

# ECONOMIC REVIEW

OCT.  
1983

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Speech



Text



Diagrams



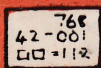
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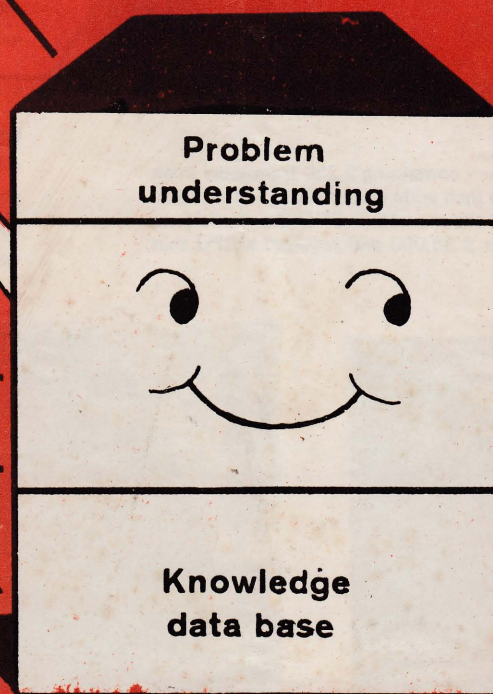


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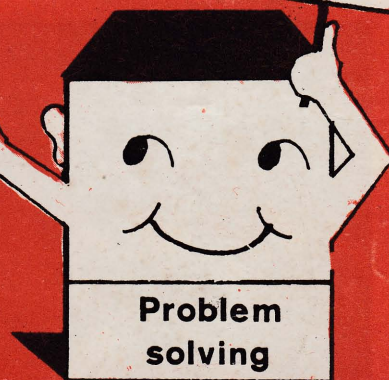


Numerical data

Modelling  
software  
system



Intelligent  
personalized  
terminal



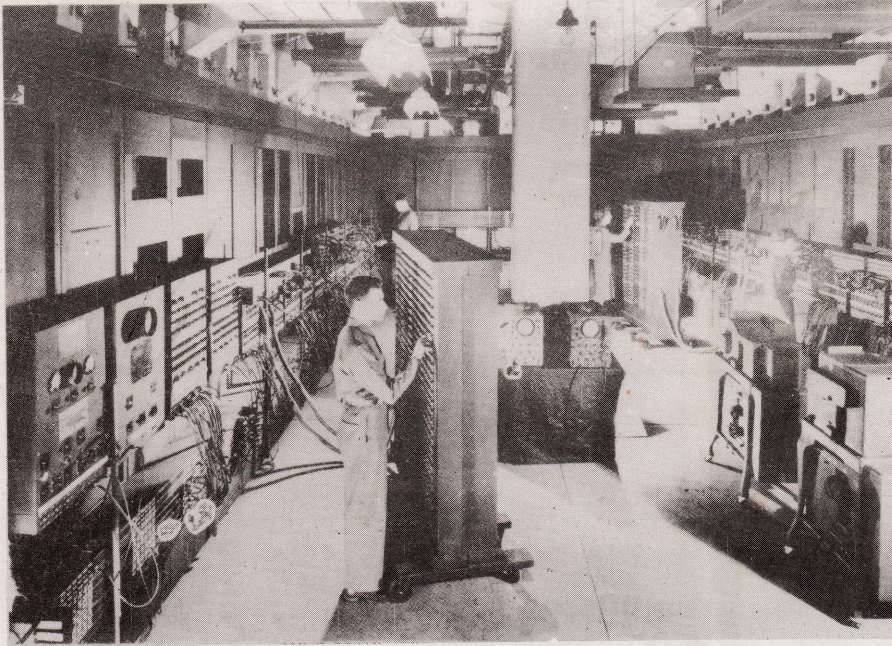
## Fifth generation computer

## TOWARDS MACHINE INTELLIGENCE

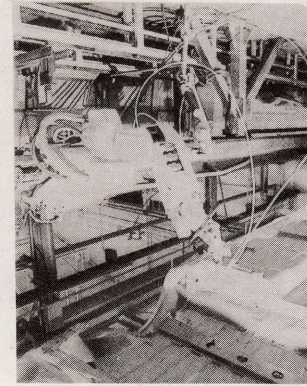


## COMPUTER ADVANCES OVER FORTY YEARS

In 1946 two scientists at the University of Pennsylvania designed an automatic calculator where numbers and instructions were represented by electric signals. This machine was completed in 1946 and was referred to as ENIAC. In many ways, ENIAC and Colossus were the first machines to qualify as computers in the sense that we use the word today. The gulf that separates them from today's machines, however, is not simply technical but one of social and psychological awareness. ENIAC meant nothing to the man in the street as for society at large the impact of its work was minimal. Today everyone is aware of computer and virtually everyone comes into contact with their output.



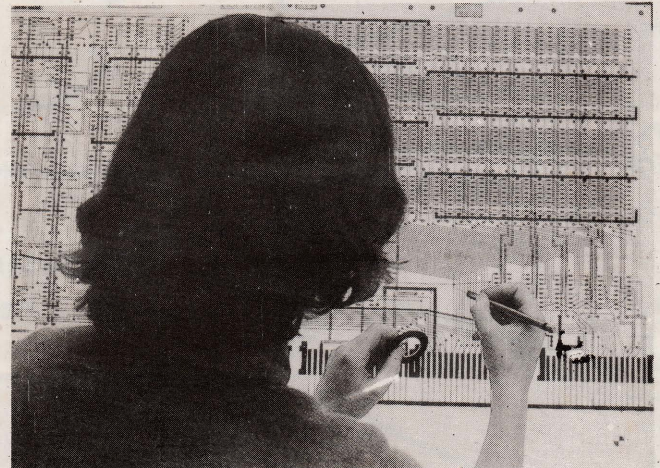
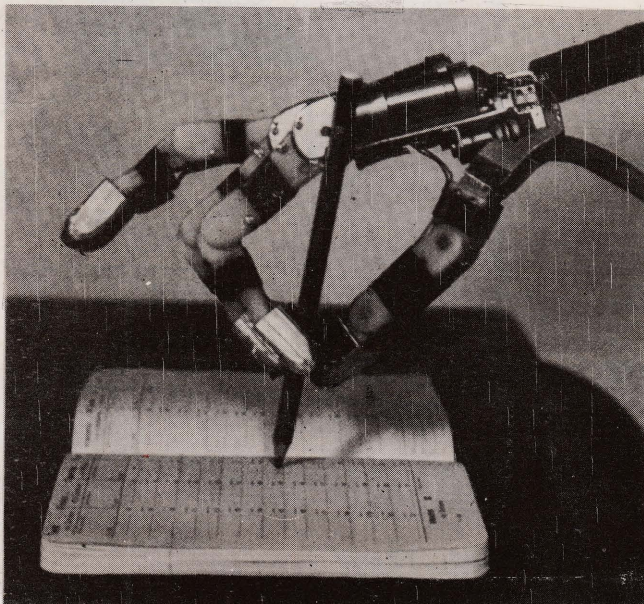
In 1971, the one-chip CPU - or microprocessor - containing 2,250 transistors in an area barely a sixth of an inch long and an eighth of an inch wide was unveiled. In computational power, the micro-processor almost matched the monstrous ENIAC and performed as well as an early 1960s IBM machine that cost \$ 30,000 and required a CPU that alone was the size of a large desk.



### Process control applications

▲ Robots working on British Leyland's Mini Metro.

A designer producing the master pattern for all the circuitry required on a single chip. The design is then photographically reduced to chip size ready for etching by laser onto a wafer of silicon. ▼



Most industrial robots look nothing like the bit of the body they imitate. But this biomechanical hand was specially designed to restore the maximum possible dexterity to an amputee. Electrodes implanted in the limb stump relay muscle contractions to mini-motors in the wrist and fingers. Work is now going on to develop pressure-sensitive artificial skin.

Pictures, Courtesy  
Micro man - Dr Gordon Pask.  
Macmillan Publishing Co. Inc.



Published by the People's Bank,  
Research Department,  
Head Office,  
Sir Chittampalam A. Gardinar Mawatha,  
Colombo 2,  
Sri Lanka.

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THE ECONOMIC REVIEW is intended to promote knowledge of and interest in the economy and economic development process by a many sided presentation of views & reportage, facts and debate.

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THE ECONOMIC REVIEW is published monthly and is available both on subscription and on direct sale.

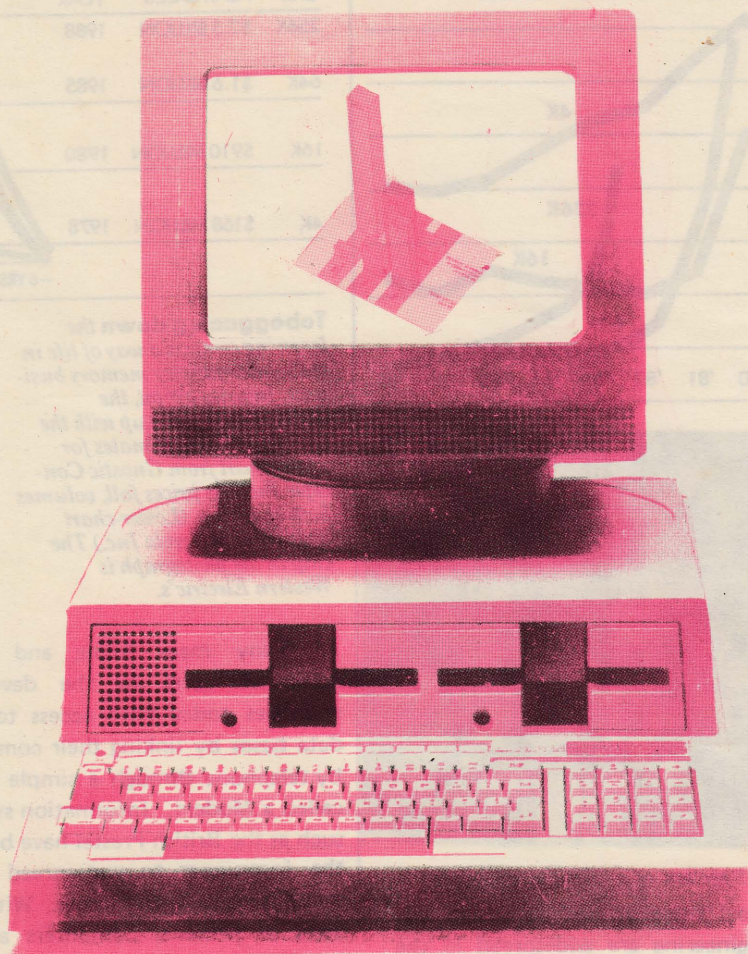


## DIARY OF EVENTS

Oct.

- 3 Experts from tea exporting and importing countries began two weeks of discussions, under UNCTAD auspices, where progress was achieved in considering technical issues relating to the elements of an international tea agreement. A time-table was established that would lead to the convening of full-fledged negotiations on an international tea agreement during 1984.
  - 4 The Lanka Electricity Company (Private) Limited (LEC) was incorporated under the provisions of the Companies Act No. 17 of 1983, to undertake maintenance, supply, development, distribution and sale of electricity hitherto handled by local authorities. The objectives of the LEC are to improve electricity distribution in the local Authority areas. The authorised share capital of the LEC is Rs. 1,200 million, and the shareholders are the Urban Development Authority, the Ceylon Electricity Board and those local authorities who have handed over their electricity distribution to the company.
  - 5 The Export Development Council of Ministers approved in principle the National Export Development Plan. This plan has been formulated by an Advisory Committee, the members of which were drawn from the relevant line Ministries, State Organisations and the Private Sector. The Plan envisages an estimated investment of Rs.12 billion for the development of the country's export sector in the four year period 1984-87. Approximately 40 percent of the total investment is expected from the public sector (mainly for the plantation industries, infrastructure, manpower development and institution building), 35 percent from the private sector, and the balance 25 percent from foreign investment. It also envisages an average annual export growth rate of 11.5 percent in real terms.
  - 15 The Government announced an upward revision of turnover tax on payments in respect of contracts relating to services of an entertainer or an artiste. The rate of tax in relation to such services has been raised from 3 percent to 5 percent.
  - 19 Portugal published its letter of intent to the International Monetary Fund on receiving an IMF standby loan of SDR 445 million. According to IMF terms Portugal has undertaken to contain public spending and reduce private demand in order to bring down the balance of payments deficit on the current account to \$ 2 billion at the end of 1983 and \$ 1.25 bn by 1984. It also includes conditions covering substantial and sustained reductions in the state budget deficit, and expenditure to be controlled in all areas of the public sector. It commits the Government to improving the self-financing of public sector enterprises and a thorough review of their investment programmes, and to keeping wage increases in public enterprises below the rate of inflation in both 1983 and 1984. It also brings in conditions for the government to curb the growth of monetary and credit aggregates by enforcing credit ceilings set by the Bank of Portugal and increasing the effective cost of credit.
  - 20 Letters were exchanged between the Governments of Canada and Sri Lanka providing for a grant of Canadian dollars 10 million (approximately Rs. 198 million) to finance wheat grain imports from Canada. The proceeds of the grant will be utilized to purchase 36,764 metric tons of wheat grain from Canada.
  - 21 The Government's downward revision of turnover tax on approved hotels and guest houses came into effect. The rate of turnover tax on hotels, guest houses and similar businesses approved by the Tourist Board was reduced from 15 percent to 10 percent.
  - 25 The battle of the computer giants in the US surfaced again when Apple Computer, the pioneering US personal computer maker facing fierce competition from other manufacturers reported sharply lower profits for its fourth quarter ending September 1983. The competition had forced Apple to make a major change in the marketing of its 'Lisa' computer, cutting the price by 18 percent. One week earlier (on October 19) IBM, the world's biggest computer manufacturer strengthened its position in the market for personal computers by announcing new high performance versions of its PC model to challenge Apple Computer's Lisa. The IBM 3270 personal computer offers the ability to perform several tasks concurrently. Like Lisa, the IBM system displays data from upto seven applications in "windows" on the video system. The 3270 PC selling at \$ 5,585 puts IBM's price significantly below that of Apple's Lisa, which sells for \$ 8,500 but includes a hard disc storage system.
  - 27 The Philippines Government tightened foreign exchange regulations and introduced new import controls, in an effort to curb foreign exchange outflows.
- OPEC's Market Monitoring Committee, meeting in Vienna, recommended that the production ceiling of 17.5 million barrels a day of crude oil, the individual members' quotas, and the benchmark price of US\$ 29 per barrel be left unchanged.
- 28 The French Government relaxed controls on purchases of foreign exchange by residents for tourism purposes, to effective from December 20.
  - 31 Israel temporarily banned the sale of foreign exchange for residents except for tourism
- At the end of October 1983 the Wholesale Price Index maintained by the Central Bank of Ceylon, had reached 381.1 (for all items) as against 283.5 at the end of October 1982.





# THE FUTURE OF COMPUTERS

Three years ago we had a special issue on computers. Published at a crucial time when microcomputers were leading to the expansion of the computer industry worldwide and in Sri Lanka it had a catalytic effect in the country. Just like previous issues of the *Economic Review* on key subjects such as those on Women, Energy and Transport which described widely for the first time in Sri Lanka a developing area of interest, our issue on Computers had a sensitising effect.

In the intervening three years, computers have been widely discussed in the country, the micro computer revolution has begun to spread on Sri Lanka, a National Computer Policy has been announced and on the international scene, there have been more significant technological changes.

The micro computer revolution started roughly five years ago with machines like the Radio Shack Model 1 and the Apple. The micro computer has since developed into a consumer

product that is selling by the hundred thousand. This has been accompanied by a drastic drop in prices. In Sri Lanka micro computers with capacities not very different from the biggest main frame computers, used in the Sri Lanka of a decade ago, are about to break the barrier of the cost of a bicycle. The developments in the last three years have been very rapid. This special feature documents some of the developments in the field, both internationally and in Sri Lanka.

ENIAC the first electronic computer built nearly 40 years ago had a memory capacity of roughly 1000 cells 1K. Thirteen years ago Intel Corporation brought out a silicon chip the size of a thumb-nail with 1K (roughly 1000 storage cells) as a Random Access Memory (RAM). Chips are created by etching of circuits through photographic processes on wafer thin silicon. The amount of circuitry that could be so etched has grown in geometric proportions. Every three years since Intel's introduction of the chip there has been a four-fold increase in the storage density of chips.

