INFORMATION SYSTEMS FOR PROMOTION & UTILIZATION OF TECHNOLOGY

Summary of proceedings of the
National Workshop on Information Systems for
Promotion and Utilization of Technology
4—7 October 1988 Colombo, Sri Lanka.

Edited by:

N. U. Yapa
W. Ranasinghe

Sponsered by:

The Natural Resources, Energy & Science Authority of Sri Lanka
Ceylon Institute of Scientific & Industrial Research
Asian and Pacific Centre for Transfer of Tecnology

1988. Colombo.

CONTENTS

National Workshop on Information Systems for Promotion and Utilization of Technology

Proceedings

INTRODUCTION

The National Workshop on Information Systems for Promotion and Utilization of Technology was held from 4-7 October 1988. The Workshop was organized jointly by the Natural Resources Energy and Science Authority (NARESA) and the Ceylon Institute for Scientific and Industrial Research (CISIR) in collaboration with the Asia and Pacific Centre for Technology Transfer (APCTT). The following served in the organization committee:

Mr L.C.A. de S Wijesinghe, Additional Director General, NARESA
Mr. M.A.T de Silva, Deputy Director General, NARESA
Mr. N.U Yapa. Director Information, NARESA
Miss C L.M. Nethsinghe, Head, Information Service, CISIR
Mrs. D. Warnasuriya, Senior Scientific Officer(Information) CISIR

The inauguration and Session I were held at CISIR and the rest of the workshop was held at NARESA.

Participants from 20 organizations both in public and private sectors, involved in maintenance and utilization of technological information, were invited to attend the workshop (annexure 1). Local and foreign specialists were invited to present papers at the workshop which was organized into six sessions; planning information needs, information systems, promotion of utilization of information, computerized information systems (annexure 2).

The chairpersons and rapporteurs were:

Inauguration - Mr. L.C. de S. Wijesinghe, Addl. Director General. NARESA.
Session I - Dr E.R. Jansz Director, CISIR
Mr. M.A.T. de Silva, DDG, NARESA

Session II - Dr. G.C.N. Jayasuriya, Director- General, NARA

Session III - Dr. Nawaz Sharif, Director. APCTT

Session IV - Dr. Anton Balasuriye, Chairman, Sri Lanka Business Development Centre

Session V - Mr. N.G.T.W.G. Seneviratne, Chairman, IDB

Session VI - Dr. Kevin Seneviratne, Lecturer, University of Colombo

Conclusion - Miss C.L.M. Nethsinghe, Head, Information Service, C.I.S.R.

Rapportuers

Mr. N.U. Yapa, Director Information, NARESA

Mr. W. Ranasinghe, Librarian, Agrarian Research & Training Institute

INAUGURATION

Dr. Anandatissa de Alwis, Minister of State and Information, ceremonialy declared open this national workshop. Mr. L.C.A. de S. Wijesinghe, Additional Director General, NARESA, welcomed the Hon. Minister, the invitees, resource persons and the participants.

Mr. Wijesinghe said that the three institutions which sponsored the National Workshop are actively involved in coordination or transfer of technological activities. One of the Working Committees of NARESA deals with S & T information and this Committee was recently engaged in the formulation of a S & T information policy with special reference to developing and strengthening the industrial sector information.

Two important events took place recently; namely the establishment of a Council for Agricultural Research Policy (CARP) and the publication of the Inudstrial Policy Statement (Annexure 3)

One of the objective of the workshop is to sensitize the decision makers of the critical importance of technological information.

Dr. E.R. Jansz, Director CISIR, welcomed the Minister, participants and the invitees. He explained the services offered by the CISIR library. He stressed the need for a centre to handle technology transfer. He said that CISIR is planning to utilize new technologies to develop the capabilities of its information systems and is also planning to establish linkage with SLSI for exchange of information.

Mr. Sharough Sharif, Asst. Resident Representative, UNDP, explained the policy of the UNDP with regard to the promotion of technology transfer. He said that the UNDP gave high priority to projects associated with technology transfer. In this respect the UNDP supports the activities of APCTT.

Dr. Anandatissa de Alwis, Minister of State and Information, said that the transfer of appropriate technology is a widely spoken subject. He hoped that the deliberations of the workshop would help the improvement of technologies needed by the people.

Scientists and technologist should utilize the mass media to publicise their findings and to capture the views of the people. A proper diologue between scientists and journalists is needed. He said that reliable information sources stored in libraries etc. should be linked together so that they could be accessible not only to the scientists but also to the general public.

Dr. M. Nawaz Sharif, Director, UN-ESCAP/APCTT delivering the keynote address said that currently the pressure from over population and the rising expectations of the people in developing countries are exerting a strong demand for rapid technological advancement. Per capita income is used as an indicator of national development. However, some countries which have attained high income through the export of naturally available resources are not considered as developed. Many developing countries may be rich in natural resources and culture but they are indeed very poor in terms of technology. The developing countries are in fact technologically under developed.

Technology can be disaggregated into four embodiments forms:

Object-embodied technology (Facilities and technoware);
Person embodied technology (abilities or humanware);
document-embodied technology (facts or inforware); and
institution-embodied technology (frameworks or orgaware)

Using the four embodiment forms of technology as the basis of enquiry, it is possible to achieve complementarity between conventional economic planning and technology-based planning at the firm, industry, sectoral and national level. APCTT has developed a comprehensive and detailed framework for development planning using such techno-economic considerations

SESSIONS

Session I

Chairman
Dr E R Jansz

1/1 Dr Nawaz Sharif

Integration of Technological Considerations in National Development Planning

Technology significantly enhances human, muscular and mental capabilities It is not an easy task to integrate industry and technology. Commonly used indicators like GNP may not reflect the genuine status of development. Resources required for economic development fall into four major components Technoware, humanware, inforware and orgaware. As technoware becomes more sophisticated more human skills are built into the machinery.

Export of industrial raw material causes loss of natural resources. Export promotion zones do not promote the transfer of technology. Close door policies in some countries have not improved economic development and technological innovations

A developing country should specialize on selected areas to build up its technological capabilities. This will help such a country to attain a better bargaining position with regard to transfer of technology

Discussion

Selection of priority areas for technological utilization has been done at the higher level of decision making in countries like South Korea. KIST which promotes contract research has played a leading role in the improvement of technology utilization.

A special law was enforced in Korea to enhance the social status of master craftsmen. This has encouraged the improvement of technology transfer.

1/2 Mr. Neville Abeysundera

Technology transfer, Development and Promotion :
Problems and Issues in Sri Lanka

Technology is a method of transforming inputs into beneficial products Technology transfer means the transfer of knowledge. The recipient of technology transfer should be capable of understanding the process. be interested in the transfer, and be motivated to accept the transfer.

