering systems
   - Representation of negative numbers; sign and magnitude, 1's complement and 2's complement
   - Floating point representation, scientific notation, excess notation
   - Binary coded decimal (BCD)
   - External Representation character Formats ASCII, EBCDIC (Internal Representation is covered further in Module II)

9. Flow Charting and Algorithms
   - System Flow Charts
   - Program Flow Charts

10. Liveware

MODULE 2

SYSTEM SOFTWARE

Time 65 hrs of lecture time and instruction Computer Time for practicals is off hrs. Minimum of 8 hrs of Terminal time per Participant.

1. Architecture of WANG 2200 VS

   - Principles of operation of CPU, IOP's Workstations and secondary storage devices.

2. System Software
   - (i) Operating System
     - control programs
     - processing programs
     - service programs (utilities)
   - (ii) Virtual Storage
   - (iii) Processor management
   - (iv) Device management
   - (v) Information management
   - (vi) Security System

3. The concepts of
   - (i) multiprogramming
   - (ii) relocation and paging
   - (iii) file map organization
   - (iv) blocking and deblocking
   - (v) buffer pooling

4. File Organization
   - (i) Indexed
   - (ii) Sequential
   - (iii) Indexed sequential

5. Use of File Management Utilities
   - (i) Control
   - (ii) Datentry
   - (iii) Report
   - (iv) Inquiry

6. Use of Other Utilities
   - (i) Editor
   - (ii) Copy
   - (iii) Linker

MODULE 3

SYSTEM DESIGN I - DESIGN OF FORMS

Time 12 hours

1. Communication and Information

2. Procedures and Records

3. Design of Forms

   Static and Variable data
   Users
   Layout, Paper, Printing, Volume, Storage
   Copies and routing of copies
   Cost

4. Common Forms

   Bin Card, Pay-slip, Paysheet, Invoice

5. Source Documents for Computer Data Entry

   Computer Printed Input Forms

6. The Use of Screen Layout Chart and Printer Spacing Chart

7. Exercises.

MODULE 4

R. P. G. II

Time 8 hours
Lectures & Instructions

Computer Time for Practical Work is off hours
Minimum 8 hours Terminal Time for entry and debugging

1. Introduction to R.P.G. II
   - Development of R.P.G.
   - The Concept of Fixed Logic
   - Applications

2. Types of Specifications and Specification Sheets
   - Nine Specifications:
     - i. Control
     - ii. File Description
     - iii. Alternate Index
     - iv. Extension
     - v. Line Counter
     - vi. Input
     - vii. Calculation
     - viii. Output
     - ix. Work Station

3. Control Level Indicators
   - the mechanism
   - the special indicators LR & MR

4. R.P.G. II Logic Flow

5. Examples:
   - i. Simple application - Printing of reports from available files without computations
   - ii. Computation and output from available files
   - iii. Update programs - Updating a Master file from a Transaction file
     - the concept of random access mode
   - iv. Data-entry programs - Programs to enter data through a workstation
     - simultaneous data entry by several operators sharing the same program and file

v. Batch Applications

vi. On-Line applications

a) Inquiry of Bank Account Status from a given file.

b) Application at point of sale
- to inquire into availability of required goods, their prices, stock positions, and if not to display relevant information about orders placed, delivery dates, estimated selling prices, etc.

- if confirmed to print-out invoice in duplicate update stock files.

- to print a stock report

: 6 :

MODULE 5

DATA STRUCTURES & ALGORITHMS

Time 60 hours

1. Effectiveness of Algorithms

   - Speed
   - Storage requirement
   - Simplicity
   - Generality
   - Infallibility
   - Regularity

2. Language of Algorithms

   - Fixed point, floating point
   - names
     - data names
     - procedure names
     - albebraic symbols
     - comparison symbols
     - indexing symbols
     - punctuation marks
     - literals

3. Data Structures
   - Vector
   - Matrix
   - Filo/Fifo Stack
   - Hash-Vector
   - Lists
   - Graphs (Tree)
     - Directed graphs
     - binary tree

4. Algorithms

   - Initialise the data structure
   - Insert items into the data structure
   - Locate items in the data structure
   - Delete items from the data structure
   - Use items in the data structure

5. Other Algorithms

- Evaluate an integer M in modulo N arithmetic
- G.C.D. of two integers
- Vector sum of two vectors
- Sort
  - postmaster sort
  - Bubble sort

- Date Checks

  - without using vectors
  - using vectors

- Day of year
- Number of weekends for a fiven month of any year
- Binary search
- Sum of two rectangular matrices
- Transpose square matrix in place
- Product of two matrices
- Aggregate a given tree

MODULE 6

COBOL LANGUAGE

Time : 90 hours of Lectures
and Instruction
Minimum 40 hours Terminal Time
for program entry and debugging

1. Characteristics of a programming language

2. Comparison of languages
   Scientific,, Commercial, RPG II, COBOL, BASIC, FORTRAN

3. Data formats supported

4. Rules of syntax

5. COBOL language structure

6. COBOL statements

7. File Organization and Access Methods
   Primary and Alternate Indices

8. Structured COBOL
   Fifteen exercises to be written in Structured COBOL, then entered, and debugged interactively.
   These exercises cover batch and transaction processing applications.

MODULE 7

BASIC LANGUAGE

Time 30 hours of Lecture and Instructions.