Only five years ago the most commonly used memories for micro computers in the RAM category (Random Access Memories) had a capacity of only 4K. A couple of years ago a major innovation was the 64K RAM, worldwide sales of which in 1983 alone were close upon one billion dollars. The 256K chip is now in the manufacturing stage and its mass production is expected to overtake the sales of 64K RAM's in 1985. A single chip with 256K has the ability, for example, to store 10,000 telephone numbers or written texts of 5200 words, i.e. about 10 pages of text of the *Economic Review*.

If a 256K memory on a small chip seems a very significant leap from the 1K computers of the 1940's (which used to fill a large room) there are further qualitative changes in store. The so called Christensen chips that are now under development are designed to store 4000 K on a chip which



is a capacity 16 times that of a 256K BIT. Behind this development is Christensen a silicon valley innovator who believes that future chips based on this principle would be able to store 400 megabites in a chip.

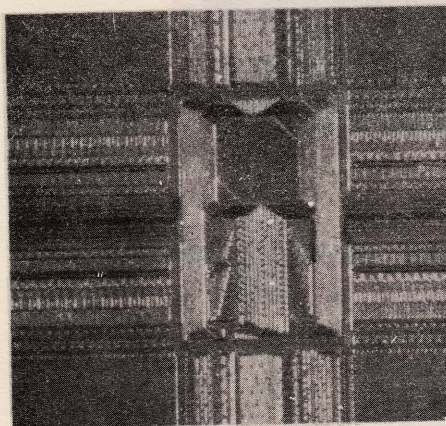
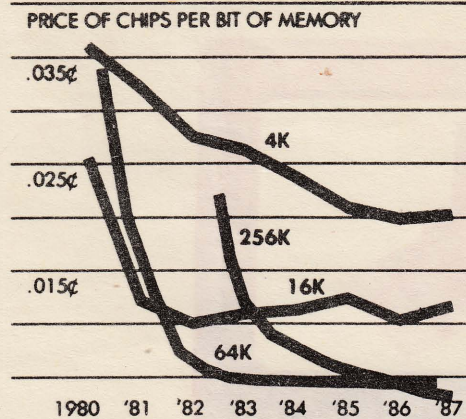
A technical barrier for packing chips had been heat generated by the chip. Chips are so densely packed that they sometimes give as much heat as a light bulb. A new range of low heat generating chips of so called CMOS chips (Complimentary Metal Oxide Semi-Conductor) is rapidly changing the situation. CMOS chips combined with liquid crystal displays are expected to lead to a new breed of transportable computers. Since last year a hand held computer, the size of a large desk diary, the Radio Shack model 100 with 24K has been selling rapidly in the United States. A Japanese company announced late last year a computer on a wrist watch with a 1K memory capacity, a far cry from the 1K ENIAC computer which filled a large room.

With mass production because of economies of scale the prices of chips per unit of memory (BIT) came down. Because of this process a chip, with a particular memory capacity, reaches a peak sale six years after its introduction and then drops in sale to be followed by a new generation of chips having a higher memory capacity. The cheaper they get the more chips sell as is shown in the above diagram. This follows a previous pattern set by the transistor radio and the Pocket calculator.

Bufs in Silicon Valley have pointed out that if the motor car industry went through the same price reduction and increased in efficiency as has the computer industry, cars would now cost 1 dollar each and run 500 miles on a gallon of gasoline.

Airline booking systems and banking were one of the earliest businesses to be computerised as these activities used very rudimentary and easily describable operations. Computerised Inventory and Accounting systems

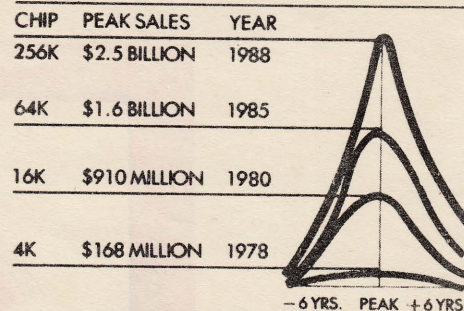
## The cheaper they get ...



A section of a 256K memory chip of most firms as well as design aids in engineering are widespread in the developed world.

Thus, in a developed country today, routine banking activities are computerised, replacing bank clerks, the telephone system is computerised replacing telephone operators, the electricity grid is computer controlled replacing lower level engineering personnel, air ticketing is done by computers. In addition routine governmental activities, done by human skills such as billing tax bills, and social security or large warehouses, are done by computer programmes and most car assembly lines are not only to a large extent built by robots, but also have been designed using computer aids, while entire factories are partially controlled by computers. The next development, so called knowledge based expert systems that border on the fifth generation computer, are already available.

## ... the more they sell



**Tobogganing down the learning curve** is a way of life in the semiconductor memory business. In price per bit, the 256K should catch up with the 64K in 1985. (Estimates for upper chart from Gnostic Concepts Inc.) As prices fall, volumes keep climbing. (Lower-chart data from Motorola Inc.) The chip in the photograph is Western Electric's.

Many main frame and micro computer users in the developed countries today have access to large data bases by linking their computers by telephone through a simple device called a Modem. Information systems such as the British Prestel have become the forerunner to widespread information access in the home. With millions of personal computers already installed, there is at the moment an explosion occurring in this information exchange between such computers national data bases and interacting information services such as those of Prestel. (Aldrich 1982) One could have access to some of these data banks from Sri Lanka too by using international telephone links. There are no accessible data banks in Sri Lanka as yet. Computers exchange information using modems—the basis for the decentralised office, where the office worker stays at home and interacts with the information world outside through a modem connected personal computer.

An exciting development on the horizon due to occur over the next ten years arises from a new breed of computers that would do very many tasks normally classified as thinking. These are the so called fifth generation



computers first announced as a major goal by the Japanese and now also sought for by research and development teams in both the US and Europe. The previous "generations" of computers corresponded largely with developments in hardware, but the new ones aim at a qualitative leap in software capacity.

The fifth generation computer is expected to understand normal speech, read documents, process images and mimic both deductive and inductive thinking. Such a development would blur the barrier between man and machine beyond recognition. Some of the features of the fifth generation computer are already available in rudimentary form.

Speech output devices for even the most simple of micro computers have been available for at least five years. Already consumer products are on sale that can "talk". Examples are appliances such as cooking stoves or washing machines that announce the state of the cooking or washing to the user. Electronic spelling devices have been selling for over five years.

Speech input devices which are essential for machines to which one can talk to, are more complicated as they require much larger memory power and sophisticated pattern recognition abilities. With the availability in the near future of very large memories at cheap cost such devices are not very far away. These devices would for instance, enable the development of typewriters to which one could talk to and which would give as an output, a typewritten document.

There has been considerable debate over the last three decades on whether machines can think or whether they could surpass humans in mental capacity. Even the very earliest computing machines were capable of very fast calculation but these activities were dismissed as being that of a speeded up abacus. However, with sophisticated programming techniques and greater insights into what is meant by "thinking"

the line between man and machine thinking is becoming thinner.

Today there are chess playing programmes which are used even in micro computers which could defeat the majority of Sri Lankan chess players. There are also more sophisticated chess playing programmes operating on main frame computers that are on the level of a Master and these programmes could of course beat any Sri Lankan chess player. Since 1977 a new breed of chess programmes have begun beating some of the best humans.

The best programmes can beat half the rated players in the world, that is those who compete in official tournaments almost everytime. At the end of 1982 there were six machines that could beat the best 30 per cent of players, and programmes have become champions of some U.S. states whilst computers have already beaten players on the grand master level. It is widely believed that within the next few years the world chess champion would be a computer programme. However, it should be noted that chess programmes are successful more because of their power of reliable and rapid calculation than of the Major Programming techniques which of course have helped. The more sophisticated computer programmes, which are being looked at in the field of artificial intelligence (AI), are bound to increase the intelligence aspect of chess programmes.

One of the founders of computer science Turing described over forty years ago a universal computing "machine" using a moving paper tape and a pencil that could mimic any mental behaviour that could be described. Turing also published a test which would decide whether a computer thinks or not.

The Turing test is based on a person communicating through a tele typewriter with a machine or a human being. On the basis of the answers given through the teletypewriter to his questions, the operator of the test

has to decide whether the replies are given by a machine or a human being. If the interrogator cannot distinguish on the basis of the answers between machine, which is answering the questions, and a human being, then the machine is supposed to have passed the Turing test and would be considered thinking.

However, as early as 1965 a programme called Doctor or Elisa Programme designed by Weizenbaum was able to answer in a realistic manner questions put by human interrogators and seems to pass the Turing test. The programme was based on sophisticated analysis of grammar and some carried replies not on an understanding of the subject.

Doctors, nurses and patients were Weizenbaum was to later record were fooled into believing that the machine was thinking. There is intense research being carried on artificial intelligence in major centres in the world. Some are developing programmes that help a computer have an internal model of the external world in the way living and growing in the world help humans to have it. In the decades to come Artificial Intelligence will still further blur the division between man and machine.

In the Hindu-Buddhistic tradition, the problem of the mind has been a major philosophical and psychological concern in the last 2500 years or so. The new capacity of machines that mimic the mental functions will raise important questions for these traditions.

The Copernican, Darwinian and Freudian revolutions have not shaken these religious traditions in the way it shook Christianity and Judaism.

The challenge of artificial intelligence is bound to question the South Asian tradition as deeply as the other scientific revolutions questioned the Judaio-Christian ones.



## TOWARDS MACHINE INTELLIGENCE

Large amounts of information are today stored, processed and transormed by machines. Increasingly they have taken over activities that were hitherto limited to the human mind.

The border line between men and machines in information processing capacity is, however, becoming increasingly thinner and strict definitions that demarcate human thinking as something exceptional is getting to be difficult with today's machines.

One of the key formal breakthroughs in the mechanisation of thought processess was in Turing's theorem of nearly 50 years ago. He demonstrated that a simple machine consisting of a moving tape on which simple marks could be written and erased could mimic any activity that a mathematician could do with pencil and paper.

Since then, and in the 60's particularly, there have been formal research programmes specifically designed to mimic human thought. A necessary adjunct to this activity was the need to define what was uniquely human intelligent thought and how one could recognise an intelligent machine. One of the key tests had been again provided by Turing. His test was based on a person interrogating a human being or a machine through a teletypewriter. The interrogator, has to decide on the basis of the answers given to his questions whether he is communicating with a human or a machine. The Turing test holds that, if after adequate questioning through the teletypewriter, no difference between man and machine could be established, then the machine is supposed to "think".

This test evoked a large amount of literature and programmes were produced which seem to have passed the test. One of the better known of such programmes is the Eliza programme by Weizenbaum. The programme emulates a psychiatrist, the human questioner acting as a patient. The "conversation" that ensues is very life like and has even followed professional doctors

and nurses to such an extent that Weizenbaum had to later write a book about the experience. He was specially disturbed that the programme which "created the most remarkable illusion of having understood in the minds of the many people who conversed with it "would result in people often" demanding to be permitted to converse with the system in private, and would, after conversing with it for a time, insist inspite of my explanations, that the machine really understood them." Because of this phenomenon certain writers have even suggested changing the Turing test. But there doesn't seem to be a reliable replacement in sight. It seems that the human mental domain as an exclusive area, is gradually getting eroded.

Non trivial mental functions attempted by artificial intelligence research include, for example, game playing, translation, music composition, production of natural languages,

understanding of languages, visual and aural recognition, thinking analogously, as well as learning.

In games like back gammon, draughts and chess, computer programmes have progressed to such an extent that they can often beat human players. Thus a checkers (draughts) programme by Samuel has been consistently beating its programmer and chess playing programmes have begun beating some of the best humans. The best such programmes can beat half the rated players in the world, that is, those who compete in official tournaments almost everytime. As at the end of 1982 there were six machines that could beat the best 30 percent rated players and programmes have recently become champions of some U S states whilst some computers have already beaten players on the grand master level. It is widely believed that within the next few years the world chess champion could be a computer programme. However, it should be noted that these successful chess programmes are a combination of brute computing

Eliza is a programme that simulates the role of a psychiatrist. A sample of an Eliza dialogue follows which programme designed in the mid - 1960's has fooled many professional psychiatrists. Eliza's comments are in capitals, the "patients" in lower case.

P Men are all alike.

E IN WHAT WAY

P They're always bugging us about something or other.

E CAN YOU THINK OF A SPECIFIC EXAMPLE

P Well, my boyfriend made me come here.

E YOUR BOYFRIEND MADE YOU COME HERE

P He says I'm depressed much of the time.

E I AM SORRY TO HEAR THAT YOU ARE DEPRESSED

P It's true. I am unhappy.

E DO YOU THINK COMING HERE WILL HELP YOU NOT TO BE UNHAPPY

P I need some help, that much seems certain.

E WHAT WOULD IT MEAN TO YOU IF YOU GOT SOME HELP

P Perhaps I could learn to get along with my mother.

E TELL ME MORE ABOUT YOUR FAMILY

P My mother takes care of me

E WHO ELSE IN YOUR FAMILY TAKES CARE OF YOU

P My father.

E YOUR FATHER

P You are like my father in some ways.

E WHAT RESEMBLANCE DO YOU SEE

P You are not very aggressive but I think you don't want me to notice that.

E WHAT MAKES YOU THINK I AM NOT VERY AGGRESSIVE

P You don't argue with me.

E WHY DO YOU THINK I DON'T ARGUE WITH YOU

P You are afraid of me.

E DOES IT PLEASE YOU TO THINK I AM AFRAID OF YOU

P My father is afraid of everybody.

E WHAT ELSE COMES TO MIND FATHER

P Bullies;

E DOES THAT HAVE ANYTHING TO DO WITH THE FACT THAT YOUR BOYFRIEND MADE YOU COME HERE

P-Patient

E-Eliza



force and heuristics (rules of thumb) which are provided by the programmers in spite of their proven powers, and are not yet versatile intelligence.

Language translation through a word for word dictionary look-up have been attempted for over two decades now. Such simplistic efforts though useful were often subjected to errors arising from idioms and context, for example, the term "hydraulic ram" is mistranslated as "water goat." More recent attempts to translation have realised that real translation would imply that the translating programme possesses also a model of the external world internalised by it in the same way as humans. Easy language to language translation is one of the qualities expected of the 5th generation of computers expected in the 1990's.

The field of vision and pattern recognition is another one where rapid advances have been made. There are devices that can recognise shapes and manipulate them and which have already been included in existing robots. Advances have also been made in the use of artificial vision devices for recognising pictorial material. Some devices can locate specified objects in photographs, break up a scene into separate objects and identify objects one by one in a scene and recognise shapes including those of human faces. Some devices can recognise Latin script handwriting and also the Chinese and Japanese printed characters and even handwritten characters. In aural pattern recognition there are devices that have a rudimentary ability to "understand" spoken words and can be taught to recognise particular voices, whilst devices with voice output are becoming increasingly common even in micro computers.

Computers even without strong artificial intelligence characteristics are entering into areas that have hitherto been the preserve of relatively creative human workers in professional fields. So called expert systems fall into this category. The work on expert systems was begun in the 1970's. Such systems

would act as consultants and teachers in a wide variety of technical subjects. An expert system would be built up by compiling a bank of basic data on a particular area, that is presently held by human professionals. The result is a general consultancy system that could be interrogated by users.

the performance of surface knowledge systems. Existing systems using surface knowledge include those that are used for the identification of chemical compounds from laboratory data, diagnosis of diseases etc.

There already exists expert systems in the medical field that can advise



'A new symbolical head and phrenological chart with the name and definition of each organ'. Natural philosophers of the past thought of the brain as containing many distinct personalities. The author of this nineteenth century engraving postulated organs of 'amateness', 'conjugal love', 'parental love', 'sublimity', 'ideality', 'tune', 'destructiveness', and many more.

These knowledge based systems are expected to answer questions given to them by both professionals and laymen. Already the first generation of such systems that give answers based on rules of experience and guided by so-called surface knowledge are already available. By 1982 there were over 50 such systems in operation largely in the US. A surface knowledge expert system incorporates the codified knowledge on a particular field. A second generation of such knowledge machines provide answers from first principles. "Deep knowledge" systems are now in the pipe line. Deep knowledge systems are expected to be far more powerful and exceed

se on respiratory diseases, bacterial infections and eye diseases. Some of these expert systems have already proved to be more reliable than humans. Thus, a medical expert system called 'Mycil' already has a better record than human physicians in its ability to identify and treat Meningitis and blood infections. The machines have beaten the humans not only in the accuracy of identifying Pathogens, but also in avoiding over prescription, a very important factor in treatment.