For efficiency of technology transfer the recipient must understand the process adopted and the end-result for which the process is targeted. Most local entrepreneurs in small and medium scale industry rely on plant suppliers for the required technology transfer.

Inadequate understanding of the process and possibly the wrong choice of supplier are the causes of poor quality production. On a turn-key basis the recipient and the supplier of machinery enter into a contract for installation and commissioning of the plant with guaranteed outputs

To develop and promote the transfer of technology. the technology itself must not be too sophisticated. Hi-tech transfer in a country like Sri Lanka. could be a waste of time and money. In the mere export of natural resources without added value, Sri Lanka would lose. No country would transfer the finer points of technology which have been developed by them at great expense both in terms of time and money. To effectively transfer technology. the development of the acquired process should be promoted. The transfer of technology should be promoted if it is appropriate and adaptive.

If the transfer of technology is considered for product export then it is reasonable to expect the end-product to meet with high standards and be produced economically. Unless the recipient of technology is fully aware of his market demands. both in quality and quantity. transfer of technology will be a waste of time and money.

Discussion

DFCC as a matter of policy does not make any recommendation with regard to selection of technology, supplier plant etc. when it looks into the economic feasibility of an industry

It is the responsibility of the buyer to check the reputation and reliability of the supplier. Developing countries often get obselete and outdated technologies which are no longer viable in developed countries. Entrepreneurs are not interested in transfer of technology. Their motive is improvement of productivity and reduction of cost by using improved machinery and processes.

Public organizations are required to follow a rigid tender evaluation procedure. No such controls exist in the private sector. Services for assessing technology are not available locally. Some mechanism or organization should be established to undertake technology assessment. A centre of technology development and transfer could be set up in an institution such as CISIR. IDB or NERD. This aspect if fairly covered with respect to the textile industry.

Chairman
Mr. M.A.T. de Silva

1/3 Dr. Nawaz Sharif

A Framework for Technology-Based Planning

The basic needs of human beings have not changed but the ways of satisfying them have changed where new technology replaces the old. Every product has a life cycle; when the product comes to maturity it should be renovated or modified so that it could start a new life cycle.

A late starter could take the advantage of adopting the latest and most modern technologies. Leapfroging becomes meaningful if the four components involved in transper of technology ie humanware, technoware, inforware and orgaware are appropriately procured. Developing countries have a tendency towards providing information free of charge and without any restrictions Developed countries have capitalized on this attitude.

Labour intensive industries are getting less and less profitable with the adaptation of advanced technologies such as CAD/CAM. robotics Transfer of technology through reverse engineering is becoming more and more difficult.

Discussion

Technology cannot be developed without appropriate support and commitment. Generally in developing countries the industry and Government do not work in harmony.

Long range planning is essential. Individualism should be overshadowed by national goals. Trend forecasting which involves technology assessment and technology forecasting is required for development of technology.

Session 2

Chairman
Dr. G.C.N. Jayasuriya

2/1 Dr. S.M. Junaid Zaidi

Technology Information System for Technology Development and Utilization

Everybody needs information for various purposes. The format of information depends on the needs of the end-user. His acceptance of the information is influenced by the authority of the source. There is a wide gap between information generation and assimilation capability. Most information services are not geared to cater to the end-users of technology.

Technical information is well defined but not so in the case of technology information as it includes other components as well. The latter is needed at macro level by individuals or enterprises and at micro level for technology planning, policy formulation, and management of technology acquisition. A technology information system thus becomes a prerequisite for technology development and utilization.

Discussion

Technology information required at technician and craftsman level is not easily assimilated in traditional print media. Other methods such as visuals can be effectively used. Extension services could be more useful here as person to person communication is regarded as the best, though difficult. Unless the information is disseminated in a language better understood by them, they tend to pay less attention to it "Gate-keeper" of information is a concept popular in developed countries but how effective this would be in the Asian context is debatable

The most efficient way of building information services would be on the basis of demand but the supply of specific technology information is difficult as it involves the services of experts.

In order to obtain up-to-date technologies, countries like Korea have used the personal experiences of people who have worked in developed countries for a period of time.

2/2 Mr. P. Anton S. Fernando

Information needs in Technology : NERD Experience

The NERD centre has placed emphasis on the R & D activities on energy related projects likely to have an influence on national economic development Information requirements relating to technology development very broadly fall into two categories

1 Technical and
2 Statistical and other.

Many projects developed by the NERD centre have national economic importance There is a need to popularize the developments in order to achieve full benefits The "Prashakthi" project is a case in point which has potential and there is a need to popularize it as a successful venture.

Discussion

Publicity efforts of NERD projects mainly depend on promotional literature. It is hoped to intensify publicity by means of a Newsletter and "open days". The need for embarking on projects is identified on the basis of feedback.

Chairman
Dr. R.L. de Silva

2/3 **Miss C.L.M. Nethsinghe**

Critical Appreciation of Information Systems for Promotion and Utilization of Technology in Sri Lanka

Tribute has to be paid to those Scientists and Librarians in the first half of the 20th century. due to whose efforts the older literature is available. In Sri Lanka the concept of a Library as an Information Centre was introduced by the first Director CISIR. Dr. Fransis Godwin He also pioneered Training for Special Librarians. Although in recent years increasing prices of Books and Periodicals and sharp increase in the exchange rates of foreign currency have adversely affected libraries valuable collections are available at major libraries. Much of the information however is based on books periodicals and reports. The areas in which Technology information is required include not only Technologies which can be purchased. but also information on Raw materials and Machinery suppliers. Health hazards and safety precautions, treatment and disposal of waste products, market information and solving of problems during the manufacturing process. Project reports are often highly priced and making available such reports through libraries may be detrimental to sale of these reports by the Supplier of the Technology.

In the future, with computerisation of libraries. arrangements will have to be made for a local network, where libraries in the network can directly access the databases of other libraries. Charges for such access need to be worked out. There is also the need for greater resource sharing and rationalisation of purchases of books and periodicals. Again, there is a need to use new technologies in libraries e.g. Facsimile transmission, especially between Colombo - Peradeniya - Moratuwa so that articles required are speedily supplied. Link up with foreign databases is often recommended, but can Sri Lanka Lanka afford the high cost ?

Discussion

Information provided on a charge ensures its quality and better use. Public sector institutions are obliged to provide information free of charge because they are maintained with public funds. Only when document delivery is involved a charge is made to cover the cost. However, private sector organizations do charge for information products and services.

Collections in universities are not accessible to the public, but attempts are being made to relax the present restriction.

Linking of organizations by facsimile and telex would not only be important but also extremely useful in resource sharing

Session 3

Chairman
Dr. Nawarz Sharif

3/1 Dr. S.M. Junaid Zaidi

APCTT s Technology Information Model

Utilizing the services of journalists in information centres would be worth considering as they are in a position to transmit technology information in a more meaningful and effective manner. Technology in effect is viewed in terms of monetary returns.