Computer Time for practical work is off hours

Minimum 16 hours terminal time per participant

1. Floating point, Integer, Alpha Numeric Variables

   Intrinsic Functions : Numeric, Trig, Alphanumeric

   User Defined Functions

   Subroutines

2. ARRAYS

3. File Processing

4. Screen Formatting

5. Computer Art

6. Exercises

   Matrix Manipulation

   Statistical Computations

   Business Applications

   Simulation

MODULE 8

COMPUTER TECHNOLOGY

1. Switching Theory

   Design of 2-level gate networks
   Algebraic, Map, and Tabular methods of reduction

2. Devices

   Half Adder, Full Adder
   Serial and Parallel Adders
   Flip Flop, R-S, J-K, D, Clocked.
   Shift Registers, Counters
   Tri State, Schmitt

3. Technologies

   Diode, DTL, RTL, TTL, ECL, MOS
   Basic Gate Circuits, Memory Cells, Principles of Operation
   Magnetic Core Memory
   Comparison of Technology lines

4. Memory Organization, Address Decoders

5. Magnetic Recording

   Recording Methods RZ, RB, NRZ, NRZI, PE
   Encoding - FM, MFM, M2FM, GCR
   Construction of Disk and Tape Devices

6. Data Communications

   Mode, Modulation, Transmission Protocol

MODULE 9

ASSEMBLER

Time 36 hours of lectures and Instructions

Computer time for practical work is off hours

Minimum 6 hours Terminal Time for entry and debugging

1. Introduction to Low Level Languages

2. Registers
   - General Registers
   - Floating Point Register
   - Control Register

3. Structure of the Program Control Word

4. Addressing of Memory Locations
   - Absolute, relative
   - Base Register Displacement

5. Assembler Specification Format
   - Definition of entries,
   - Rules

6. Types of Instructions
   (i) Mnemonic Machine Instructions
   (ii) Internal Format of Machine Instructions
   (iii) Extended Mnemonic Instructions
   (iv) Macro Instructions and Assembler Instructions

7. Examples
   (i) Simple Mathematical problems which illustrate use of Registers and Memory Locations
   (ii) Read a file and print selected fields
   (iii) Data Entry and File Update Program

MODULE 10

BUSINESS MANAGEMENT AND QUANTITATIVE TECHNIQUES

Time 80 hours

1. Business Management
   - Objectives of Business and Government
   - Principles of Management
   - Management Control and Decision Making
   - Corporate Planning and Management by Objectives
   - Introduction to Information Systems
   - Management by Exception
   - Design of Organizations

2. Financial Management
   - Book-keeping and Accountancy
   - Books of Prime Entry, Control Ledgers
   - Management Reports and Financial Statements
     - Budget, B/S, P & L
   - Processing

3. Materials Management
   - Reorder Policies
   - ABC Analysis, EOQ, ROL, Buffer Stocks
   - Stock Records, Supplier Records and Supplier Selection
   - Stores Procedures

4. Production Management
   - Types of Production and their Characteristics
   - Product Costing
   - Production Planning - B/E Analysis, EBQ, Stocks, Operation of a Scarce Resource
   - Network Analysis - Activity Scheduling, Resource, Levelling, Progress Control
   - Project Costing
   - Utilization of Machinery and Equipment

MODULE 11

SYSTEM DESIGN II — Time 90 hours

1. Overview of System Design

2. System Concepts

3. Systems Analysis and Design
   - Workstudy and Systems Analysis methods
   - Observation and Measurement
   - Recording Techniques
     - Flow Process Chart
     - System Flow Chart
     - Clerical Procedure Chart
     - Horizontal Time Line Chart
     - Block Diagram, String Diagram, Activity Flow
     - Document Analysis Form
     - Grid Chart
     - Decision Tables
   - EDP Facilities
     - Manual vs EDP
     - Bureau Facilities
     - Batch vs Transaction Processing
   - Objectives of Systems Design
   - System Specifications
   - Computer Suppliers, prices, support facilities
   - Conversion
     - Types of Conversion, Process of Conversion, Planning of Conversion

4. Data Base Organization
   - Advantages and Objectives
   - DBMS Components
   - Hierachical, Network and relational approaches
   - Design of Hierachical, Network and Relational Data Bases

5. Forecasting

Judgment, Extrapolatention, Casual Model

Moving Average, Exponentially weighted average, Linear Growth Model

6. Probability and Statistics

Descriptive Statistics, Frequency Distributions

Probability

Definitions, Independent Events, Mutually Exclusive Events, Compound Events

Probability Distributions - Normal, Binomial, t, Chi Squared

Hypothesis Testing, Significance

Test of mean (Normal and t tests)

Contingency Tables (Chi Square test)

Correlation - Product-Moment, Rank

Linear Regression

MODULE 12

SYSTEM DESIGN PROJECT

Time 2½ months or more

1. Students are instructed 6 hours on Investigation, Recording, Design and on Report Writing. Projects are done by teams of 3 or 4 studunts at Government institutions and private companies.

2. Approximate programme

   3 weeks investigation, 6-8 weeks analysis and report writing.

3. Project includes:

   Feasibility Study, and Cost-Benefit Analysis
   Gross Design
   Inputs, Outputs, Files and Program Functions
   Implementation Programme

4. Oral Examination of each student upon submission of project report