Similarly, expert research system called Dendral and Secs has had a very high success in the field of chemistry. The Dendral system has been used by chemists to test hypothesis



and gather evidence. It has been said by those professionals familiar with it that this programme "has as much reasoning power in chemistry as most graduates students and some PhD's in the subject."

Recent expert systems have also been produced for arriving at computer configurations, trouble shooting and repairing of heavy equipment and machinery in oil and mineral exploration, computer aided education and also in the military. It is expected, by military professionals, that machines would be equal partners in decision making with humans. Expert systems are being designed to computerise the practical decisions taken in the field by generals. The assumption is that as in any bureaucracy those who reach the top in the military are a mixture of "good" generals and "dumb". An expert system with judgemental ability at a level of a general is currently under development by the Pentagon and is expected to be operating by 1990.

A major attempt at synthesising recent advances in 'artificial intelligence', on a commercial basis, is the so called 5th Generation computer scheduled to make its appearance in the 1990's. First proposed by the Japanese a few years ago and made a Japanese national goal, it is now also being pursued by American and European research teams.

A 5th Generation computer has several human like characteristics. It would automatically translate from English to Japanese and vice versa. (Thus, an advanced 5th generation computer would enable a telephone caller in America, phoning Tokyo, to speak in English, whilst being received in Tokyo in Japanese and vice versa.) Such a computer would also have an advanced speech recognition ability so that it would understand verbal commands. It would also be able to act as a very large expert system. It would have inference capacities and judgement and decision making abilities. Such a computer would in all probability be able to hold an intelligent conversation with a human being in several separate fields.

There are several already existing programmes that mimic more creative scientific work apart from those that we have already mentioned under ex-

pert systems. Expert systems work on received knowledge. The creative systems help generate this knowledge base.

One of the most widely discussed of such programmes is the BACON programme developed by Patric Langley and others (Gardener 1983 p.87). The principle on which such programmes is based on is simple. The computer is fed experimental data on a particular phenomenon. The computer then searches through this data to arrive at low level equations that would fit the data, a common feature in scientific work. This programme once given data about the outcome of experiments have re-discovered some of the major fundamental laws that were turning points in the history of science. Such laws discovered through such programmes include for example, Archimedes principle, Kepler's Third Law of Motion of Planets, Boyle's Law of Gases, Snell's Law which describes the refraction of light, Black's law governing specific heat, Ohm's Law Electricity (Ibid).

Still more promising than Bacon is a programme Urisko developed at Stanford that allows a computer to develop its own theories once it is fed with the major principles of a discipline.

Only a few scientists are engaged in the field of creative thinking. Most scientists do repetitious mundane research. Increasingly computers and computer based systems are entering this field.

Chemists have been increasingly turning to computers to study exotic molecules through the discipline of computational quantum chemistry. These attempt the predicting of properties of patterns and molecules using quantum theory. Sophisticated programmes such as ALCHEMY, ATMOL, MOLECULE AND POLYATOM have been devised to automate this process.

Chemists not only do calculations from first principles as in the above example, but many engage in experimental work. Falling prices of robots is resulting in the introduction of the unmanned laboratory; the lab being one of the few places still untouched by automation.

One of the most exciting experimental fields at the moment is in gene splicing where biochemical processes

change the basic templates of life. Since 1981 a Canadian company has been selling computerised gene machines. The computer in this machine, times the entry of chemicals and the sequences of chemical bases in the genetic chain. It has been calculated that such a machine promptly does what a fully trained genetic engineer would do in six months.

Computers have been used for observation in astronomy (they had been used for well over a generation to process astronomical numerical data). It is now being increasingly used for observation purposes where star photographs are regularly counted and classified using computers, leaving only the most creative tasks for humans.

Computers have been used for quite some time in the design, as well as the manufacture of computers. The growing complexity of designing tightly packed integrated circuits have been eased by computer techniques. Today many computer designs are being made which would not have been possible without the intervention of computers. There are also several programmes today which transform one computer language to another automatically and act as higher level programme writers.

A combination of both energy and information based machines are taking over the functions of human muscle and nerve, in physical activities as is evidenced by the recent explosion of the robot population, specially in Japan. Robots are today running large sections of industrial plants, particularly in places that are dangerous to humans or are boring. In applications such as motor car assembly, robots are today much cheaper than human labour (specially in developed countries) which is three times as costly as a robot.

Engelberger, one of the pioneer manufacturers of robots in the US, has spoken of a second generation of robots that are about to emerge in the coming decade. These would have flexible mobility, voice instruction, general vision facilities, touch facilities and several arms. These developments according to Engelberger's predictions would be such that by the turn of the century robots would be so cheap that a large amount of production of material wealth would be carried out by robots.

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## ARTHUR C CLARKE IN CONVERSATION WITH SUSANTHA GOONETILLEKE

### FUTURE OF COMPUTERS

S. G.

Since we are going to talk on the immediate past and the future I would like to first begin on a personal note; to recall a similar meeting with you about 20 years ago, when as an undergraduate editor of the University Maths magazine, I came to you for an article on Space. Over 25 years ago you also wrote the book "Profiles of the Future". What have been the major developments in computer hardware and software that you did not envisage in that book?

A. C.

It isn't easy for me to answer. (Incidentally the "Profiles of the Future" was re-issued in a new edition a couple of years ago).

But the most astonishing thing, which nobody ever anticipated or could have anticipated, is the micro-chip. Twenty years ago, a computer filled many rooms and consumed kilowatts of power. Now their function could be done with something the size of your finger nail. It is absolutely incredible. A thing which I can't get used to is the fact that I spent all my youth and early manhood, using a slide rule and mathematical tables — it was a basic tool of all scientists and all engineers. No one ever dreamt that within five years of introduction of calculators, based on chips, the slide rules would no longer even be manufactured. This extraordinary development in micro chips is the greatest revolution I think in recent human technology.

S. G.

Suppose we now stretch our horizons over the next 25 years and attempt to predict developments ahead.

A. C.

It's impossible. So, there's no point in stretching out over so many years. I mean anything one could imagine can be done in the next 25 years.

S. G.

Shall we then consider a shorter time horizon, say 5 years. What do you think would be the hardware developments over the next 5 years, say in miniaturization of components and the increase in packing densities.

A. C.

I do not think there is any point in getting any smaller for ordinary applications. Anything you want to do for ordinary purposes can be done by the existing personal computer, which is as small as a portable typewriter and getting

even smaller. Limits in miniaturization are now set entirely by human hands. You obviously can't make a keyboard smaller than the limits set by our fingers. In fact some key boards are already much too small so that you have to pick at them with tooth picks. As far as packing density of chips is concerned; this is only important, say, in very high-powered scientific applications, when you want to do hundreds of millions of calculations in a second. For commercial applications and for routine everyday work, we have already reached the ultimate.

S. G.

That is about processing. How about memory capacity? Do you think that one would see, for all practical purposes, limits to packing densities in personal computers in the next few years?

A. C.

No. One won't see the limits. But it doesn't matter. I mean the personal computer I have on my desk today could hold the equivalent of 10 books, in its hard disc. In fact I haven't even used a quarter of the memory capacity in the machine I have, even though it is now already obsolete. So far as most business purposes are concerned — certainly for most personal computers — we've already got everything we will ever need. It is only the scientists and the big corporations that will need any more capacity, any more memory. What we do need is more "user friendliness", that is my problem. And we need standardization. I mean I have 6 or 7 computers none of which can "talk" to each other, and that's a great difficulty. We have to get common standards.

S. G.

The trade was of the view last year that with the arrival of the IMB PC standardization was on its way. 'Because of its market penetration, and IMB's strong image, the PC will probably bring about standardization'. How soon do you think standardization would occur?

A. C.

Some day it has got to be done. Today it is a great battle between Apple and IMB. IBM and Apple are the two gladiators — you can say — in the field at the moment. Some computer firms are going to fall by the wayside — it's already happened to some.

S. G.

With economies of scale, the prices of personal computers have been going down and seem



to be following a path already set by other electronic products like transistor radios and pocket calculators. It seems therefore that computers, would be affordable; in fact very affordable in the Third World, much more for example, than "Hard" products like cars.

A. C.

Yes. Certainly in comparison with cars. A computer or calculator already costs only a fraction of the cost of a car and it costs virtually nothing to run. But my particular theme now is what the developing world needs is a telephone. And that is one thing the Arthur Clarke Centre in Moratuwa is concerned with, solar powered telephones and then solar powered radios, so that there is no need to worry about batteries. And computers and information storage devices would then follow.

S. G.

Solar powered telephones with wires or radio links.

A. C.

Today, you just can't afford them with wires anywhere, they are too expensive, and they get stolen.

S. G.

Yes. Specially in Sri Lanka. Ever since the advent of computers there has been anxiety about them, that they would be taking more and more of the intelligent functions of humans. Do you think that artificial intelligence would make significant jumps in the near future. For example in your film 2001 there was the talking computer HAL, and there are now devices for personal computers which one can buy for about \$20/- which give a crude voice output.

A. C.

Nothing like HAL is going to be a reality in the foreseeable future. In my Apple I have a programme with which you can type anything, it will say it. However, you have to play around with it because English spelling is a bit peculiar. The bigger problem is for computers to understand spoken language, particularly English. I do not think we will have machines which can really understand, in the sense that say HAL on the film, by 2001, but I'm sure we will have them some day.

Incidentally we have started shooting 'Odyssey 11' the sequel to 2001. I am on line several hours a day on my computer to the producer in Hollywood. I just loaded up today's despatch and I'm doing a live interview on my keyboard, for the 'Los Angeles Times'. That means my

life has been totally revolutionised by my personal computer and the telephone link. These could put everybody in the electronic global network and here again the problem is of standardization.

S. G.

The Japanese and now the Americans and the Europeans are working on the 5th generation computer, which they hope will come in the 1990's. It is supposed to have voice recognition and several other intelligent functions.

A. C.

We sure will have a lot of voice recognition by then, but the question is whether we will have comprehension.

S. G.

You implied that there would be a strong impact on the emergence of artificial intelligence on mankind, could you perhaps elaborate?

A. C.

Well, obviously, when we have entities that can talk to us, do a conversation, you know, that will have a great impact. But its a question of how quickly people adapt to computers. The younger generation will take them for granted, younger people for example do not get much excitement of going to the moon anymore.

S. G.

A few years before you wrote your article on Satellite transmission to *Wireless World*, in the 1940's Turing wrote a very significant paper on computing. He showed that with a piece of paper and "scratches" on it, one could simulate almost any mental activity. That is, mechanisation of almost any thought process was possible in principle.

Now Sri Lanka belongs to the South Asian religious traditions which place a strong emphasis on the mind, very much more than the Judaic-Christian tradition. What in your opinion would developments in artificial intelligence have on cultures like ours, which are, say, "mind" centered.

A. C.

I think it will have a strong influence on all cultures. It happened earlier with the Copernican revolution when the earth was dethroned from the centre of the universe, and the Darwinian revolution when man was dethroned from the top of the animal kingdom and just became another animal. And artificial intelligence



is a final stage, when we realise that ours are not the only intelligence possible, and that we may even create our own successors.

point. Getting out to space means that there are no limits.

S. G.

Of course, we should remember that Copernicus and Darwin had a particularly strong impact and were resisted in the Western world because the Western religious system was strongly man centred. In the more philosophical and broader Hindu-Buddhistic world it is somewhat different.

A. C.

Yes. One could also mention China. The Chinese had a correct view of the Universe; that the universe is enormous. But then, the Jesuit priests arrived and talked them out of it.

S. G.

("Bringing what was then called "western learning")

In computers there is a sequence of machine "evolution", which perhaps parallels the biological evolution that has been underway for roughly the last 4,000 million years. There are indications that the machine "evolution" would take place at an accelerating pace, and that one would have an exponential growth of machine intelligence. Would such an exponential growth flatten out?

A. C.

Of course every such growth will eventually flatten out. Then again what happens is that another exponential curve starts at a higher level using different technology, giving a series of such curves.

S. G.

Limits to growth may occur on physical resource based systems, but when you talk of growth of information based phenomena there may not be limits in that sense.

A. C.

Even the limits to growth in energy and material is from an earth based view-

S. G.

Computers seem to be almost a new information processing species which are accelerating its rate of evolution. A new "generation" appears every few years. A large amount of information processing and "mental" phenomena are in the future going to be done by this new "species". This would mean that humans become more and more marginal to the information system. Do you think that a hypothetical film script "2100" would be written by a future HAL in 2050. I mean would you as a science fiction writer become marginal and disposable?

A. C.

Well; science fiction changes its attitudes, its view points, and its objectives. I mean, it would continue.

S. G.

Reading through the science fiction literature, one finds that by and large they had been anthropomorphic, a projection as it were of the man centred view of the world. As a genre science fiction could be considered a historical outcome of the hopes and fears of the 19th and 20th century when human centred scientific progress was rapid. Would 21st century science fiction have to phase itself out and become marginalised, because the information processing, the "thinking" system would no longer be human based?

A. C.

Science fiction would always have been there in some way or another as fantasy or whatever way you may want to call it. No one ever agrees on definitions. It just changes bases. First science fiction was the first voyages out to sea, then you had religious myths and so forth. And the science fiction tradition of the 19th century was superseded by the first flight to the moon. That's all finished now. We are just changing the direction again now. With robots and artificial intelligence especially, more science fiction is written now; but it changes and it is far more realistic and on a much



firmer basis. So I'm surely not worried about science fiction writers being out of job.

S. G.

There is a continuing debate in Artificial Intelligence (AI) circles about whether human consciousness could be programmed and be simulated. Now, discussions on the nature of consciousness, have pervaded philosophy both in the East and the West very early times. Do you feel that such discussion would become irrelevant?

A. C.

Probably. I mean, it might be like many of these ancient debates which turned out finally to be meaningless, and now you forget about them. Like say "angels dancing on the head of a pin". One realises that most, if not all theological discussions are meaningless. Certainly the development of AI is going to have a profound effect on the debate.

S. G.

What would you like to see happen in Sri Lanka in, say, 15 years through the Arthur C. Clarke Centre?

A. C.

Well in 15 years from now it will take us up to nearly 2,001. I would like to see everybody have a communication link.. They also need transportation. But communication is more important than transportation. I would like to see everybody within walking distance of a telephone for emergencies, to call their friends. Well, we have the potential for islandwide television now. We could have good programmes as well. We will then be able to get programmes from all over the world by small satellite receivers. I also expect a good measure of computer literacy in the country and of course literacy of all kinds. I would like to see a completely bilingual nation, is not a trilingual one.

S. G.

Trilinguism, with perhaps computer interphases with which one could talk in Tamil and be understood in Sinhalese?

A. C.

No, I like to see people able to do that without the use of a computer. I do not think that in 15 years we will have computers that could do that. There will be computers that do scientific and technical translations from any language to any other.

But no more than that, I think all children should be brought up speaking two languages; preferably two in entirely different linguistic frames. I mean an Eastern and a Western language.

S. G.

15 years, as you said, would be 2001. This year, however is 1984; and the Orwell industry is big business. Orwell's "1984" has yet not occurred in any developed country, although there are some near examples, such as when in the early seventies the US government monitored every telegram that went out of the country. The fear of dictatorship, is there, I think, today more in the developing world than in the developed. A succession of sometimes brutal dictatorships have taken over in many Latin American, African and Asian countries. How could the computer and the technological revolution effect this tendency towards dictatorship? Do you think it would strengthen the tendency or weaken it?

A. C.

I think it will weaken dictatorship. A wise statesman once said: "A free press can give you hell; but it can save your skin". That is even more true of TV reporting — which, thanks to satellites, will soon be transformed out of all recognition.

Today there are electronic cameras. However, even the electronic cameraman still has to get his cassettes through an obstacle course of postal authorities and customs officials and censors. But not for much longer; very soon he will need only a small collapsible dish, about the size and shape of a beach umbrella and he will be able to beam his pictures upto the nearest satellite, and straight to his country.

Exposures of scandals or political abuses — especially by visiting television teams that go home and make rude documentaries — can be painful, but also very valuable. Many rulers may still have been in power, or even alive, had they known what was really happening in their own country.