The framework for technology information services should be based on a given set of considerations such as objectives, priority areas, needs of end-users etc. Their scope should be restricted, programmes complemented and the information should be made accountable. Activities relating to technology information are diversified, requires careful scrutinity and specialized skills. Computerization is helpful but not essential, networking certainly facilitates resource sharing.

Too much emphasis is still given to science information thereby making the library the main source. Technology information should be provided based more on demand rather than on supply.

Disscussion

Pricing policy should be based on demand and different rates could be adopted for different categories of users. Having specialized and valuable information will enhance the bargaining powers of an information system. Developed countries tend to be secretive about technology information because it means power.

APCTT is collecting indigenous technologies from several countries in the region to be disseminated among those countries. Priority areas are food technology, low cost housing and renewable energy.

3/2 **Mr. Mohd. Shazali Hj Othman**

Patent information system

SIRIM maintains the Malaysian Patents Database of patents registerd in UK and registered in Malaysia. Also a vast collection of foreign patents are collected and linkage with external sources of patent literature have been established. Patent information service is provided by the technical library and by the Patents Information Centre. Documents are supplied in the form of microfiche. The computerized SDI service is organized to provide personalized information to users. It also operates programmes to promote utilization of patent literature.

Discussion

Patents do not divulge the information to improve knowledge but serve as a source which provides awareness. Some of the expired patents could be still valuable. Patents also provide information on sources that could be contacted for acquiring technologies.

3/3 Dr. T.R. Sharma

Technology Transfer of Processed Food: Experience of Defence Food Research Laboratory

Technology transfer is quite different from information transfer. There are basically three types of technology transfer processes depending on the purpose for which it is adopted. Channels of transfer are several, some of which are more effective than the others, and the choice of the channel is dependent on many factors, prevailing in the recipient country. So it would appear that the process of technology transfer is characterised by variability and complexity, each requiring careful planning and application.

The type of technology selected for transfer should match both the needs and the capabilities of the industry in order to achieve optimum results. Ideas perceived by scientists and tested in laboratories ultimately end up as potential technologies after a range of interactions with the industry and the market. Effective communication between technology generation and adoption is a critical component in the transfer process. Yet this is rather weak as it exists at present. Most of the communication takes place after the development is more or less over and when the need arises to commercialize the technology. In the Indian scene, technologies relating to convenience foods have been developed quite successfully during the last few decades.

Discussion

Industry must be convinced of the demand for given products in order to be able to successfully transfer any technology. Experience has shown that some technologies are easily launched while others hardly take off the ground Technologies which are ahead of time have also appeared, but they do not appeal to the industry.

Technology imported to developing countries should be digested and adopted. A case in point is Japan. The objective should be not to transplant but to adopt technologies.

The process of acquiring technologies can be quickened by educating the end-users. One of the present problems lies in the non-receipt of research results by those who are in a position to effect changes. In Sri Lanka, by bridging the gap between researchers and extension workers, we have witnessed that the flow of information to the end-users has been facilitated particularly in agriculture.

Session 4

Chairman

Dr. Anton Balasuriya

4/1 Mr. Sarim Kol

Methodologies for promotion of technology utilization of the role of technology information with reference to Asia and Pacific

Technology has a very important role to play in national development. In each country, there are relevant technologies which need to be supplemented by imported technologies. High technology is not necessarily a solution for national development.

The development gap between the country supplying the technology and the country receiving it has become an important factor. Institution, legislative and financial infrastrucres need to be improved for effective transfer of technologies.

The main object of APCTT is to assist the developing countries in the region for effective utilization of technologies both indigenous and imported. It deals direct with small and medium entrepreneurs. Programmes such as technology mission, exposition, individual syndication, Tech Mart, advisory assistance, training are utilized by APCTT for this purpose.

Discussion

APCTT is actively engaged in transfer of technology by establishing contacts between the enterprises which need technology and the enterprises which are willing to offer technology. Tech Mart is often used for this service. The effect of introduction of a product on the market through such transaction should be looked after by the parties concerned. Once transfer of a specific technology is arranged in a country, APCTT does not entertain a similar request from another enterprise of the same country.

4/2 Mr. D.B.J. Ranatunga

Critical Evaluation of Indigenous Technology

Indigenous technology is not different from other technologies because it must be subjected to the same criteria of evaluation. Instances are not rare of certain craftsman in possession of indigenous technologies being possessive and reluctant to divulge or transfer them due to some reason or other. Their experiences gained through trial and error thus remain undocumented and unknown to the world at large. Unwillingness to change traditional technology is often a weakness associated with certain individuals, may be due to emotional or sentimental reasons. Similarly wrong skills are as bad as having no skills, for they not only enhance production costs, but also downgrade the products. Consequently they cannot become competitive.

Technologies incapable of being competitive due to higher production costs or sentimental factors must be dispensed with as unsuitable. Conversely, viable technologies should be encouraged and supported. Handicrafts have an advantage due mainly to their cheap labour component and skills.

Appropriate technology is a relative term, rather vague in concept but viability, low production costs, and suitability to local conditions are of prime importance.

Discussion

It is generally believed that technologies developed in advanced countries find their way to the Third World when such technologies become no longer viable in countries of their origin. We in the developing countries should guard against such practices. For no reason should unsuitable technologies be allowed to be transplanted here regardless of whether they come in as part of aid packages.

4/3 G.A. Piyadasa

Promotion of Technology Utilization Policies and Procedures in Sri Lanka

S & T occupy an important place in planning. In advanced countries technologies have progressed indigenously with market environments acting as the driving force.

In Sri Lanka, trends in S & T development can be pigeonholed into three eras dating back to the early post independence years. At the beginning R & D institutions were expected to work on government-directed priorities influenced mainly by local needs. After a period of protectionism in the mid fifties and sixties, policies came to be liberalized resulting in technology starvation whereupon the industrialists were foced to a situation of profit motivated input imports and survival in the face of competition from imported products. A recent study has shown that R & D institutions have directed their energies more towards academic pursuits and moved away from technology improvement. The situation is so grim that technology developmet seems to be almost at square one.

To move away from this situation, a technology policy geared towards the twenty first century seems to be imperative. It should enable access, acquisition, mastery, adoption and use of new market oriented technologies which in turn would instil a sense of self-reliance. Credit support, tariff and tax concessions and other incentives would have to form part of such policy. With many other supplementing supports, technological advancement would need to be given the impetus it needs.

Discussion

Difficulties associated with retention of engineering skills and procurement of necessary pilot plants equipment seem to have effected CISIR. However, their research efforts have been directed towards essential oils spice and food industries. The study cited earlier had made a general reference to R & D institutions resorting to academic research.

Several R & D institutions appear to be working on the same problem or the same kind of technology and this pinpoints the need for a co-ordinating body which would also take care of many other functions such as deciding priorities, funding etc. It should also consider the position of particularly the private sector organizations that had come up under conditions where capabilities were not available elswhere. Again, there are considerations that point to the need for a demand-oriented technology policy and strategy.

Session 5

Chairman
Mr. N.G.T.W.G. Seneviratne

5/1 Dr. Nilyadi Kahar

Technology Information Requirements from the Technology Management Point of View

Technology requires both inputs and time for its creation and improvement. Its application in a meamigful manner can result in the improvement of the socioeconomic conditions of marching towards a better quality of life. The availability of well-tested technologies undoubtedly hastens the process of technology transfer and the consequent improvement of the socioeconomic conditions prevailing in recipient countries. Technology management has thus become an important issue in the development process, particularly in the developing countries.

Information is an essential pre-requisite in the multi-faceted process of technology management. Technology generation, adaptation, improvement, transfer, acquisition and utilization are a few of the many purposes for which information is needed. The information requirements vary from national through regional to international level, be it for the purpose of analysis, for refinement of indicators, for strengthening the capabilities or for a host of other purposes.

Taking information to the user can sometimes become expensive because he may need the technology at the highest level of sophistication and refinement. The need may also arise for subsidizing information services for technology development. Networking at regional level by establishing appropriate indicators and data base systems would facilitate comparative assessments.

5/2 Mr. Mohd. Shahabuddin Faruque

Information Needs of Small and Medium Enterprises in the Content of Sri Lanka

Small and medium enterprises (SMEs) occupy an important place in the economy of most developing countries, so much so that development planners lay considerable emphasis on the development of SMEs in order to achieve some measure of higher productivity and greater employment opportunities. In the context of Sri Lanka, this has been demonstrated through SMEs located in the Export Processing Zone (EPZ).

The information needs of SMEs are quite complex encompassing many sectors and diverse situations. However, the bulk of information required by SMEs broadly consists of statistical, technological, market and management aspects, yet their requirements are hardly satisfied due to several reasons. Distance of location from the information centres, relevance and specificity of the information available as well as its timeliness and the language problem are some of the constraints faced by information seekers. Packaging of information may be a viable proposition to overcome these vexed problems.

Many information services in Sri lanka are in possession of technological information of relevance and value to SMEs, but the users find it difficult to obtain the most appropriate information from a single source. this situation could perhaps be improved by forming an organizational network with common interests. This will eventually lead to the need to set up a clearing house for technological information which may function as a national focal point for accessing a foreign data base.

Discussion

Information needs vary at different stages of growth of SMEs. So, there should be a proper assessment of the specific needs and it must be ensured that the information provided meets the requirements, priorities and expectations of the entreprenuers. this is where packaging of information may become useful. In order to achieve good results in this respect, two-way communication must be improved.

5/3 Mr. C.S. Shanmugalingam

Information Needs of Small and Medium Industry and Small and Medium Enterprises: Sri Lanka Experience

Both the role of industrialization in the developing process and the importance of SMIs in this connection are well recognized. However, the optimal role of SMIs as against large scale industries has not been fully settled largely due to the absence of a clear-cut policy towards the SMI sector.

SMIs have a good employment potential though modest use relatively simpler technology and are less capital intensive. They are also capable of producing a wide variety of products suitable for thin markets in developing countries. Characterized by several problems and shortcomings as they are, SMIs should be approached in an effective and dynamic manner in the matter of transfer of technology. They need access to information not only relating to technology but also with regard to market trends, availability of appropriate equipment and raw materials, credit facilities and more importantly, government support such as subsidies, incentives etc.

While technology and other information is available in many centres in Sri Lanka, it is invariably not available in the form in which it is required by the SMIs. Information required by the entrepreneurs must necessarily be assessed in order to determine their specific needs because timeliness, level of assimilation and level of operation are important determinants as far as their use of information in concerned. These considerations should therefore be treated as prerequisites to the development of an industrial information system, particularly involving SMIs as clients.

In addition to simple, well-tested traditional methods of information dissemination, audio visuals should be extensively used as receipients tend to assimilate as much as 80% of knowledge imparted through audio-visual means. Decentralization of the dissemination process should be effectively organized. Co-operation among the several institutions involved in the dissemination of technological information and the co-ordination of their activities would appear to be vital for developing a successful information system. An uninterupted flow of information to the industry should be the ultimate objective.

Discussion

The Industrial Development Board (IDB) has been in the forefront of disseminating information to SMEs for a long time. Personal contact is maintained with entrepreneurs. Assistance has been sought from the IDRC to improve both the capacity and the activities of the IDB s information service. It is hoped to enhance co-operation with other institutions in the field of technological information.

Session 6

Chairman
Dr. Kevin Seneviratne

6/1 Mr. Hohd. Shazali Hj. Othman

Technology Information Databases for Networking

Technology information is a valuable national resource and its use is vital to everybody concerned, from government to the private sector. Problems arise when the available information resources in a country are not conveniently located and are not geared to easy access by those who need the information.

In Malaysia, SIRIM is both a user as well as a provider of technology information and has, over the years, developed its own databases primarily for its in-house needs, and also with a view to catering to the future, possibility of sharing information with others through a networking facility. The networking requirements to access SIRIM's databases have been made as simple as possible in order to induce more clients to join. At the same time all information Nodes are encouraged to develop databases of their areas of specialization so as to make the exercise of networking more meaningful. It is usually costly to obtain information from outside the country.

The ultimate objective of all these efforts is to develop an Industrial Technology Information (ITI) system spread over three phases. However, there is no legal or statutory framework withing which the ITI system is designed to be developed. All R & D institutions, universities and other establishments both in the public and private sectors are expected to voluntarily co-operate with one another. "Information at right time, right place and in right format" is said to be the driving force behing all these efforts.

Discussion

When industrialists or investors seek information, communication within the country is done manually because still two-way networking facilities are not available. consideration has, however, been given to the feasibility and posibility of having a two-way local network. This concept is said to have proved successful in Korea. Usually it is quite difficult to convinece the potential participants without a prototype. We hope to emulate the Korean model.