A. C.

The implications of the new technology are truly enormous. Just one example: how many soldiers would shoot a cameraman, if they knew that millions of people were watching? And if you think that some countries would not admit TV teams under these conditions — well, as equipment becomes so compact that a single man could carry it, the more difficult would it be to keep him out. And the harder closed societies try, the harder will they have to explain what it is they are so anxious to hide. In the end, they will give up.



## COMPUTER DEVELOPMENT POLICY AND ORGANISATION IN SRI LANKA

In March 1981 the government decided on the setting up of a Computer Centre to service government departments and corporations that need computing. The Ministry of Industries & Scientific Affairs was asked to report on the feasibility of expanding computer capability.

Following this decision the government also asked the UNDP to study the use of computers in Sri Lanka and to make a recommendation for National Computer Policy in Sri Lanka. On these studies and recommendations the President of Sri Lanka requested the Natural Resources Energy and Science Authority (NARESA) to set up the National Computer Policy Committee (COM-POL) in November 1982 to formulate policy guidelines and recommend a practical framework and action programme for implementing such policies. The Committee's April 1983 report was accepted by the government, including its principal recommendation to set up a national level advisory body on computers, functioning directly under the President.

This 10 member Computer and Information Technology Council (CINTEC) will advise the government in formulating, coordinating and implementing policy. CINTEC 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 emphasis will be on promotion, encouragement and coordination, rather than controls and regulation that can stifle initiative in this rapidly progressing field.

The government also gazetted a Bill on 12th January '84 for the setting up of a Computer and Information Technology Council of Sri Lanka. The functions and duties of the Council will be:

- (a) to advise the Minister on
  - (i) the formulation and implementation of a national policy on computer and information technology;
  - (ii) measures to promote, facilitate and assist, the use of and application of computer and information technology in Sri Lanka with a view to improving the quality of life of its people and enabling Sri Lanka to acquire the necessary capability to meet the challenge of technological change;
  - (iii) measures to develop and improve the infrastructural facilities necessary for the introduction of computer and information technology to Sri Lanka;
  - (iv) measures to develop education in computers and information technology in all its aspects;
  - (v) measures to advance the skill and knowledge of persons employed in the computer and information technology industry;
  - (vi) measures to establish professional standards in the computer and information technology industry with particular reference to the integrity of data in computer and information technology installations and the abuse of personal information in such installations;
  - (vii) measures to assess the manpower requirements necessary for the development of the computer and information technology industry in Sri Lanka and the training of such manpower; and
- (b) to promote and conduct research on all aspects of computer and information technology;
- (c) to monitor developments in computer and information technology and to adopt these developments for use in Sri Lanka;
- (d) to collect and disseminate information on computer and information technology and related subjects; and
- (e) to do such other things as may be necessary for the performance and discharge of the duties and functions of the Council and for the development of computer and information technology in Sri Lanka.

According to the Chairman of the National Computer Policy Committee and advisor to H.E. the President "the use of computers in Sri Lanka is in its infancy, both in terms of the number of systems installed and their level of sophistication. However the establishment of CINTEC is based on the conviction that given the support and guidance of the government, and a commitment of resources that will be very modest in terms of our overall national investment programme, the resulting developments in computers and information technology will bring about fundamental improvements in our lifestyles and contribute significantly not only towards material progress but also to sociopolitical development and national cohesiveness".

The new policy in computers has a short-term programme (2 to 3 years) of introducing the use of computers to raise productive efficiency of both private and public sectors. Also there will be a major effort in computer education, encompassing schools, universities, industry and commerce, and the general public.

The medium-term (5 to 10 years) is expected to lead to the development of Sri Lanka as an Asian Service Centre for computerized international banking and trade. Sri Lanka's assets include the attractive economic poli-



cies of the government and stable climate for investment, convenient geographic location, highly educated manpower base, and acceptability among all countries in the region. In this time frame, we also expect the development of more decentralized domestic institutions, to meet the needs of administration, finance, production and exchange of goods and services. 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. Exports of computer software and hardware as well as programmers and analysts provide encouraging prospects. By this time, carefully nurtured centres of excellence will be making significant contributions. CINTEC hopes to play the leading role in coordinating and guiding the sustained and systematic national effort necessary to bring about this scenario.

### National Computer Policy Objectives

The following broad national computer policy objectives were identified in the National Computer Policy Committee's report of April 1983, and subsequently approved by the government.

- (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.

### Policy Guidelines

The following is an initial set of national policy guidelines that CINTEC will revise and update as appropriate in the future on a regular basis:

#### (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 installations 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 Application, Computer Literacy and Appreciation of the Potential of Computers:

The Government should take immediate steps to improve com-

puter 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 Local 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.



## Organisation of the Computer Sector and Policy Implementation;

CINTEC is expected to create a Central Computer Secretariat (CEC-SEC) to service its needs and those of the sector.

The growth and development of several Centres of Excellence, identified in the first instance as, the Arthur Clarke Centre, the Universities of Colombo, Moratuwa and Peradeniya, and the National Institute of Business Management, will be supported. CINTEC also hopes to 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. Such non-governmental bodies will have a key role to play in assisting CINTEC within the decentralized organisation envisaged, especially in areas such as:

- (a) establishing and maintaining a code of conduct for computer professionals;
- (b) maintaining the standards of computer education, among private organisations;
- (c) providing a regular forum for exchanging ideas, and disseminating in Sri Lanka, the latest information on computers; and
- (d) helping to ensure the integrity and security of data in computer installations, and prevent abuse of privacy.

One of the first items on CINTEC's 1984 work programme would be the organizing of several regional/international workshops on the latest applications of computers in science, technology and business. Leading foreign and local experts will lecture and demonstrate; thus enabling a large number of Sri Lankan participants to obtain valuable up-to-date training and skills in these areas. Specific studies concerning the scope of application and impact of computers in different sectors will be initiated. Other organizations will be encouraged to assist in these efforts.

*(Extracted from a paper on "Planning for Future Computer Development in Sri Lanka" by Dr. Mohan Munasinghe, Chairman, National Computer Policy Committee).*

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## THE MINISTRY OF EDUCATION COMPUTERS PROGRAMME MICRO ELECTRONICS EDUCATION PROJECT

*The following are extracts from a paper presented by S.Yogendran, Systems/Software Manager, D M S Electronics Limited on the micro-electronics programme formulated by the Sri Lanka's Ministry of Education.*

Educationists are currently engaged in exploring the impact of innovation in micro-electronics, computers, and communication on children's education in schools and other educational institutions. The implication of those developments for educational planning and curriculum development are profound. Significant changes are taking place in the content and methodology of school education. Children will need different skills for tomorrow than the current generation have today. In order to meet this need and recognising that learning about computers or computer literacy has emerged as a subject in its own right, the Ministry of Education launched a Micro-electronics Education Programme (MEP) in schools.

### Aim

The aim of the programme is to help schools to prepare children for life in a society in which devices and systems based on micro electronics are commonplace and pervasive. These technologies form the basis of the new scientific revolution that is taking place in the developed world.

### Scope of Programme

The programme is concerned with micro electronics application in schools at upper secondary and GCE (AL) courses. In the Sri Lankan context, the initial use of those technologies will come from those who have covered this span of education.

There are two parts in the programme. The first covers the investigation of the most appropriate ways of using the computer as an aid to teaching and learning, as a guide to the individual child, as a learning aid for small groups of children, or as a system which involves the whole class. In principle, software can be developed for computer

based learning across the curriculum, but the programme will give priority to applications in mathematics and the sciences. As the programme develops some attention will also be given to geography, languages, commerce and the humanities, and assist appropriate developments in remedies and special education.

The second part of the programme is concerned with the introduction of new topics in the curriculum, either as separate disciplines or as new elements of existing subjects. The new topics will include;

- \* micro electronics in control technology
- \* computer studies
- \* Computer linked studies, including computer aided design, data logging and data processing
- \* word processing and other "electronic office" techniques
- \* use of the computer as a means of information retrieval from data bases.

### Programme Activities

The programme will cover three main areas;

- 1) Curriculum development
- 2) Teacher training
- 3) Resource organisation and support

The work involved under each of these areas is examined in some detail below.

#### 1) Curriculum Development

New materials for teaching and learning are needed to meet the following needs:



- \* materials which make use of micro computers and other areas based on micro processors to assist with the learning of "traditional" subjects;

- \* materials which support the teaching and learning of the "new topics" previously mentioned.

- \* supporting documentation which will help teachers make the most effective use of the new equipment and its associated curriculum materials.

Such resources may be developed at different levels. National level projects may be undertaken by organisations such as the Sri Lanka Association for the Advancement of Science and the Computer Society. The universities too will undertake projects. The Computer Education Centres referred to below and the individual schools linked to the Centres will develop projects at the local level.

## 2) Teacher Training

Teachers require both information about micro electronics and professional skills to apply the technology effectively in the classroom. The training of teachers, both in service and pre-service must therefore be organised in such a way as to support the curriculum changes envisaged in new topics. Training is required at a number of levels:

- \* courses aimed at improving general awareness and familiarisation are needed for teachers of all kinds.
- \* short specialist familiarisation courses are required for teachers who have been enthused by the awareness courses and for those wishing to modify their subject teaching to include new topics, for example, teachers of commerce requiring knowledge of word processing and biology teachers requiring knowledge of data logging.

- \* longer specialist courses aimed at teachers requiring additional training in particular fields.

Examples would include science teachers wishing to expand their knowledge of electronics; and teachers wishing to acquire the skills needed to develop computer based learning materials.

- \* for these courses to be effective, resources also need to be devoted to the training of trainers and to the refresher courses.

## 3) Resources Organisation and Support

Access to information, materials for teaching and learning, and advice, are important for teachers and their work in schools. Knowledge about technological developments and about the range of supplementary materials which are available must be made as accessible as possible and they should be able, so far as is practicable, to explore and experiment with equipment and materials with a minimum of difficulty.

The Education Ministry envisages, the following groups organised centrally to support the Microelectronics Education Programme.

### Pilot Project

The first phase of the project is a pilot project in about 110 schools which will be equipped with micro computers. Individual schools will be linked to the pilot centres. Each pilot centre will be responsible for:

- \* dissemination of information
- \* inservice training of teachers, and
- \* development of material for teaching and learning.

### Training Centres

Colombo Educational District

- \* Ananda College
- \* Royal College
- \* Devi Balika M.V.
- \* Anula Vidyalaya, Nugegoda

Kandy Educational District

- \* Girls' High School, Kandy

Gampaha Educational District

- \* Sapugaskanda M.M.V.

### Supporting Institutions and Consultants

- \* University of Colombo - Computer Centre
- \* DMS Electronics Limited
- \* Moratuwa University - Faculty of Engineering
- \* Peradeniya University - Faculty of Engineering.

### Achievements to Date

- \* 05 teachers and 05 officers from the Ministry of Education and the Curriculum Centre have been trained to be in charge of the Training Centres.

- \* 55 teachers have been trained at the Royal College Centre and the Ananda College Centre. They are from 50 schools from 13 Educational Regions. A few teachers, depending on their performance, will be selected from this course as trainers to train the second and third batch of teachers.

- \* The training of the second batch of 55 teachers was completed at the Kandy Girls' High School and the Sapugaskanda M.M.V. Centres.

- \* The training of the third batch of teachers commenced in November 1983 at Devi



Balika and Anula B.M.V. Centres and was successfully completed in December 1983.

- \* Computers were supplied to 110 schools last year. At least one teacher from each school was trained.

### Plans for the Future

- \* Teaching of computer awareness at school level will be started at the above 110 schools from January 1984. Initially, this awareness will be given to A/L Science Students

- \* This programme will be conducted as a pilot project until 1985. The project staff will conduct a feasibility study at the pilot stage regarding the use of these computers as a teaching aid at school level in Science, Mathematics, Commerce and Social Science subjects.

- \* A glossary of computer terms and a syllabus are being prepared. All those documents will be distributed among schools by end January 1984.

- \* All the Training Centres will be used for training of teachers Students Residential Courses and Seminars will be conducted during week ends and school vacations specially for students and teachers in distant areas of these training centres.

### TRAINING — PRIVATE SECTOR

Apart from the courses of study and training being introduced at the Universities and Schools, there are a wide variety of private institutions providing programming languages and basic computing courses to small children (9+), school leavers, unemployed graduates and allied professionals. There are at least 25 of these private institutions which advertise their services regularly in the press. Some of these firms are listed in the table below:

1. Data Serve Ltd.
2. Colombo Polytechnic.

3. Data Processing Aides.
4. Institute of Computer Studies (Bartleet Electronics).
5. Institute of Computer Studies.
6. Ladies' College.
7. Metro Lanka.
8. National Institute of Business Management.
9. Professional & Business Consultants.
10. Rainford Computers Limited.
11. Stafford Institute of Higher Education.
12. Wetherby Training Institute.

### TELECOMMUNICATIONS

Efficient telecommunications facilities are an essential part of basic infrastructure that is required to support the Government's development programme, and also more important for connecting and maintaining in operation remote terminals to computers in the Colombo area. It is for reasons such as this that the Government gave priority for implementation of its Telecommunication Plans for modernising and expanding the telecommunication network

It has been found that introduction of a computer terminal for the Government was not feasible due to telecommunication difficulties, particularly the cable connections were wholly inadequate. This short coming is now being remedied with the new Telecommunications Development Programme.

The plans of the Department of Telecommunications fall into the categories of:

- (a) Rural Sri Lanka; and
- (b) Colombo Area (sub-divided into exchange and cables).

For Rural Sri Lanka the plan is to :

- (a) Provide in 28 districts modern Stored Program Control Public Branch Exchanges (SPC-PBX); of these 4 have already been completed, work on another 15 is in hand, and planning for a further 2 has commenced, with that on the balance 7 to start shortly;
- (b) establish 14 District Switching Centres with microwave communication facilities;

For the Colombo Area Exchange the plan is to:

- (a) complete by end 1984 the installation of Stored Program Control Public Branch Exchanges (SPC-PBX);
- (b) increase thereby the availability of direct-dialling (currently the Colombo Central Exchange serves 14,000 subscribers and has to cope manually with 2 million calls daily thus causing delays and cross-connections; it has been in service for the last 15 years and uses old out-of-date technology);
- (c) finance these projects from funds provided by the World Bank/IDA (US\$ 35 million) and the Sri Lanka Government U.S.\$ 10 million), using technical advice from Swiss consultants as required by the World Bank.

This US\$ 35 million project, which is funded by the International Development Association, provides for the following:

- (a) Expansion of the subscriber network,
- (b) Replacement of electro mechanical exchanges by SPC/Digital exchanges,
- (c) Improvement of underground cable networks,
- (d) Provision of new services to rural areas and,
- (e) Computerisation of telephone and telex billing services.

This project is presently underway in the many different areas including the installation and commissioning of a computerised telephone and telex billing system. BC Computers Ltd. was awarded the contract for this aspect of the project and work is presently underway. The contract is on a turnkey basis and will be implemented over an eighteen-month period.

*Toward a National Computer Programme Distribution; "Report of the UNDP/ILO Study Team" and Paper presented by Sunil Wijesinghe, Managing Director, BC Computers Limited.*



## EXPORT CAPABILITY AND ASSOCIATED PROBLEMS

From a paper on "THE EXPORT OF COMPUTER SOFTWARE" by Dr. Maya Sittampalam Rainford, Managing Director, A-Z Computer Services Ltd.

The major problem associated with indigenous software development capability remains the lack of growth of the supporting infrastructure of the computer user base in SL. This is, in effect, a chicken-and-egg situation—development of the infrastructure would, in turn, fuel indigenous capability, setting up a positive feedback effect, each urging the other onwards.

The problems may briefly be set out as follows:

- (1) The lack of advice from 'above'—potential buyers taking the initial step towards computerisation have to rely on hearsay evidence, on computer salesman, on newly-promoted programmers into advisory positions or on under-experienced systems consultants. Thus greater priority is given to hardware identification, even by 'software consultants', than on a machine-independent assessment of the system solution. This lack could well be dissipated by an active National Computer Policy Committee, capable of deploying personnel to give expert advice on acquisition and usage of computing equipment.