6/2 Mr. N.U. Yapa

Computerization of Scientific and Technological Information : NARESA's experience

Computerization of SLSTIC activities had two main objectives. Firstly, It was intended to improve capabilities of SLSTIC and thereby expand its activities. Secondly, it was aimed at promotion of exploitation of the modern information technologies by libraries in Sri Lanka. Two factors were considered in the selection of computer applications : (a) activities that required participation of other S & T libraries. SLSTIC wished to share its experiences in computer applications with cooperating libraries with the view of encouraging them in using computers (b) activities that would help SLSTIC to produce improved information products. UNICAST was selected as the first project for computerization. It was observed that many libraries were enthusiastic in the project and indicated their willingness to participate actively in the computerization activities. This was the first opportunity that was available to many library personnel to experience computer applications. Another major project undertaken by SLSTIC was, compilation of a cumulative list of periodicals holdings in science and technology available in libraries in Sri Lanka. The SLSI project was launched by SLSTIC in 1977 to collect analyse, organize, store and disseminate local S & T literature. Selective Dissemination of Contents Pages (SDCP) project was launched in 1984 with the cooperation of 24 libraries attached to organizations interested in agriculture and allied fields to provide a user-oriented service. SLSTIC used its computer systems to compile the SDCP scheme. SLSTIC was designated by UNESCO/PGI as the national distribution centre for CDS/ISIS Software in Sri Lanka. SLSTIC will be in a better position to organize computerized coopertative programmes when the libraries in SLSTINET have more personnel knowledgable and experienced in computer applications.

Discussion

At least 40 libraries have received CDS/ISIS package from SLSTIC. Library personnel of many of these libraries have been trained by SLSTIC. A committee appointed by S & T librarians have designed a common bibliographic format for structuring the databases using CDS/ISIS. This would ensure exchange of data among libraries and operation of data sharing programmes.

Observations and Recommendations

Observations

While recognizing the slow pace of economic development in Sri Lanka, in contrast to other countries in the Asian and Pacific Region, the Workshop felt that -

THE TECHNOLOGICAL TRANSFORMATION OF SRI LANKA THROUGH DISSEMINATION AND DIFFUSION OF INORMATION ON AVAILABLE TECHNOLOGIES TO ENABLE BETTER UTILIZATION OF TECHNOLOGY AND ADOPTION OF THESE TECHNOLOGIES WAS THE KEY TO DEVELOPMENT.

Recommendations

1. A Steering Committee comprising the following be appointed

Mr. N.U. Yapa	(NARESA)
Mrs. G. Abeydeera	(SLBDC)
Mr. S. Shanmugarajah	(IDB)
Mrs. S.M. Wijewansa	(SLSI)
Miss C.L.M. Nethsinghe	(CISIR)

A representative from the Federation of Chambers of Commerce & Industry of Sri Lanka

in order to :

(1) Study the existing technology information systems.

(2) Evaluate the infrastructure for handling technology information.

(3) Study and report on the feasibility of establishing a technology information network,

and submit the report to NARESA within 06 months.

2. The concept of a Facility for Handling Technology Information to be changed to that of an active Information Centre rather than a passive library.

3. A specialisation scheme be introduced whereby an Information Centre strengthens its resources in the area of specialisation assigned to it, and in so doing makes better use of the resources in other Centres so that duplication of resources within the country is minimised.

4. Standardisation of procedures used in Information Centres, wherever possible, to facilitate interchange of information

5. Compilation and maintenance of a database of Industries in Sri Lanka

6. Funding be made available through the government and other sources for :

   (a) A country-wide survey of Information needs of Industry

   (b) Strengthening the resources of Technology Information Centres

   (c) Human resources development i.e. training of information personnel and users of technology information

7. Organization by APCTT of other Workshops relating to Technology Information

8. Assistance be provided by APCTT for training programmes and study visits of Technology Information personnel to Centres of excellence in the region.

Annexure I

PARTICIPANTS & RESOURCE PERSONS

1. Ms. Gayathree Abeydeera
   Deputy Executive Director,
   Sri Lanka Business Development Centre,
   Colombo 03.

2. Mr. Neville Abeysundera*
   Consultant Mechanical Engineer,
   Development Finance Corporation of Ceylon,
   Colombo 03.

3. Dr. Anton Balasuriya,
   Chairman
   Sri Lanka Business Development Centre,
   Colombo 03.

4. Mr. M.A.T. de Silva,
   Deputy Director General,
   Natural Resources, Energy & Science Authority
   of Sri Lanka
   Colombo 07.

5. Dr. R.L. de Silva,
   Consultant
   Janatha Estates Development Board,
   Colombo 03.

6. Dr. Sahubudeen Faruque*
   APCTT
   SINGAPORE.

7. Mr. Anton Fernando*
   General Manager,
   National Engineering Research &
   Development Centre
   Ekala.

8. Mr. R.D. Gunapala,
   Manager,
   Equipment Finance,
   National Development Bank,
   Colombo 01.

9. Dr. T. Habarakada,
   Officer in Charge,
   Pilot Plant & Design Section,
   Ceylon Institute of Scientific & Industrial Research,
   Colombo 07.

10. Dr. E.R. Jansz
    Director,
    Ceylon Institute of Scientific and Industrial Research,
    Colombo 07.

11. Dr. G.C.N. Jayasuriya
Director,
National Aquatic Resources Agency,
Colombo 15.

12. Dr. Nilyardi Kahar*
Consultant,
APCTT,
Bangalore,
INDIA.

13. Mr. Sarim Kol*
Consultant-APCTT,
Bangalore,
INDIA.

14. Ms. Clodagh L.M. Nethsinghe*
Head, Information Services,
Ceylon Institute of Scientific & Industrial Research,
Colombo 07.

15. Mr. Nohd Shazali Hj Othman*
Head, Patent Information Centre,
Standard and Industrial Research Institute,
MALAYSIA.

16. Dr. V. Pathirana,
Research Officer,
Mineral Technology Section ,
Ceylon Institute of Scientific & Industrial Research,
Colombo 07.

17. Mr. G.L. Perera,
Director,
Technical Services,
Greater Colombo Economic Commission,
Colombo 01.

18. Mr. G.A. Piyadasa*
Deputy Director,
National Planning Division,
General Treasury,
Colombo 01.

19. Mr. W. Ranasinghe,
Librarian,
Agrarian Research & Training Institute,
Colombo 07.

20. Mr. D.B.J. Ranatunga*
General Manager,
State Mining & Minerals Corporation,
Colombo 08.

21. Mr. N.B.M. Ranatunge,
Senior Scientist,
National Building Research Organization,
Colombo 07.

22. Ms. Sriya Samaranayake,
Asst. Director,
Sri Lanka Export Development Board,
Colombo 03.

23. Dr. Kevin Seneviratne,
Lecturer,
University of Colombo,
Colombo 7.

24. Dr. Nawaz Sharif*
Director,
APCTT,
Bangalore,
INDIA.

25. Dr. T.R. Sharma*
Director,
Defence Food Research Laboratory,
INDIA.

26. Mr. C.S. Shanmugalingam*
Director Planning,
Industrial Development Board,
Moratuwa.

27. Mr. Shree Shanmugarajah,
Actg. Director,
Industrial Information Division,
Industrial Development Board,
Moratuwa.

28. Ms. Shamini Tennekoon,
Librarian
Industrial Development Board,
Moratuwa.

29. Ms. Dilmani Warnasuriya,
Senior Scientific Officer (Information),
Ceylon Institute of Scientific & Industrial Research,
Colombo 07.

30. Mr. U. Wadanapathirana,
Senior Economist,
Central Bank,
Colombo 01.

31. Mr. L.C.A. de S. Wijesinghe,
Addl. Director-General,
Natural Resources, Energy & Science Authority
of Sri Lanka
Colombo 07.

32. Dr. R.C. Wijesundera,
Senior Research Officer,
Agro-Industries Section,
Ceylon Institute of Scientific & Industrial Research,
Colombo 07.

33. Ms. S. Malathi Wijewansa,
Director (Information & Documentation),
Sri Lanka Standards Institution,
Colombo 03.

34. Mr. N.U. Yapa *
Director - Information,
Natural Resources, Energy & Science Authority
of Sri Lanka
Colombo 07.

35. Dr. S.M. Junaid Zaidi*
Adviser Technology Information - APCTT,
Bangalore,
INDIA.

(* Resource Person)

Annexure 2.

NATIONAL WORKSHOP ON INFORMATION SYSTEMS FOR PROMOTION AND UTILIZATION OF TECHNOLOGY

4 - 7 October 1988, Colombo, Sri Lanka

JOINTLY ORGANIZED BY NARESA, CISIR AND APCTT

VENUE: 4th October 1988 at the CISIR Auditorium
5th, 6th & 7th October 1988 at the NARESA Auditorium

PROGRAMME

4 October 1988	INAUGURATION	
	Chairman	Mr. L.C.A. de S. Wijesinghe, Addl. Director General, NARESA
9.00 a.m.	Welcome address	Mr. L.C.A. de S. Wijesinghe
		Dr. E.R. Jansz Director, CISIR
		Mr. Sharouh Sharif Assistant Resident Representative, UNDP
	Inaugural address	Hon. Dr. Anandatissa de Alwis, Minister of State and Information
	Keynote address	Dr. M. Nawaz Sharif Director, APCTT
10.30 a.m.	Tea Break	
11.00 a.m.	SESSION I	
	Chairman	Dr. E.R. Jansz
	Integration of Technological Consideration in National Development Planning	Dr. Nawas Sharif
12.00	Lunch	
2.30 p.m.	Technology Transfer, Development and Promotion: Problems and Issues in Sri lanka.	Mr. Neville Abeysundera, Consultant, DFCC
3.30	Tea Break	

	Chairman	Mr. M.A.T. de Silva
3.45 p.m.	A Framework for Technology Based Planning	Dr. Nawaz Sharif
5 October 1988	SESSION II	
	Chairman	Dr. G.C.N. Jayasuriya
9.00 a.m.	Technology Information Systems for Technology Development and Utilization	Dr. S.M. Junaid Zaidi, Consultant, APCTT
10.00 a.m.	Information needs in Technology - NERD's Experience	Mr. Anton Fernando, General Manager, NERD Centre
10.45 a.m.	Tea Break	
	Chairman	Dr. R.L. de Silva
11.00 a.m.	Critical Appreciation of Information Systems for Promotion and Utilization of Technology in Sri Lanka	Miss C.L.M. Nethsinghe Head, Information Services, CISIR.
12.00 noon	Lunch Break	
1.30 p.m.	SESSION III	
	Chairman	Dr. Nawaz Sharif
	APCTT's Technology Information Model	Dr. S.M. Junaid Zaidi
3.00 p.m.	Tea Break	
3.15 p.m.	Patent Information System	Mr. Mohd Shazali Hj Othman
4.15 p.m.	Technology Transfer of Processed Food: Experiences of Defence Food Research Laboratory	Dr. T.R. Sharma, Director, DFRL
6 October 1988	SESSION IV	
	Chairman	Dr. Anton Balasuriya
9.00 a.m.	Methodologies for Promotion of Technology Utilization and Role of Technology Information with reference to Asia and Pacific	Mr. Sarim Kol
10.00 a.m.	Critical Evaluation of Indigeneous Technology	Mr. D.B.J. Ranatunga, General Manager, State Mining and Minerals Corp.,
10.45 a.m.	Tea Break	

11.00 a.m.	Promotion of Technology Utilization Policies and Procedures in Sri Lanka	Mr. G.A. Piyadasa, Deputy Director, National Planning Division, Ministry of Finance & Planning
12.30 p.m.	Lunch Break	
	SESSION V	
	Chairman	Mr. N.G.T.W.G. Seneviratne
1.30 p.m.	Technology Information Requirements from the Technology Management Point of View	Dr. Nilyardi Kahar
2.30 p.m.	Information Needs SMEs in the content of Sri Lanka	Dr. Mohd Shahabuddin Farugue Consultant, APCTT
3.30 p.m.	Tea Break	
3.45 p.m.	Information Needs SMI/SME - Sri Lanka Experience	Mr. C.S. Shanmugalingam Director/Planning, IDB
4.15 p.m.	Prepartation of Draft Final Report	
7 Octobwe 1988	SESSION VI	
	Chairman	Dr. Kevin Seneviratne
9.00 a.m.	Technology Information databases for networks	Mr. Mohd Shazali Hj Othman
10.00 a.m.	Computerisation of S & T Information NARESA Experience	Mr. N.U. Yapa Director Information, NARESA
10.45 a.m.	Tea Break	
	Conclusion Chair person	Miss C.L.M. Nethsinghe
11.00 a.m.	Discussion of Final Report and Recommendations	
12.00 noon	Lunch Break	
1.30 p.m.	Discussion of Final Report and Recommendations.	

Annexure 3.

Welcome Address

Mr. L.C.A. de S. Wijesinghe,
Additional Director-General
NARESA

Hon. Dr. Ananda Tissa de Alwis, Minister of State and Information, Dr. Navaz Sharif, Director, Asia Pasific Centre of the Transfer of Technology; Mr. Sharouh Sharif, Assistant Resident Representative, UNDP; Dr. Jansz, Director, CISIR; distinguished Guests and Participants:

It is my pleasant duty today to welcome all of you on behalf of the organizers NARESA, CISIR and APCTT to this Workshop on Information Systems for the Promotion and Utilization of Technology. Information systems is an aspect of communication, and communication is a skill that you, Honourable Minister, have developed to perfection and this has earned for you the prestigious honorary degree, Doctorate of Letters. We are therefore specially happy to have you with us to inaugurate this workshop and address the participants. We are thankful to you for having spared the time to attend this function in the midst of your heavy schedule of state duties.