### CONSULTANTS, SOFTWARE HOUSES, SERVICE BUREAUX

There are also several specialised consultants, software bureaux and servicing agencies. Some of them are listed in the table below:

1. Associated Management Services.
2. A-Z Computer Services Limited.
3. Bank of Ceylon Merchant Banking & Management Consultancy Division.
4. Chemanex Limited.
5. Computer Management Services Limited.
6. Computer Systems Consultants.
7. Computer Systems Limited.
8. Management Services Limited.

Source: *Toward a National Computer Policy in Sri Lanka*  
*Report of the UNDP/ILO*  
*Study team 1982.*

- (ii) The tendency, as in most developing countries, to make experts out of returning Computer Science graduates, computer salesman, semi-experienced computing professionals, other disciplinary personnel who have undergone brief computer courses or exposure to computing environments or external consultants with little or no checking up as to the suitability or otherwise of their prior fields of expertise.

- (iii) The clinging to the traditional concepts of promotion within an organisation such that programmers with barely two years of on-the-job programming experience can, before becoming masters of their own craft, find themselves entirely at sea in an analysis, design, project management or dp-management post. The concept of adequate training, whether initial or on-the-job, is highly important in an environment with a scarcity of trained manpower. Compromise on the quality required, either through time, inadequacy or knowledge-inadequacy, can only lead to long term degradation of the total situation. The entry of the microcomputer has only accentuated the problem, the cottage-industry approach to software being encouraged with hobbyists and small, hastily set-up programming teams dictating on micro acquisition and usage.

The recognition of software as a specialist science requiring a high level of expertise in order to develop the complex, integrated systems required in the

developed nations and using complex environmental software must emerge before we are able to develop a viable software industry for local usage as well as export. This means relinquishing the idea that quality software can be produced by one or two programmers working for a period of weeks on cheap equipment employing unsophisticated systems software.

SL cannot possibly hope to compete in the retail sector of microprocessor based software which is cottage-industry based, fiercely competitive and already well provided for by an army of highly experienced and competent systems programmers. Our hope lies in advanced software products requiring many years of man effort, for it is in the development of labour intensive

systems that we can be sufficiently competitive to emerge victorious. This means heavy concentration on the following:

- (1) Software products for minis and main frames in specialist applications;
- (ii) systems software products for interaction in sophisticated real time environments
- (iii) specialist products employing novel software techniques for use as development aids, control systems, interfaces etc.

The key lies in the clever deployment of manpower. The controlling and usage of this vital resource will be the basis of our future as a software exporter.

### COMPUTERS IN SRI LANKA

Nearly 30 makes/manufacturers of computers have now entered the country and are competing keenly for what is forecast to be a booming market in the years ahead. Among them are:

- |                        |                |
|------------------------|----------------|
| 1. APPLE               | 14. ICL        |
| 2. ACORN               | 15. KIENZLE    |
| 3. AQUARIUS            | 16. MULTITECH  |
| 4. BBC                 | 17. NEC        |
| 5. BROTHER             | 18. NIXDORF    |
| 6. BURROUGHS           | 19. OLIVETTI   |
| 7. CANNON              | 20. RADIOSHACK |
| 8. COMMODORE           | 21. SHARP      |
| 9. CONSOLE ELECTRONICS | 22. SINCLAIR   |
| 10. CASIO              | 23. SOLA       |
| 11. DATA GENERAL       | 24. SYSTIME    |
| 12. HEWLETT PACKARD    | 25. TOSHIBA    |
| 13. IBM                | 26. WANG       |



# ECONOMY

## SRI LANKA'S STAND-BY ARRANGEMENT WITH THE IMF

The activities of the IMF have rarely escaped comment, much of it critical, ever since the Fund was set up in December 1945. A body of opinion gaining ground is that its policies of recent years are 'in violation of the Fund's Articles of Agreement which enjoin upon it the adoption of policies to maintain high levels of employment, income and economic development as the primary objective of economic policy'. The terms of its assistance to Sri Lanka in 1982 and 1983 (from its official statements listed below) may be put to test in the light of such criticism.

In mid September 1983 the International Monetary Fund approved a stand-by arrangement authorising Sri Lanka to obtain financial assistance from the IMF up to the equivalent of SDR 100 million (approx. Rs.2,598 million) till July 31, 1984 in support of the Government's economic and financial programme. Under the arrangement, this drawing, equivalent to 56.02 percent of Sri Lanka's quota of SDR 178.5 million (approx. Rs.4,637 million), will be financed in part from the Fund's ordinary resources SDR 43 million or (approx. Rs.1,117 million) and in part from resources borrowed by the Fund (SDR 57 million or approx. Rs.1,481 million).

From the end of 1977, Sri Lanka introduced extensive economic reforms which were intended to stabilize the economy, improve infrastructure, stimulate growth of output, and increase employment. According to the IMF, in many respects these policies were successful. Investment revived and a rate of growth of close to 6 percent a year could be maintained on average. Since 1980, however, under the combined impact,

of a sharp deterioration in the terms of trade and accommodating financial policies, the pressures on prices and the balance of payments increased. In particular, the current account deficit of the balance of payments rose from 5.5 percent of gross domestic product (GDP) in 1978 to a level averaging 16 percent of GDP in the three year period 1980-82. Substantial borrowing abroad on commercial terms was under-taken and by early 1983, Sri Lanka's external debt service had risen significantly while reserves were declining.

The main objectives of the programme, which the present stand-by arrangement supports, were to reduce the current account deficit of the balance of payments to 12 percent of GDP in 1983 and to about 10 percent in 1984; to maintain a high rate of economic growth; and to contain the rate of inflation to 13 percent annually, on average, in 1983 and further to 8 percent by mid 1984. For this purpose, the overall and bank-financed budget deficits for 1983 were reduced substantially, tighter credit policies applied, substantial adjustments have been made in the administered prices of several goods and services, and flexibility in exchange rate policy is being implemented. Moreover, progress is being made in solving some of the more fundamental structural weaknesses.

Sri Lanka's outstanding financial obligations to the Fund resulting from past operations and transactions, excluding Trust Fund Loans, currently total the equivalent of SDR 302.7 million (approx. Rs.7,884 million).

Receipt of IMF funds between 1977 and 1982 amounted to Rs1,197 million. The Central Bank's records

of net receipts of foreign assistance in the years 1977-1982, show IMF drawings as follows:

Year	Rs.Million
-----	-----
1977	—
1978	789.2
1979	599.3
1980	520.6
1981	8.2
1982	—
	-----
	1,917.3
	-----

Sri Lanka's previous IMF drawing was on the Compensatory Financing Facility in August 1982. The Fund approved a purchase equivalent to SDR 39.2 million by the Government of Sri Lanka under the compensatory financing facility. This drawing compensated for a shortfall in Sri Lanka's export earnings experienced during the 12-month period ending July 1982.

During the shortfall year, Sri Lanka's export earnings from tea, fell by SDR 13 million, and from rubber by SDR 15 million, from medium-term trends; and together, these two commodities were accounting for about half of Sri Lanka's export receipts. The shortfall was mainly the result of a drought which lasted from late 1981 through the first quarter of 1982, lowering the production of both commodities and the quality of tea exports. In addition, weakening world demand contributed to lower prices for rubber and to a moderation in the rate of growth of receipt from other exports.

Sri Lanka's quota in the Fund is SDR 178.5 million, and its outstanding financial obligations to the Fund at that time resulting from past operations and transactions, excluding Trust Fund Loans, totalled equivalent of SDR 325.0 million.

C. G.  
19



# COMMODITIES

## COCONUT

### Production Falls and Prices Soar

Prices of both coconut oil and copra in the local market climbed almost 200 percent during the 12 months of 1983. Coconut oil prices

were up from Rs 9,700 a metric ton in January to Rs 25,842 by November 1983. (By February 1984 the wholesale price in Colombo was Rs 40,000 per metric ton). The price of coconut oil in November

1982 stood at Rs 9,500 per metric ton. The price of copra recorded an equally rapid increase to Rs.635 per 100 kgs. from January to Rs.1,631 per 100 kgs. in November 1983. The price of copra in November 1982 stood at Rs 569 per 100 kgs. The local market price of desiccated coconut also recorded noteworthy increases with the transacted price of DC moving up from Rs 9.75 per kg. in January to Rs 24.64 per kg.

### EXPORTS OF COCONUT PRODUCTS JANUARY-NOVEMBER 1983/82

Product	Jan-Nov 1982	Volume (metric tons)			Value (Rs. Million)		
		Jan-Nov. 1983	Percent Change	Jan.-Nov. 1982	Jan-Nov. 1983	Percent Change	
1. Coconut Oil	36,286	32,716	- 10	367.42	439.98	+ 20	
2. D.C.	38,869	39,817	+ 2	548.49	871.37	+ 59	
3. Copra	3,591	3,951	+ 12	52.27	66.54	+ 27	
4. Fresh Nuts	7,105,802	5,696,275	- 10	23.85	20.80	- 12	
5. Coconut Poonac (By Products)	23,350	-	-	63.82	-	-	
6. Sub-Total Kernel Products	577.55	555.86 (Mil. Nut Equiv )	- 4	1,055.65	1,398.69	+ 32	
7. Mattress Fibre	37,835	37,120	- 1	115.83	120.27	+ 04	
8. Bristle Fibre	8,659	7,511	- 14	94.03	88.76	- 06	
9. Twisted Fibre	26,286	27,056	+ 3	136.77	145.48	+ 006	
10. Coir Yarn	1,094	1,233	+ 13	11.38	12.38	+ 09	
11. Coir Twine	1,005	1,075	+ 7	17.98	19.64	+ 09	
12. Sub-Total Fibre Products	74,979	73,995	- 1	375.99	386.53	+ 03	
13. Coconut Shell Charcoal	26,492	29,610	+ 12	58.49	66.48	+ 14	
14. Coconut Shell Flour	153	373	+ 144	0.52	1.24	+ 138	
15. Coconut Shells	938	1,215	+ 29	1.24	2.24	+ 81	
16. Coconut Shell	815	1,429	+ 75	16.69	32.53	+ 95	
17. Sub-Total Shell Products	28,398	32,627	+ 15	76.94	102.49	+ 33	
18. Coconut Ekels	6,253	9,937	+ 59	13.45	22.69	+ 69	
19. Finished Products (Fibre)							
(a) Pcs	14,305,582	18,076,580	+ 26	26.81	40.91	+ 52	
(b) Sqm.	54,497	41,637	- 24	6.68	4.95	- 26	
20. Other By-Products							
(a) Rafters (L.ft)	303,561	431,607	+ 42	1.43	1.82	- 26	
(b) Seedlings (Nos)	3,500	112	- 97	0.16	0.01	- 93	
(c) King Coconuts (Nos)	13,165	3,014	- 77	0.14	0.06	- 57	
(d) Seed Nuts (Nuts)	-	53,761	-	-	0.71	-	
(e) Fibre Dust (kgs)	9,900	147,700	+1312	0.01	0.99	+9800	
(f) Ekel Brooms (MT)	675	-	-	0.01	-	-	
21. Sub-Total Non-Kernel Products	-	-	-	501.61	560.96	+ 12	
22. Total Value of All Products	-	-	-	1,557.26	1,959.65	+ 26	

Source: Coconut Development Authority



in November 1983. In November 1982 prices stood at Rs 8.75 per kg.

The prices of copra, coconut oil and desiccated coconut in the international market also recorded increases though not as much as in the local market. Sri Lanka's desiccated coconut was quoted CIF UK at US \$805 per metric ton in January and US \$1,436 per metric ton by November 1982. The price in November 1982 was US \$734 per metric ton. International coconut oil prices (CIF Europe) which were US \$435 per metric ton in January reached US \$884 metric ton by November 1983. The price in November 1982 was US \$416 per metric ton.

These dramatic price increases were the result of shortfalls in production by international suppliers and in the rapid upward trend in all vegetable oils and fats in international markets. Malaysian palm oil, soya bean, sunflower and rape seed oil all registered impressive price gains during 1983. Local coconut production affected by severe drought and lack of fertilizer in 1982/83 resulted in heavy production shortfalls. In 1983 coconut production was almost 100 million nuts below that of 1982. Production is estimated to have dropped by nearly 10 percent in 1983 to 2,270 million nuts from 2,521 million nuts in 1982. Coconut oil production also registered a heavy shortfall of almost 24 percent; from 102,485 million nuts in 1982 to 78,189 million tons in 1983. The fall in desiccated coconut production was not as sharp, coming down from 42,096 million tons in 1983 to 40,653 million tons in 1983.

These production trends also resulted in a drop in the volume of exports from 576 million tons in January—November 1982 to 556 million tons in January—November 1983. The lack of supplies deprived Sri Lanka of

taking advantage of the rising prices in international markets. However, despite the smaller quantities or volume of kernal products exported earnings, increased by as much as 32 percent from Rs. 1,056 in January—November 1982 to Rs. 1,309 in January—November 1983. The volume of exports of Desiccated Coconut and Copra showed a small increase while Coconut Oil and Fresh Nuts exports came down by as much as 10 percent in 1983.

Leading buyers of Sri Lanka's coconut oil in 1982 such as the United Kingdom, India, and China who together purchased nearly 15,000 metric tons or over 40 percent of exports in 1982 obtained no supplies at all in 1983. The US, Italy and Holland, however, made big increases in their purchases during 1983.

Total earnings for all coconut products for the first 11 months of the year was 26 percent more than in 1982. Details are given in the table

#### International Markets

The shortage in the supply situation has kept pushing up prices of vegetable oils to unprecedented levels and has compelled India to seek supplies from abroad to meet its enormous domestic market. India's Commerce Minister recently announced government plans to import 150,000 tonnes of edible oil every month until prices stabilise. Of this coconut oil will account for 1,000 tonnes; the other oil to be imported being soya bean and palm oil. Sri Lanka exported 12,836 metric tonnes of coconut oil to India in 1982 and supplies ceased thereafter, but are now expected to resume again in 1984.

Meanwhile, both Philippines and Malaysia the world's largest producers and exporters of coconut oil and palm oil, respectively, are experiencing an unexpected boom in their export earnings. According to recent reports palm oil which sold at \$310 a tonne

at the end of January 1983 was fetching \$1,065 at the same time in 1984. Malaysia's additional earnings are expected to top a billion Malaysian dollars (US\$435 million).

In the Philippines too both coconut oil and copra had recorded a new high in prices. Indonesia which also produces substantial quantities of both coconut oil and palm oil are expected to reap windfall profits.

The cause for the new price hike is the low production resulting from unfavourable weather last year, which affected most Asian producers, including Sri Lanka. Stocks continued to be run down while demand was increasing. A further cause for high prices was the poor soya bean harvest in much of the US and cottonseed crop failures in other parts of the world, including South East Asia.

Among the other apparent reasons for the worldwide shortage of vegetable oils is that both India and Pakistan have been moving away from animal tallow as a major ingredient in household cooking. The agitation that broke out in India last year when it was discovered that a mainly Hindu country was importing beef tallow has pushed India's demand for imported vegetable oils to one million tonnes in 1984, from a mere 100,000 tons in 1975. The bulk of India's exports are expected to be Malaysian palm oil.

Pakistan too is expected to increase its imports of edible oils from 550,000 tonnes in 1983 to 650,000 tonnes in 1984; the bulk of which is likely to be Malaysian palm oil and US soya bean oil. Meanwhile, Philippines coconut oil production which was down 6.5% in 1983 is expected to drop a further 5-10% in 1984.



# FOREIGN NEWS REVIEW

## NIGERIAN HOPES "DASHED"

The largest number of Sri Lankans employed in Africa, South of the Sahara, are in Nigeria. The employment of Sri Lankans especially of professionals such as accountants and engineers, pre dated the Nigerian oil boom. Since the oil boom, university academics and a large number of school teachers found jobs in the then expanding economy. In addition some of the professionals such as engineers, who went to Nigeria almost two decades ago moved into business and launched relatively large construction companies, engaged in civil engineering contracts like building roads and dams. (Some of the Sri Lankan firms had even their own private planes).

The current economic crisis in Nigeria has left many of the Sri Lankans of both these categories — professional and business — with a sense of acute uncertainty. Some of the major firms have had severe debt problems because official contracting agencies have not paid their bills, whilst teachers in certain states have not been paid — sometimes upto six months. These, were not acts of discrimination against Sri Lankan persons, but part of the general reality (affecting everyone) that prevails in today's Nigeria. It is with this background of a country, only a shortwhile ago awash with oil money and now in the throes of a severe economic crisis, that one has to view the coup that took place on the 29th of December.