This National Workshop on Technology Information is very appropriately sponsored by the three institutions, the Natural Resources, Energy and Science Authority (NARESA), the Ceylon Institute of Scientific and Industrial Research (CISIR), and the Asia Pacific Centre for the Transfer of Technology (APCTT).

The CISIR is the main laboratory complex that is responsible for carrying out testing, investigation and research, and for providing advisory services to industry. APCTT is an international institution for assisting the countries of this region in the transfer of technology. And NARESA is concerned with policy matters and establishing and providing information network services in identified areas.

One of NARESA's working committees deals specifically with the subject of science and technical information. One of the recent activities of this committee was to draft a national S & T Information Policy statement. One section of this statement deals with S & T information and industry. It identifies the various information linkages which should be developed and strengthened in the industrial sector.

In the national scene, in the sphere of science and technology, there were two very important events that took place in the last 12 months. One is establishment of the Council for Agricultural Research Policy (CARP) by an Act of Parliament. Now, this is a landmark event in scientific and technological development in this country. For the first time, S & T planning is being attempted on a sectoral basis covering such diverse areas as agriculture, spice crops, tea, rubber, coconut, fisheries, and forestry. These subjects fall within the purview of ten institutions in seven ministries.

The second important event, and one that is of more particular relevance to the subject of our Workshop, is the publication of an Industrial Policy statement by the government. The broad objective of the Industrial Policy Statement is to give a blueprint for strengthening the industrial sector in the country; to develop the sector so that it would provide more employment and income opportunities to the growing population. With our limited land area, agricultural development will soon reach the limits of expansion, and industry will have to play an increasingly important role in socio-economic development in our rural areas in the future.

The industrial policy statement is now being developed into a more detailed plan. It goes goes without saying that in such an industrial sector development plan, the development of relevant information systems should be accorded the highest priority.

Scientific and technical information is an indispensable resource which has to be harnessed and utilized if Third World countries like ourselves are to develop. The total knowledge of humankind is now said to double every eight years. To keep up with it, and to utilize it even in a few selected areas, organization, skill and planning, and the input of adequate resources are necessary. It is here that a very strong commitment by the government is needed.

Today, unlike at any other time in the history of man, the world is in the midst of a technological revolution. The advantages that Third World countries had, like abundant natural resources and cheap labour, are fast diminishing in importance. Knowledge, scientific and technological knowledge and capability is going to be the dominant resource of the future. The Third World countries which have progressed rapidly and those which will do so in the future are the countries that will master the skills of modern science and technology.

In this context Sri Lanka has one advantage. It has the basic requirement for a rapid take-off in that it has a very high literacy rate. But this alone is not enough. We have to build up a solid scientific and technological capability in selected areas.

We are thankful to Dr. Sharif and Dr. Zaidi of APCTT for proposing the holding of this workshop. They are here to help and guide the workshop. We also welcome the experts from overseas who have come as resource persons. No less , we are thankful to our local experts who have responded to our request to present papers at the workshop.

One of the objectives of the workshop is to sensitize the decision makers of the critical importance of technological information, and that more and more will the capability to absorb and use technological information be the limiting factor in socio-economic progress. I would like therefore to invite those of you who are not full-time participants to attend any of the workshop

sessions which may be of special interest to you.

Finally, I would like to welcome and thank all of you for your presence here today.

Annexure 4.

W E L C O M E A D D R E S S

Dr. E.R. Jansz
Director, CISIR

1. Honourable Minister of State and Information Dr. Ananda Tissa de Alwis, Ladies and Gentlemen, in welcoming you here today I would like to say a few words on the Workshop we are now inaugurating.

2. Glancing through the programme I noticed that the objectives of this National Workshop are two-fold (1) firstly to review information systems and identify needs and (2) secondly to survey experiences in the development and transfer of technology in Sri Lanka.

3. By organizing this workshop we have recognized the needs for strengthening information technology in Sri Lanka. This is crucial especially at a time when we lag so far behind industrial nations.

4. Further organization of an information technology base is also crucial for strengthening the horizontal transfer of technology process from local R & D especially cottage level and small scale industry.

5. However, I am not implying for a moment that information technology is a panacea for all our technological ailments. It is imperative that many other changes must take place. Among them being the greater involvement of technologists in the technology transfer process. There is also a need for strengthening technology transfer infrastructure and a Centre for Transfer and development of technology is considered very necessary.

6. I would now like to say something on the history of CISIR's involvement in information technology. Many years ago in 1957, just two years after the enactment of the CISIR Act, a Colombo Plan expert from Canada gave a special training course at CISIR in Science Librarianship. Thus giving recognition for the need for training staff to man information units. CISIR was the pioneer in this field in the country and soon others followed suit.

7. Over the years with the help of the Government grant and also assistance from Colombo Plan, British Council, USAID, Asia Foundation, World Bank, The Netherlands Government and so on, we have systematically built up an excellent collection of applied science literature, a collection which is unique in the region.

8. This collection has been catalogued, classified and indexed for all exploitation. The CISIR has always been aware of the country's needs and the library is being used by scientists, technologists, industrialists, academics and many others. In fact any accredited inquirer has access to our information base.

9. As regards to plans for the future, in early 1989, our Information Section will have access to a mini computer and will also have three micro computers which will be available to those visiting the library.

10. In 1989, CISIR will also have a data base in literature and on-going research activities in the field of medicinal and aromatic plants in the Asia pacific region.

11. We are happy to announce that CISIR is now a nodal point at the national level in the technology information network which is being organized by the Asia Pacific Centre for Technology Transfer (APCTT). This data base will serve to identify technologies in the Asia Pacific region that can be purchased by local industrialists.

12. Other plans include a local network of computerized information between the CISIR and the Sri Lanka Standards Institution (SLSI).

13. In the long term, CISIR has plans for an on-line access facilities to foreign data bases.

14. I am happy to welcome on behalf of the Ceylon Institute of Scientific and Industrial Research (CISIR), the Honourable Minister of State and Information, Dr. Ananda Tissa de Alwis. This is a special honour as it has been a very long time that we have had a Minister of Cabinet rank in our auditorium at a formal occasion - to my knowledge 20 years.

15. I also welcome to CISIR the members of the Asia Pacific Centre for Technology Transfer team, Dr. Nawaz Shariff, in particular, who has been an old friend of ours. The Asia Pacific Centre has an impressive record of work in the past three to four years. Its country studies on technology policy and planning has been a revelation. Their journal, The Technology Monitor is being widely used by scientists and technologists in this country. Their Technology Atlas Project has attracted considerable attention and would be of immense use to planners.

16. I also extend our welcome to specialist lecturers who come from the Republic of Korea, India and Pakistan. I also welcome the participants of this seminar and you ladies and gentlemen.

WORKSHOP ON INFORMATION SYSTEMS FOR PROMOTION AND UTILIZATION OF TECHNOLOGY

Keynote Address
by
M. Nawaz Sharif
Director, UN-ESCAP/APCTT

Over hundreds of centuries, human societies have gradually evolved from their sole dependence on mother nature to a predominantly human-made world. This change was possible through the use of technology. Thus the society that we live in today has come to be known as a technological society. With our ever-increasing dependence on technology it is quite natural that promotion and utilization of technology is considered as an important issue by all countries. Our individual life-styles, the quality of life in the society we live in, and the status of our country in the world community -- are all very much dependent on the level of our technological advancement.

Currently the pressure from overpopulation and the rising expectations of the people in developing countries are therefore exerting a strong demand for rapid technological advancement. This is because, in spite of its shortcomings, technology has taught humankind at least one important lesson - nothing is impossible!

It is customary to use per capita income as an indicator of national development. However, some countries which have attained high income through the export of naturally available resources are not considered as developed. Furthermore, we can see that many developing countries may be rich in natural resources and culture but they are indeed very poor in terms of technology. In other words, what I am saying is that developing countries are in fact technologically underdeveloped. It may therefore be worthwhile to establish technology-based measures to represent the level of development. For this purpose, let us look into the role of technology for economic growth.

The conversion of natural resources to produced resources for economic growth is achieved through the production system of a country consisting of a series of transformation activities which may be described in terms of inputs, outputs, transformer and climate. The inputs going into the transformation operation may include natural resources and intermediate goods. The outputs may be consumer goods, intermediate goods and capital goods. Technology, is the transformer and the core of the transformation activity. The national technology climate is the setting in which the transformation activity takes place.

In this context of economic transformation of resources, technology may be regarded as a combination of both the physical tool and the related know-how, either to make or use that tool. Viewed in this manner technology can be disaggregated into four embodiment forms, namely: object-embodied technology (Facilities or Technoware); person-embodied technology (Abilities or Humanware); document-embodied technology (Facts or Inforware); and institution-embodied technology (Frameworks or Orgaware).

Any resource transformation can take place only when all four components of technology are present at a certain minimum level. Facilities need operators with certain abilities. Abilities have to be strengthened gradually from operation to improvement and generation of facilities. Facts representing accumulated knowledge need to be updated regularly, while the frameworks have to continually evolve to meet changing requirements.

Further scrutiny of productive activities of our societies would reveal that the inputs to any transformation activity enter the system with a certain technology content and the outputs leave with a higher technology content - the difference is the technology content added. This technology content added is a direct result of the contribution of the four components of technology utilized for transformation.

One simple indicator of the level of technological development of a country could be the relative difference between the technology-content of its imports and exports. It is well known that the developing countries export mostly products of low-technology-content (such as agricultural goods and industrial raw materials). Prices of these low-technology-content exports in the international market fluctuate widely. On the other hand, the developing countries import mostly high-technology-content products (such as machine tools and production facilities). Prices of these high-technology-content products have been continuously increasing. Moreover, in most of the developing countries, the volume of exports is much small compared to the volume of imports, and the commodity prices in the international market have fallen sharply over the last few years. Thus the balance of payment situation for many developing countries is becoming worse day-by-day.

It may be obvious, therefore, that achieving a balanced state of trade in terms of "technology content" is nowadays considered to be the key strategy for sustainable development. This is qualitatively different from

the import-substitution and export-promotion strategies of industrialization. The core of the new strategy is a deliberate attempt towards achieving a balanced state of "technology exchange". In other words, it can be called a strategy of "buy-some-and-make-some technologies". Buy-some means importation from other countries, and make-some means indigenous generation for local consumption as well as export to make import possible. The developed countries have been following this strategy for quite sometime.

Even the developing countries have come to realize now that technology-content should be used as a yardstick for evaluating the status of international trade, and thereby for assessing national development. Thus, there is a felt-need to formulate the national socio-economic development plans in terms of programmes and projects, taking into consideration the aspects of importation, generation and exportation of technologies. How to realize this felt-need is, however, not well understood.

At the national level it is being recommended that a new approach be used in the development planning process which may help an organic integration of technological aspects with the socio-economic aspects of national development. However, one prerequisite for the utilization of technology as a strategic variable in national planning is the establishment of a practical decision-support-information-base which would enable the planners in the developing countries to probe questions, such as: What is the current status of the country's technological capabilities? What are the immediate and long-term technological needs of the country? In which technological areas has the country high-potential in the international market? Which technologies should be targetted for specialization? And so on. Thus, information related to these questions are essential for technological development, which would eventually improve the living condition of the people in the developing countries.

As far as information is concerned, I think the basis for effective acquisition and utilization of any technology -- is timely, topical and understandable information, not only on what is happening in the developed world but, perhaps, more importantly what is happening in one's own country as well as in the neighbouring countries. It is well known that there is a wide gulf between information generators and information users. There may be reasons for this, such as, information generated by technical experts may be incomprehensible to non-technical persons; lack of mechanisms for prompt dissemination of information; and in many cases the information generated has no relevance to the pressing needs of the users.

When we are talking about information services, it may be useful to remember that the quality and value of information has to be improved step-wise with the increase in technology-content. Examples of increasing levels are: familiarizing facts, describing facts, facts on specifications, utilization facts, comprehending facts, generalizing facts and facts for assessment. The value of the information provided increases as we move up this ladder.

Before I conclude, please allow me to say a few words regarding technology transfer and appropriate technology.

It is obvious that technology is a marketable commodity and therefore technology transfer is a commercial transaction between a buyer and a seller. Technology is not given away free! Technology is owned by its producers and ownership is protected by proprietary rights. Furthermore, we must note that the technology market is imperfect. Critical information is closely guarded and the technology transfer price is determined by the relative bargaining positions of the seller and the buyer. A buyer with a high technological capability stands a much better chance of negotiating favourable terms.

As far as appropriate technology is concerned, please note that it is a circumstance-dependent, value-based, dynamic concept. Technological appropriateness is not an intrinsic quality of a technology, it depends upon the objective for the use of any technology. Suggestions for the use of labour-intensive technologies in developing countries seem to overlook the fact that having a large population does not necessarily mean the existence of a high level of human embodied skills and knowledge, without which the physical tools are mostly useless.

Finally, the conclusion. For meaningful integration of technological considerations with the socio-economic development planning process, it is essential that the analyses performed by the economists and the technologists be mutually supportive. Using the four embodiment forms of technology as the basis of enquiry, it is possible to achieve complementarity between conventional economic planning and technology-based planning at the firm, industry, sectoral and national levels. APCTT has developed a comprehensive and detailed framework for development planning using such techno-economic considerations.

However, I would like to caution you that technology-based development planning cannot be left to chance, it has to be by choice. It can be achieved only by determination, resolve and a strong political will -- a will to chart one's own future using technology as a means for development.