With roughly 83 million people, Nigeria is the most populated country in Africa, one out of every four black Africans being Nigerians. Its population belongs primarily to four ethnic groups (tribes) the Hausas and the Fulani in the North and the Yoruba and the Ibo in the South. North of Nigeria is predominantly Muslim,

whilst the South is predominantly Christian, but the major religious group among Nigerians (47%) as a whole is Muslim. These ethnic differences have had a bearing on some of the country's socio-economic problems. (Thus the Biafran War over a decade ago was an unsuccessful secessionist war by the Ibos and arose from the economic fact of having been favoured by the British).

Before the oil boom, the economy rested largely on agricultural products and among its principal exports was cocoa. The sudden oil riches changed this dramatically. During the oil boom cocoa plantations were run down and almost all the national income was now obtained through oil. The oil revenues suddenly generated a get-rich-quick-mentality both in the nation as a whole and in segments of the population. In 1981 approximately 80 per cent of Nigerian operating revenue and 90 per cent of export revenues came from oil.

Oil rich countries in the Middle East were also subject to a similar mentality and went on a buying spree that was often tainted with corruption and massive waste. Yet what was purchased in the Middle East has by and large "worked" for these states. Thus, many Middle East countries have some of the most upto date and reliable communication systems, power supplies, sewerage and water supply stems. The contrary has happened in Nigeria. The buying spree was accompanied by not only massive corruption but also gross mismanagement. The power supply in almost every city in Nigeria is sometimes interrupted several times a day. A similar pattern exists also in the water supply, sewerage and telecommunication systems. Clearly even the physical infrastructure had not established itself and was in decay amidst massive riches.

Corruption was rampant. It extended right from the top (with perhaps Prime Minister Shagari innocent). Collections by key politicians by way of bribes amounted to thousands of million naira. (1 Naira = ₦1) At the petty level, on the other hand, policemen would set up road blocks to collect money whilst certain officials would openly solicit "tips". "Dash" — the Nigerian tip — had become very large and a way of life. Shortly before the coup 500 million naira worth of import licences granted to ease shortages created by the fall in income from oil had found their way into the hands of wayward officials. Other examples of gross corruption abound. One of the high officials of the party in power that was deposed, celebrated the depositing of his one billion naira in his deposit account by throwing a party on the occasion and televising it. The national revenue of Nigeria was only 9 billion naira. So brazen had corruption become that flaunting it became also a norm.

Inflation had been accelerating very fast during the months prior to the coup, with the prices of many essential items rising by 200 or 300 percent. Hoarding of household items like soap and washing powder led to artificial scarcities. Figures for unemployment are not available, but indications suggest that it had been rising very rapidly. Because of severe import restrictions after the collapse of the oil boom, factories were operating without adequate raw materials, some were even closing down. International and national contracts had not been honoured by both Central government and state level agencies. Several firms had folded up because many states and the Central government had not honoured debts. Several tens of thousand state sector employees, including teachers, had also not been paid for periods of upto ten months.

Major General Mohammed Buhari took power in an almost courteous



coup on Sunday 31st December. In his first broadcast Buhari drew attention to "the grave economic predicament and uncertainty which an inept and corrupt leadership had imposed" on Nigeria. He noted that the economy had been hopelessly mismanaged. Nigeria had become a debtor and beggar nation ..... inadequacy of food at reasonable prices existed, health services were in shambles where hospitals were "reduced to mere consulting clinics without drugs, water or equipment".

All reports indicate that most Nigerians have enthusiastically welcomed the coup. This was in spite of the earlier regime apparently being a "democratic" one. In fact it had an election only a few months before the coup. It is now widely believed by both Nigerians, as well as by foreign observers that the last election had been rigged. In fact the intelligentsia had been complaining about this during the preceding months and also about the blatant greed for power and corruption that characterised the previous Shagari regime.

Easy money and a rampant patronage system helped fritter away the oil money. At the height of the boom Nigeria was producing nearly \$ 26 billion worth of oil a year. By 1983 the oil revenue had dropped to roughly \$ 10 billion a year and its foreign debt was estimated at \$ 15 billion.

In store for Nigeria now is bitter economic medicine. A devaluation is probably round the corner. The new leaders have announced that they would honour international debts. They also would not take a possible easy way out by leaving OPEC and selling their oil at a cut price. International observers now allow three years of austerity before the economy is put back into order.

The new leader has an image of being uncorrupt and austere. But the previous military regime,

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## RISE AND FALL OF THE LOOTOCRACY

Chinweizu

*The events surrounding the fall of President Shehu Shagari's civilian government in the first week of 1984 are revealed in this on the spot report from Chinweizu for SOUTH.*

With the sharp drop in Nigeria's oil earnings which began in 1982, its import — all — importables economy began to suffer from acute shortages of everything, from food to spare parts to industrial raw materials. Prices soared, factories shut down, and workers were laid off in droves to swell the already huge ranks of the unemployed. But the government did nothing much, and was seen to do nothing much, to cure the crisis it insisted was caused entirely by the world oil glut. All it felt able to do was to set up presidential task forces to import rice, flour, tyres, sugar and other essential commodities. Meanwhile highlevel, wholesale looting of the impoverished national treasury continued unabated. In fact, the various task forces were designed to help the ruling party and its chief agents in their habitual plunder of the nation.

Party chieftains or their agents were given licences and government funds to import goods. They did

that reigned for 13 years, had also its share of corruption. Many downtown Lagos businesses are owned by ex-military personnel. Corruption however, was not so brazen then as under the civilian "democracy". The weeks following the coup, the authorities were exposing several scandals and were attempting to clean the Augean stables. However, some key suspects mysteriously disappeared from detention and reappeared in London. Nigerian newspapers (which are by Sri Lankan standards surprisingly free) have been campaign-

ing against corruption. Some have also carried stern articles warning the new leader of the pitfalls ahead.

When the public complained of hunger, Umaru Dikko, the strongman in the cabinet, retorted that things were not that bad since the people were not yet eating off rubbish heaps.

The NPN also undertook to subvert the political system in order to entrench itself. To accomplish what was no less than an electoral coup in August, it bent to its will every organ of the state which was supposed to arbitrate the contest impartially. The state-owned media were turned into organs of party propaganda; the Federal Electoral Commission, Fedeco, which was supposed to organise and conduct the elections impartially, was used to rig them. The police force was



### 2.8 Billion Naira (not) Stolen

It is criminal to steal five naira,  
It is daring to rob a bank,  
And a mark of greatness to loot the nation.  
The blame decreases as the guilt increases.

Postcard circulating in pre-coup Nigeria

ning against corruption. Some have also carried stern articles warning the new leader of the pitfalls ahead.

It could prove in the final analysis that the Nigerian military would perhaps only be marginally less corrupt than those whom they threw out. However, one thing the military could not be accused of, is that greatest civil corruption of all, namely, pretending to be a democracy whilst the actual reality of the everyday Nigerian was a far cry from being democratic.



turned into a partisan outfit to intimidate the opposition and protect the vote-riggers.

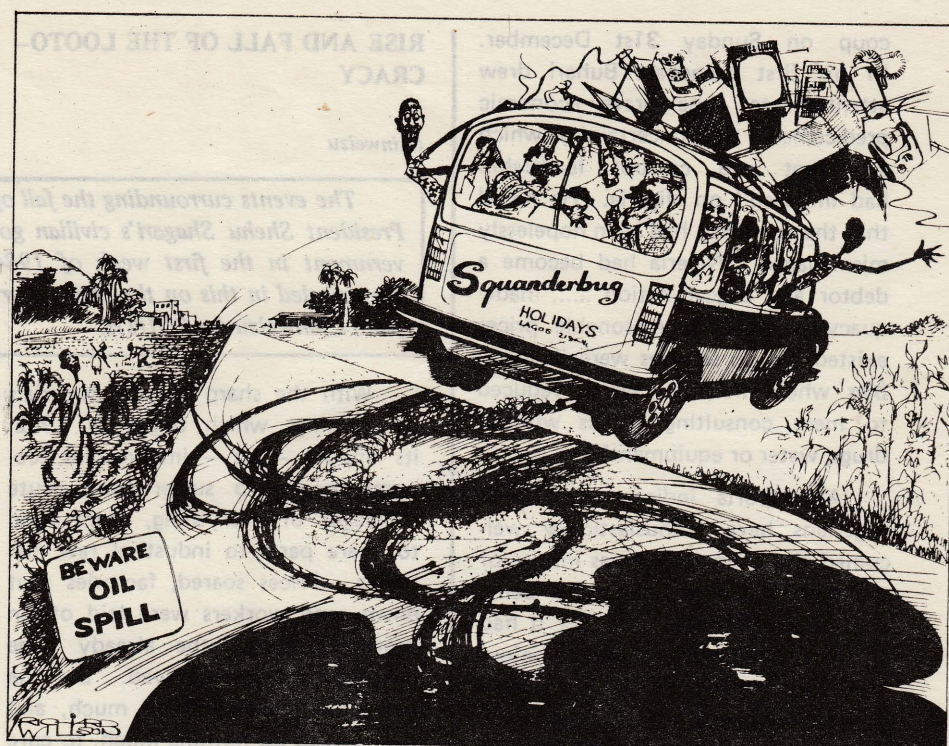
By the end of the election, there was a widespread feeling among Nigerians that they had been robbed of their right to electoral choice.

Despite claims that food was plentiful, shortages worsened and the public suffered a fresh burst of price explosions. In the last six weeks of 1983, prices rose between 15 and 100 per cent for various essential items. Shortages of tyres, spare parts and lubricants nearly crippled transport.

The brazen looting of the treasury continued. High-level scandals involving millions of naira, and implicating the executive and the legislative branches of government, continued to emerge. Despite Shagari's new "tough-look" and his pledges to deal with corruption all the nation was offered was yet another anti-corruption agency, a full-fledged Ministry of National Guidance, which would join the ranks of such toothless watchdogs as the Code of Conduct Bureau and countless commissions of inquiry. In other words, more cosmetics and shadow boxing.

Then came the 1984 budget, which Shagari presented on 29 December 1983. In a season of national austerity, the budget projected a deficit of US \$ 1.65 billion to be financed by incurring domestic and foreign debt. At a time when the public was alert to dangers to political independence and economic health from an existing foreign debt of over US \$ 15 billion, this budget rang alarm bells. A full US \$ 2.25 billion out of the total foreign exchange earnings of US \$ 6.38 billion would be used to service existing debts, leaving only about US \$ 3.75 billion for essential imports.

The taint of squandermania and insensitivity to public suffering finally touched Shagari himself. Just before



presenting his budget, he had obtained from the legislature a contingency fund of US \$ 210 million, for which he was not accountable. Many saw that as simply putting scarce public funds straight into Shagari's pocket. To make matters worse, the President acquired a US \$ 37.55 million luxury jet to add to a fleet of presidential aircraft. The illusion that Shagari was a Mr. Clean, surrounded by corrupt advisers, was finally shattered.

Having buried the party's rivals in the landslide, NPW chairman Akinloye boasted there were only two parties left in Nigeria; the NPN and the military. To counter any military threat to its power, the NPN continued its already advanced and unconstitutional moves to convert the police into a private political army. On the excuse of quelling civil unrest during and after the elections, the anti-riot section of the police (whose excesses had earned it the nickname "kill and go") was equipped with military hardware, including armoured vehicles and assault rifles, and was turned into an elite commando unit.

As it felt its muscles expanding, the police began to confront the armed forces. In Calabar, there was a violent public feud between navy and police. In Lagos, street clashes between military and police were becoming frequent. In the upper echelons of the army, disquiet over police militarisation grew. This explains why on the day of the coup, the military publicly disarmed and scattered the "kill and goes", and why a soldier triumphantly declared: "We the soldiers, the husbands of the police, have taken over".

What were the high-flying power-horses of the NPN doing when the coup halted their act so abruptly? One senator who allegedly sold senate committee chairmanships for a million naira each in order to build up his campaign fund for the 1987 presidential elections, fled the country 24 hours before the coup, and is now a wanted man. Another would-be president, having recently celebrated making his first billion, was planning a grand New Year's party for which



22 cows had been rounded up for slaughter and where countless guests would gather in a show of conspicuous consumption that his wife hoped would live forever in the public memory. But on the morning of the coup, the billionaire had other things on his mind. By the time the soldiers came for him, he had fled, leaving two slaughtered cows to the flies, and granting an inadvertent reprieve to 20 which had not been led to the butcher's knife.

Other NPN chieftains spent the Christmas season buying private jets — that ultimate symbol of the Nigeria lootocrat; or consolidating deals which would make them billionaires. Perhaps the most dramatic crash landing of high flying ambition and power was suffered by Uba Ahmed, the powerful secretary of the NPN.

While the coup was in progress on the ground, Ahmed was returning from London on a Nigeria Airways flight. His trip had taken him to Japan, where he negotiated a sole agency in Nigeria for various Japanese companies, and to Europe, where he ordered his private jet. The flight was denied permission to land in Lagos, and told to fly to a neighbouring country. The pilot relayed this to his passengers, adding that there had been a coup in Nigeria, "Impossible; said Uba Ahmed. He instructed the pilot to inform the control tower that there was a VIP on board who had to land. Learning that this was none other than the secretary of the NPN, the controllers gave the plane permission to land. When Uba Ahmed met soldiers welcoming him instead of his usual police escort, he lost his nerve, collapsed into their arms, and was taken into custody: it was quite symbolic of how the NPN, with heedless arrogance, had landed the Second Republic in the arms of the Military.

SOUTH, February, 1984.

# AGRICULTURE

## MARKETING INFORMATION — HOW FAR DOES IT HELP THE SMALL FARMER

Specialists from various institutions met recently to discuss marketing of farm produce, with special reference to the small farmer and providing him with the necessary information for more effective marketing. Among the different views at this discussion was the point that feeding the small farmer price and market information will not help his marketing very much since there are other factors that dominate his efforts. The researcher who stated this view further attributed a major part of the problems in marketing of agricultural produce by small farmers in Sri Lanka to the dominance of the marketing system by private traders or "middlemen"; and also the faulty gathering of information on prices and markets by officials. A People's Bank Research Department study has shown that sources of information for the small farmers are uncertain, because of the role of private readers in these agricultural areas.

A study conducted in the Mahaweli Settlement H1 area revealed that about 90 percent of the traders in 1978 and 64 percent of them in 1982 were obtaining their inputs and consumer items on a credit basis. Average credit sales per day were higher than the cash sales, particularly during the off-seasons. This credit transaction was used by the traders not only, as a means of intergrating into the settlement but also as a means of purchasing farmers' produce at a low price when they had to settle their debts. Therefore, credit sales play a dominant role in the operation of the price mechanism and trade structure in these areas. The records of day to day credit sales are often maintained by the traders and the settlers rely on these records not only due to their lack of education but also due to their obligations and dependent position as debtors. Secondly, the trader who sells small quantities of a farmer's daily requirements on credit charges higher prices. (for instance when a quarter bottle of Kerosene or Coconut oil is sold on credit, the price was 50 percent higher than for a cash purchase.) A settler who buys on credit however, has to settle those debts in kind at the time of harvest. When purchasing of farmers' produce weight under priced and selling commodities at higher prices on credit are taken into consideration, the real incomes of the settlers decrease to a great extent. The usual methods of collecting price information does not clearly bring out this hidden operation of the marketing system.

### Crop Mortgage

Another important feature of the new form of credit relation of the trading system is the "crop mortgage". The majority of low income settlers who have got into a simple reproduction cycle within the process of cash crop cultivation have no alternative but to borrow for cultivation and suffer from lack of finance during the harvesting period. Therefore, settlers develop a habit of obtaining advances from traders with an agreement of selling their produce to the same trader at an agreed price in order to cover the expenses during the harvesting. According to the information collected a trader in block N.309 has lent out about Rs 200,000 to the settlers on the basis of crop mortgage. Over 75 percent of the total production in another block was purchased by big traders on an advance payment or crop mortgage basis. In the 1982 Maha season the total estimated advances to the settlers on such a basis was about Rs 300,000/-. The farmers sale prices agreed on under the crop mortgage system ranged from between Rs 38/- to Rs 40/- per bushel of paddy when the average market price was Rs 60/-. The settlers were supposed to settle their debts with their produce. However, the price of the paddy under crop mortgage system is generally not revealed by the settlers. The price information officially collected is always based on this small proportion of paddy sales in the open market. It was observed that the farmer could not earn an income sufficient for his subsistence when his produce was marketed under the crop mortgage system.

### Food Crops for Consumer Goods

About 40 to 50 bushels of paddy are kept by most of the settler families mainly for consumption during the off-seasons. However, often this paddy is sold in small quantities when they are pressed to purchase their day to day consumer needs, such as bread, sugar, kerosene etc. As revealed in the study, when small quantities are exchanged for consumer goods the price of a measure of paddy was Rs 1/- in 1978 and Rs 1/25 in 1982. This means that the price of a bushel of paddy under this exchange transaction was Rs 28/- to Rs 44/- per bushel while the open market price was Rs 40/- to Rs 60/-.



## Market Incorporation

The main focus of policy makers has been to establish an organised marketing system, through Government Departments, to eliminate middlemen and protect the farmers from the exploitation of the private traders monopoly. However, it has not been an easy task for these organisations to compete with private sector trade. The rapid expansion of public sector investment and transformation of traditional farming into modern commercial farming, particularly in the Mahaweli Settlement area, created commercial opportunities for the private sector businessmen while the policy of free open market also encouraged them to compete with the formal sector. As a result the private sector has slowly moved into control of rural marketing by offering effective competition to the government sponsored marketing organisations such as the Co-operatives, Paddy Marketing Board etc. These marketing organisations therefore adopt measures not to confront but to incorporate into the existing system.

For example, the paddy purchasing of the Paddy Marketing Board in the settlement area has decreased dramatically during the last few years. To overcome this problem paddy purchasing agents were appointed. Most of them are established private traders to whom the Paddy Marketing Board has offered a commission of Rs 6/87 per kgm of paddy. The transport costs of paddy to the Paddy Marketing Board stores are also paid at a rate of Rs 1/47 per 100 kgms of paddy. According to the regulations of the Paddy Marketing Board these agents were supposed to buy paddy at a rate of Rs 2/75 per kgm acting purely as Paddy Marketing Board agents. But it was revealed that they purchased paddy as private traders using their usual trade channels and techniques, so that they could purchase a kgm of paddy at a rate of Rs 2/55 to Rs 2/65 in addition to buying under weight, and other forms of exploitation. As stated by several agents they have a very close link with the Paddy Marketing Board store keepers and pay a sum of Rs 100/- per lorry load of paddy to some for the help and assistance given to them by the store keeper. Thus although this system was introduced to help them the settlers did not get the actual prices of paddy, although the records of the Paddy Marketing Board as well as the agents would indicate that farmers were getting a reasonable price.

### Production Pressures

The most striking feature of the small family farm system in the Mahaweli Irrigation Settlement was the production

pressures on the settlement families, due to increasing costs of production and consumption. Although average paddy production increased, the "real" incomes of farmers has not increased beyond their levels of subsistence. All the land in the settlement area brought under the plough has required a degree of intensive farming in order to maintain economic levels of production. This has required a shift to the use of modern farm inputs such as High Yielding Varieties (HYV's) and also chemical fertilizer. This form of farming however is costly and necessitates increased capital investment on the land. But a small farmer with a large number of dependents and seasonal unemployment often does not have his own resources to finance this process. He therefore, has to rely heavily on borrowing either from credit institutions or from private sources.

### Estimated Income and Cost of Production (Paddy) and Consumption per season (6 months) in the H Area of the Mahaweli Settlement

(Average family with 6 members and 21/2 acre allotments)

Per 2½ acres	1979/80 Maha (a) Rs.	1980 Yala (b) Rs.	1980/81 Maha (c) Rs.
Seed	225.00	300.00	300.00
Land preparation	900.00	995.00	1,000.00
Transplanting	500.00	245.00	—
Fertilizer	250.00	200.00	750.00
Weedicides	150.00	190.00	500.00
Harvesting & Threshing	1,150.00	1,245.00	1,700.00
Labour charges	—	—	1,000.00
Sub Total	3,175.00	3,175.00	5,250.00
Cost of basic Consumer (food) items per season	5,400.00	5,400.00	6,200.00
Total Production & Consumption (d)	8,575.00	8,575.00	11,450.00
Average yield per 2½ acres (e)	192.00	158.00	212.00
Total Gross Income	9,600.00	8,690.00	12,720.00
Total Monthly Income	1,025.00	115.00	1,270.00
Total net monthly income	170.00	19.27	211.67

Loans have to be paid back with interest and unless returns on the investment on such capital are sufficiently large the borrower has to end up in indebtedness. The increases in costs of inputs such as chemical fertilizer and other agro-chemicals and costs of labour have aggravated the situation. The end result is that the borrowing capacity of farmers has tended to decline, despite the increasing costs of consumption and production. When the borrowing capacity of farmers decreases they adopt to their poor financial position by reducing the volume of high cost modern inputs, used for cultivation,

which result in a reduction in yields of the HYV's. The financial needs for such inputs are also closely linked to their seasonal poverty conditions. Having invested all available funds for land preparation and seed they have barely sufficient means for subsistence and run up heavy debts with the village boutique keeper. Fertilizer and agro-chemicals are needed during this period but these are beyond their financial capacity. The following Table shows the estimated income, cost of production (paddy) and consumption and the real income.

This information indicates the pressures on low income farm families in attempting to continue in production. The peasants who were trapped into this reproduction cycle will not benefit from any price and market information because

they are not free to make use of such information; since they are more dependent on other forces, particularly those that help to maintain them. One conclusion of the study is that price and market information made available at the producer level alone does not solve the problem: and that the growth and expansion of the existing agrarian and marketing structure contributes to the marginalisation of the rural producer.

However, it should be noted that the continued growth of the middlemen in rural marketing network indicates that they in fact provide services which are not otherwise available to the small producer.

C. G.

ECONOMIC REVIEW OCT. '83



# FEATURES

## IMPROVEMENT IN EDUCATION AMONG WOMEN IN SRI LANKA OVER THE 1971-81 DECADE

Sepalika Fernando

*In this paper Sepalika Fernando of the People's Bank Research Department analyses trends in educational attainment in Sri Lanka and shows from the data gathered in the Census of Population, 1981 that more women are being educated since free universal education was made available and in the important age group of 15-19 years more females than males were attending school and also the women in this age group had a higher level of educational attainment.*

The literacy rate among the women of Sri Lanka, has been showing a gradually increasing trend and attained its highest growth rate since 1946 during the 1971-1981 decade. This figure which was as low as 21.2 percent of the female population in the year 1921, increased to 43.8 percent in 1946. Since then with the introduction of the free-education system in Sri Lanka this percentage has increased gradually, and the high growth rate of this figure shown during the decade of 1971-1981 is of special importance. The significance of this trend is more clear, when one considers the fact that, the growth of the literacy rate among the male population had not shown a corresponding rate of increase within the same period. During the year 1971 this figure was 70.9 percent among the women, and a 85.6 percent among the men. During 1981 these figures had changed to 82.4 percent and 90.5 percent respectively. This shows that during the 1971-1981 decade, the rate of literacy among the women has increased by 11.5 percent, whereas this rate among the men, has increased only by 4.9 percent. It is clear therefore that the female population of Sri Lanka has achieved a marked improvement in their educational standards. Here too the improvement is more marked in the rural sector than in the urban sector.

The rate of literacy of women in the rural sector which was 67.9 percent in 1971, had increased by

12.0 percent to 79.9 percent in 1981. The corresponding figure of increases for men, during the same period is 4.9 percent. It is clear therefore that rural women have achieved a growth rate more than twice that of men, during this period.

**Table 1** Percentage of the population 10 years and over found to be literate

	1971			1981		
	Total	Male	Female	Total	Male	Female
All areas	78.5	85.6	70.9	86.5	90.5	82.4
Urban	86.2	90.3	81.5	93.3	95.3	91.0
Rural	76.2	84.1	67.9	84.5	89.0	79.9

Source: Census of Population and Housing 1981  
Dept. of Census and Statistics

In the urban sector, while men, show an increase of only 5 percent in their growth rate of literacy during the 1971-1981 period women have achieved a comparatively high increase of 9.5 percent from 81.5 percent in 1971 to a 91.0 percent in 1981.

Men have achieved a slightly higher growth rate in literacy in the urban sector (0.1%) than in the rural sector while among women, the increase is greater in the rural sector.

District wise - Gampaha district shows the highest literacy figures

(94.2%) and the rates of literacy here among women and men are as high as 92.2 percent and 96.1 percent respectively. The lowest rate for a district is indicated in the Batticaloa district, (66.1%), where the literacy for women is 59.4 percent and that for the men is 72.7 percent.

The widest difference in respect of the rates of literacy among the women and men is found in the Nuwara Eliya district. The gap here is 17.7 percent, the rates for women and men being 69.7 percent and

87.4 percent respectively. The Jaffna district shows the least difference in this regard, where the literacy among the women is 91.7 percent and the men 94.1 percent; the difference being 2.4 percent.

The reasons for this situation, could be the greater availability of facilities for studies, enjoyed by the populations of the Gampaha and Jaffna districts.

It was found that the literacy rate of the male population has always attained a higher percentage,



at every census that has been conducted in the country, but that since 1946 the females have always shown a higher increase in their rate of literacy — than males. Therefore, it is clear that since the introduction of the free-education system, which gave the majority of people access to higher education a wide dissemination of knowledge and literacy has taken place among the masses which was hitherto restricted only to the more affluent classes. Also it is noticeable that the rate of literacy which was low among the women, has always grown at a greater pace since then. The main reasons for this change could be explained by the emergence, of the attitude that women should be employed and the urge of parents to educate their children to the highest possible levels. Before 1946, parents did not feel the necessity in general to admit their daughters even to village schools. Since that year, the establishment of schools on an island wide basis has gradually widened access to education, and this has also acted as an incentive to parents to educate their children.

Of the total school going population between 5 and 29 years of age, the percentage 'not attending' is almost the same for women and men, 43.2 percent for females and 52.6 percent for males. It differs, however, among the various age groupings.

The age at which children are generally admitted to school is 6 years. The Census of Population of 1981 has revealed that the percentage of non-school going male children of 7 years is 9.0 percent and the corresponding figure for the female children is 9.2 percent. Here the difference in percentage is a mere 0.2 percent for the females.

It has been shown that in urban areas among the non school going the percentage for male children 7.5 percent and for the female children 7.6

percent the difference being 0.1 percent in favour of males. In the rural sector this difference of percentage is a 0.2 percent, which is higher than in the urban areas, the respective percentages of non-school goers for the males and the females being 9.4 percent and 9.6 percent. This shows that the percentage of non-school going children in the rural areas, is higher than in the urban areas, but in general the percentage of non-school going females is not more than that of males in Sri Lanka. A classification of percentages of non-school going children according to the age groups is given in the table below.

leaving of male children by the age of 15. This trend is clearly shown in the 17–19 years age group of the urban areas. The reason for this situation may be due to a variety of reasons. These children get employed as a measure of economic support for their families while the female children of this age group of both the urban and rural areas are mainly engaged in their educational activities. Thus in considering the levels of education attained, females are a higher percentage than the males of this same age group.

According to table 3 females have a higher percentage of educa-

Table 2  
Percentage of non-school going population between the ages 6–22 according to sex, urban and rural

Age	Sri Lanka			Urban			Rural		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Yrs.									
6	13.2	13.3	13.2	11.6	11.4	11.5	13.6	13.7	13.6
7	9.0	9.2	9.1	7.5	7.6	7.5	9.4	9.6	9.5
8	8.4	8.8	8.6	6.6	7.1	6.8	8.8	9.2	9.0
9	8.0	8.9	8.4	6.5	6.3	6.4	8.4	9.5	8.9
10	8.9	10.8	9.8	7.2	8.8	8.0	9.3	11.3	10.3
11	10.8	11.9	11.3	8.8	9.9	9.3	11.3	12.4	11.8
12	17.3	18.2	17.7	13.7	16.1	14.8	18.3	18.7	18.5
13	21.0	22.3	21.6	17.3	19.1	18.1	22.0	23.1	22.5
14	28.7	29.2	28.9	23.5	24.8	24.1	30.1	30.4	30.3
15	37.6	36.4	37.1	32.2	31.6	31.9	39.2	37.8	38.5
16	48.3	46.7	47.5	42.5	41.0	41.8	60.0	48.4	49.2
17	60.1	58.3	59.2	54.5	51.7	53.1	61.8	60.2	61.0
18	71.1	68.3	69.7	68.0	63.1	65.7	72.1	69.7	70.9
19	77.6	75.7	76.3	75.2	71.5	73.4	77.5	76.9	77.2
20	84.9	85.0	84.9	84.8	83.9	84.4	84.9	85.3	85.1
21	89.9	89.4	89.6	89.3	88.1	88.7	90.1	89.7	89.9
22	92.8	92.1	92.5	91.9	91.0	91.5	93.1	92.4	92.8

Source: Census of Population and Housing 1981  
Dept. of Census and Statistics.

The table shows an increasing trend in percentages, according to increase in age group. In all groups between 6–14 years the percentage of non-school going females is higher than for males. But between the ages of 15–19 years, the percentage for females is lower than that for males. What should be noted is the comparatively high level of school

tional attainment in the age group between 15 — 19 years: mainly because of the higher level of success at the G.C.E. (O/L) and G.C.E. (A/L) examinations. Here the percentage for the A/L is higher than that for the O/Ls. This shows an improvement in the level of participation by the females as they progress further up the educational ladder. This trend



**Table 3**  
**The percentages and the number of students belonging**  
**to various educational levels between 15–19 years**  
 (Grouped according to sex)

Educational Attainment	Male		Female		Total	
	No. **	%	No.	%	No.	%
* All attainment	815.2	50.7	792.3	49.3	1607.5	100.0
G.C.O. (O/L)						
6 or more subjects	39.4	44.7	48.8	55.3	88.2	100.0
G.C.E. (A/L) less than three subjects	15.3	43.0	20.3	57.0	35.6	100.0
G.C.E. (A/L) more than three subjects or equivalent	4.8	41.4	6.8	58.6	11.6	100.0
Post graduate degree or equivalent	.009	47.4	.01	52.6	.019	100.0

What is shown in the table is an extraction of a specified section which shows an improvement in women's participation.

Note: \* In this column the above numbers are the aggregates of the number of students from the non-school goers to the highest educated of the same age.

\*\* In thousands.

Source: Compiled from Census of Population and Housing 1981, Dept. of Census and Statistics;

Further details are given in table 6.

The number of students who have passed the G.C.E. (O/L) with a minimum of 6 subjects shows an increase in respect of both the male and female categories but here too the percentage of increase in respect of the females is higher. This trend in increase is also seen from G.C.E. (A/L) to the University level, and in all instances the females have achieved a better percentage of increase than the males. Also, according to the 1981 Census among the age group 10–29 years, which is the population engaged in studies, the highest degree of participation and achievement in respect of the female category was found to belong to the G.C.E. (O/L) and G.C.E. (A/L) levels. This is clear from table 5.

As depicted here the females who have passed the G.C.E. (O/L) in 6 subjects or more exceed the number of males by 8 percent; those who have passed in less than 3 subjects, at G.C.E. (A/L) by 6.66 percent; and those who have passed in more than 3 subjects, by 8.16 percent.

It is more important therefore to note that of the school going population, the percentage of women who have received more than 8th grade education is 50.06 percent.

is even more clear when compared with the Census data of 1971.

In general, we observe a decline in percentages of non-school goers from 1971 to 1981, the decrease of percentage for the females being 12% from 29.5% in 1971 to 17.5% in 1981. In respect of the males the percentage has decreased from 16.0% in 1971 to a 8.7% in 1981 by 7.3%. The population who have completed a primary education has also increased the percentage of females in this category being 42.4% in 1971 and 62.3% in 1981. Here it has increased by 19.9%. In the male category it has increased by 17.5% from a 50.7% in 1971 to a 68.2% in 1981.

**Table 4**

**Population aged 10 years and over by level of educational attainments by sex 1971 to 1981**

Educational Attainment	Sex	1971		1981		Difference(%)	
		No.	%	No.	%		
Passed G.C.E.(O/L) in at least 6 subjects	Male	223,128	4.6	409,796	7.1	+2.5	
	Female	192,392	4.3	390,513	7.0	+2.7	
Passed G.C.E.(A/L) in at least 3 subjects	Male	56,509	1.2	81,648	1.4	+0.2	
	Female	41,974	0.9	76,822	1.4	+0.5	
Degree or higher	Male	29,081	0.6	49,543	0.9	+0.3	
	Female	12,358	0.1	26,847	0.5	+0.4	

Source: Compiled from Census of Population and Housing 1981, Department of Census and Statistics



This figure indicates a slightly higher percentage (0.12%) for females over the percentage of males (49.94%).

Since the implementation of Free Education the rate of literacy among the women in Sri Lanka has been improving gradually, and it is significant that they have achieved a level which is very close to that of males (all attainments). The emergence of this situation could be defined as a very beneficial impact of the expansion of accessibility to education, which was confined to a limited population earlier. Also, another feature that emerges from the increased number of women who

seek higher education, is that more women now carry greater hopes and aspirations for a prosperous future. This change in trends may be explained as a situation brought about by the prevalence of stiff competition for the limited number of job opportunities available, which in turn necessitated the acquisition of the highest possible educational qualifications, by all. Another factor which accounts for this situation is a change in the attitudes of women, to lead a more self-sufficient and independent life, which in turn requires a sound economic base. These reasons for high levels of education among women could be for better prospects of

employment, marriage etc. but it also appears that some women delay their opportunities of employment and marriage, in pursuance of a higher education.

A general trend that could be noticed by a comparison of Census data of 1981 with that of 1971 is the increasing age of marriage for women. It is revealed that the number of women between 15–19 years who do not get married has increased by .3 percent between 1971 and 1981. This increase for the 20–24 age group is 2.1 percent and an increase of 5.5 percent is seen in the 25–29 age group. Thus it can be assumed that this trend of the increasing percentage of women seeking higher education has in an indirect manner resulted in the increase of the percentage of un-married women, of the marriagable age group in Sri Lanka.

Note: In this paper tables 3 and 5 are compiled from table 16 of the Census of Population and Housing 1981— Department of Census and Statistics (Population tables).

Educational Attainment	Population aged 10–29 years by level of educational attainment by sex					Improvement as a % (Female over Male)
	Male	%	Female	%	Total	
Passed grade 8,9 or G.C.E. (O/L) less than 6 subjects only	988.0	50.79	957.2	49.21	1,945.2	(100.0)
G.C.E.(O/L) 6 or more subjects	133.4	46.0	156.6	54.0	290.0	+ 8.0 (100.0)
G.C.E.(A/L) less than 3 subjects	62.4	46.67	71.3	53.55	133.7	+ 6.66 (100.0)
G.C.E.(A/L) or more subjects or equivalent	29.8	45.92	35.1	54.08	64.9	+ 8.16 (100.0)
Below degree but above G.C.E.(A/L)	5.4	60.0	3.6	40.0	9.0	(100.0)
Degree or equivalent	9.4	54.65	7.8	45.35	17.2	(100.0)
Post graduate degree or equivalent	.7	70.0	.3	30.0	1.0	(100.0)
All attainments	3,069.9	50.49	3,010.9	49.5	6,080.8	(100.0)
Passed grade 8 and above	1,229.1	49.94	1,231.9	50.06	2,461.0	+ 0.12 (100.0)

Source: Compiled from Census of Population and Housing 1981. Dept. of Census and Statistics.

SRI LANKA	
SCHOOL ATTENDANCE AND EDUCATIONAL ATTAINMENT	
ALL SECTORS	TOTAL
TOTAL	601 0953
ALL ATTAINMENTS	435209
NO SCHOOLING	210315
PASSED GRADE 1 OR 2 ONLY	542920
PASSED GRADE 3 OR 4 ONLY	2389061
PASSED GR. 5,6 OR 7 ONLY	1321640
PASSED GRADE 8 OR 9 ONLY	623556
G.C.E.(O/L) LESS THAN 6 SUBJECTS	289966
G.C.E.(O/L) 6 OR MORE SUBJECTS OR EQUIVALENT	133725
G.C.E.(A/L) LESS THAN 3 SUBJECTS	64978
G.C.E.(A/L) 3 OR MORE SUBJECTS OR EQUIVALENT	8953
BELOW DEGREE BUT ABOVE G.C.E. A-LEVEL	17269
DEGREE OR EQUIVALENT	1010
POST GRADUATE DEGREE OR-EQUIVALENT	42352
UNSPECIFIED	



## COPING WITH INCOMPETENCE

C. Bhktavatsala Rao

*The problems of subordinates having to cope with incompetent managers is the subject of Rao's discussion in this paper; in which he concludes that if incompetence is an aberration, there is immense sense in seeking a strategy of optimisation and subsequent migration to better spots of work within the organisation. He adds, however, if an organisation has low norms of efficiency it makes better sense to seek separation and take up more challenging assignments elsewhere. The interregnum would entail the risk of intellectual decay unless subordinates take effective steps to understand and cope with managerial incompetence that puts fetters on their performance.*

Performance of organisations and career growth of personnel are explicitly linked to the competence of personnel constituting the organisation. Several management experts, however, established through incisive, even if irreverent, analysis that there could be the very real risk of managers reaching their levels of incompetence.

Piquant situations develop in organisations when competent and professionally qualified personnel have to work under relatively incompetent and professionally ignorant managers. These situations cannot be wholly avoided. Organisations find it difficult to remove all the managerial deadwood or isolate the incompetent

managers without assigning responsibilities. Nor can the capable subordinates seek immediate change either within or outside the organization. Despite such a situation, therefore, one has to be conscious of the need to contribute effectively to organizational performance, if one has to aspire for long-term career growth.

### Defining Incompetence

Incompetence is determined relatively and usually with reference to the larger organisation-wide norms of efficiency and the more specific divisional demands of professional knowledge, experience and grasp.

Essentially, a manager may be considered incompetent when he fails to lend a firm direction to his divisional activities and pales into intellectual insignificance when compared to his subordinates.

### Why incompetent managers exist

Prima facie, it appears an oddity that incompetent managers should exist at all in organisations, as the commonly understood organisational ethos emphasizes growth linked to proven results. But there are certain specific circumstances under which the incompetent may not only exist but also grow to positions of responsibility.

Some such conditions are:

- (1) Irrespective of the degree of performance orientation, a weakness to accommodate persons who totally, unquestioningly and unabashedly support plans of superiors is shared across most organisations.
- (2) As organisations grow and diversify the skill profile that is intrinsically demanded will

## CENSUS OF POPULATION 1981

TABLE 6 POPULATION 10 - 29 YEARS BY SCHOOL ATTENDANCE, EDUCATIONAL ATTAINMENT, AGE AND SEX

S E X					A G E				A G E				
TOTAL	15 - 19	20 - 24	25 - 29	TOTAL	10 - 14	15 - 19	20 - 24	25 - 29	TOTAL	10 - 14	15 - 19	20 - 24	25 - 29
1690248	1607534	1509787	1273381	3069987	863911	815199	753338	637547	3010969	826344	792336	756461	635830
109106	124932	109533	91643	188206	50193	57947	45353	34713	246999	58912	66981	64179	56927
78632	54663	42414	34609	115046	44475	29813	22904	17860	95268	34158	24843	19515	16752
233364	110793	107995	90772	292985	125258	59838	59039	48853	249940	108109	50959	48959	41918
1097336	449687	440177	401866	1225454	562239	240592	221860	200763	1163607	535100	209093	218320	201103
155726	520118	359520	286267	685743	74010	267544	190779	153407	635890	81720	252575	168741	132861
2163	199560	233165	188678	302282	1153	93816	113710	93607	321278	1011	105740	119455	95067
357	88250	107338	94030	133396	152	39458	48238	45545	156583	206	48786	59102	48485
-	35668	61141	36919	62451	-	15343	28822	18285	71279	-	20329	32314	18631
-	11578	32961	20441	29861	-	4786	15193	9859	35140	-	6796	17769	10580
-	338	3195	5422	5374	-	216	1800	3353	3579	-	122	1390	2067
-	50	2979	14242	9441	-	40	1575	7826	7831	-	10	1405	6416
-	19	190	802	659	-	9	146	503	350	-	10	53	297
13580	11881	9192	7702	19118	6429	5788	3914	2982	23237	7145	6092	5277	4724



need continuous change and refinement. Functional capabilities of manager's become obsolete unless they are continuously exposed to well conceived training and job rotation programmes which are tailored to future requirements.

- (3) Even otherwise, as organisations grow, it becomes difficult to ensure uniformly high standards of management calibre at all levels. Relative incompetence is tolerated in the interests of adequately manning the structure.
- (4) Managerial turnover is a factor that effects an organisation's stability, irrespective of the quality of the organisation. For example, top class organisations which enjoy a reputation as good training grounds inevitably lose high calibre managers due to predation by other organisations. Companies which do not offer career challenges would, in any case, face turnover of competent personnel.
- (5) In an environment of managerial turnover, life-time stay, in itself, works out as a great qualification, though in a dubious sense. Even in performance-conscious companies incompetence is offset to an extent by seniority considerations in deciding promotability. 'Status Quo' organisation will, in any case, be happier with life-time mediocrity.
- (6) Unless organisations are very innovative and extremely conscious of costs and productivity, organisational systems and operations often place a high degree of premium on routine-ness. This encourages, and tends to institutionalise incompetence in management systems.

#### **Crux of the problem**

Incompetent managers either fail to recognise the competence and worth of subordinates or feel insecure as a result of recognition of subordinates' capabilities. In the former case, employees are often frustrated as they will have to do routine, meaningless jobs and let their

faculties rust. In the latter case, there could be overt or covert moves by the managers to stifle their subordinates' creative capabilities and to keep them away from the organisational mainstream. This naturally, gives rise to friction in interpersonal relations and could culminate in reaching non-cooperation or open hostility in day-to-day work.

The ultimate casualty in both the events is organisational efficiency and performance. There cannot be two opinions that managements as well as employees have to work towards eliminating the deleterious effects of managerial incompetence. But to the extent that incompetence within the ranks is allowed by the management either deliberately or ignorantly, the problem of managerial incompetence is internal and intrinsic to the management. In this sense, the employees are externally inducted into a defective system.

The strategy for dealing with incompetence depending on the nature of incompetence in managers is discussed below.

### **TYPES OF MANAGERIAL INCOMPETENCY**

#### **(1) Benign incompetence**

Managers in this category recognise their incompetence and tend to be realistic enough to encourage competence in their subordinates. They believe that they will gain, rather than lose, if their subordinates effectively contribute to organisational goals. For subordinates under such managers, the frustrations are that their boss is incapable of defining new areas of contribution, and even if they generate and implement new ideas, they are not still in the limelight due to managerial barriers. Despite this, this is the most acceptable and least harmful of all the incompetence situations.

#### **(2) Adaptive incompetence**

Managers in this category too have very little to contribute on their own to organisational performance. But they use their subordinates' ideas as inputs to their thought process and adopt subordinates' work as their own after making some cosmetic changes. These managers make every effort to identify only

themselves with divisional performance on the premise that this would strengthen their position in the organisation.

The problem with this situation is that while the organisation takes their contribution seriously at face value and involves them in all the important deliberations, they lack the deliberative process.

Subordinates, though deriving a mild satisfaction of working for the organisation, will be frustrated because they are kept out of focus. Moreover, they lose the continuity of action in whatever work they do as the manager neither involves them in the deliberative process nor communicates the results of the process effectively.

#### **(3) Servile incompetence**

Managers in this category recognise their incompetence but cover it up with open servility towards positions of power and by opportunistic links with capable subordinates or peers. A maintenance manager, for example could play second fiddle to production manager and totally desist from questioning the misuse of machinery. Capable staff under him who are in a position to point out methods of control would not be supported and even would be exposed to the wrath of production staff.

Servile incompetence will also be manifest through close links with heads of related functions so that they bail him out of his difficulties. At its worst, it can also involve servile aggrandising of one or two capable subordinates so that they have a modicum of knowledge of the affairs.

#### **(4) Insecure incompetence**

Most incompetent managers feel insecure. This feeling of insecurity increases as they perceive that their subordinates are more competent than they are. They also believe that the competence of their subordinates is bound to get shown up if the activities of the department are kept at a high key. The more insecure among the incompetent managers perceive that they will soon be castaways in the organisation in such a situation.

As a defensive reaction, such managers adopt a very low profile, being content to do the very least that the organisation expects from them.



Subordinates under such managers would be highly frustrated with the circumscribed nature of work and near total denial of opportunity to perform.

### (5) Hostile incompetence

Managers in this category pose the most serious threat to organisational performance as well as individual growth. They exhibit very little appreciation of overall organisational interest and view the capabilities of subordinates as threats to their positions. What differentiates this class from insecure competence is that these managers try to bring down the subordinates also to their level of incompetence. They not only discourage subordinates from performing, but also openly criticise any acts of initiative and positive thinking. Such will be their persistent discouragement that subordinates would, in due course, be losing their ability to think and act creatively.

Such managers not only prevent their subordinates from interacting meaningfully with others, but do not hesitate to speak disparagingly of their subordinates. Growth of such managers is sustained, in spite of the incompetence, due to a willingness in manipulative politics and a strong survival instinct that throws overboard all decent norms of organisational behaviour. Working under such managers would be the most damaging factor for the career of subordinates. It could even be ethically revolting.

The above 5 types of incompetence are certainly not exclusive to each other. Despite dominant characteristics conforming to one of the above types may also exist. The problem of course, will be so much worse due to that!

### Overcoming managerial incompetence:

There is often a fatalistic streak in competent subordinates having to work under relatively incompetent managers. The problems often cannot be resolved quickly or easily. But as the stake is greater for subordinates, it is they who need to take positive action to overcome the constraints

imposed by managerial incompetence. It would be risky and harmful to attempt flouting of organisational discipline to solve this problem. The following approach and strategy should help in a more enduring solution to the difficult issue.

First, subordinates should give the benefit of doubt to the manager and try to keep him fully informed of the potentialities and functions of the department he heads. Apparently this should be done in a suave manner without overtly sounding to be highly knowledgeable. The rationale for this cautious approach is that where the manager is not in professional touch with the function, it takes time to get a grasp of the activities. Functioning of the professional advantage would only harden attitudes at the stage of preliminary contact.

Secondly, when the contours of incompetence begin to take shape subordinates should explore the possibility of educating the manager. He may be told politely but firmly that the problems in the functional area need a particular kind of professional approach. Illustration of alternative routes of action to functional problems would help.

By the time the second step is executed the nature of incompetence of the manager would manifest itself clearly enabling the subordinates to formulate appropriate further strategies. When managers are benignly incompetent, the first two exploratory steps are adequate to develop a working rapport. But in other classes of incompetence reaction of managers would not be conducive to effective performance by subordinates.

It is possible in such cases to choose a Strategy of optimisation. This rests on the promise that the productivity standards of an incompetent manager are usually lax. It would be possible for a subordinate working under such a manager to fulfil the requirements of his boss and yet carry out other assignments which would earn him high visibility in the organisation. Such a strategy would mean that the subordinate should establish his personality independent of both

his function and his boss. This strategy, however, is likely to lead to further friction in a situation of hostile incompetence.

Hostile incompetence cannot normally be faced in the usual work relationships. A strategy to overcome this is essential. The strategy should however, be in continuation of the approach of optimising and retaining the high visibility outlined earlier. However, when the hostile manager confronts the subordinate on his extra-departmental assignments the subordinate should not buckle under pressure. The competent subordinate should adopt a strategy of upholding organisational interests and establishing a nexus between work assignments and organisational performance duly backed by a readiness to pursue an independent line of action in order to establish unequivocally his intellectual and professional independence.

### Conclusion

Incompetence in managers adversely affects the organisation's performance and individual career growth. While certain types of incompetence can be adjusted with, a few others can seriously spoil the development process of subordinates. It is possible to optimise or overcome managerial incompetence with appropriate strategies. But the final decision on continuing under an incompetent manager has to be taken in relation to overall organisational norms.

If incompetence is an aberration, there is immense sense in seeking a strategy of optimisation and subsequent migration to better spots of work within the organisation. If however, an organisation has low norms of efficiency it makes better sense to seek separation and take up more challenging assignments elsewhere. The interregnum would entail the risk of intellectual decay unless subordinates take effective steps to understand and cope with the managerial incompetence that puts fetters on their performance. The framework developed in this paper is aimed at just that.

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