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9. ABSTRACT
A large number of research and development activities on appropriate technologies is being conducted in many countries in Asia. The governments of the LDCs are providing some support for most of those R&D activities. However, no coordinated effort is being made to maximize the use of available resources. Another bottleneck is the lack of viable information systems, both inter-country and intra-country. In some instances this results in duplication of R&D efforts. A coordinated global network of Appropriate Technology Centers (ATCs) should be established. This should be accomplished by strengthening national or private organizations that have demonstrated capabilities for this type of R&D. In-country linkages should be encouraged with regional institutions to maximize the multiplier effects within a given country. Information exchange systems should be established to link local ATCs in a network, so that each can be an information source. These local information resources should be aggregated in national data banks that are coordinated on a regional (multinational) level to ensure uniform exchange policies and practices.

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APPROPRIATE TECHNOLOGY STUDY:

SOME BACKGROUND CONCEPTS, ISSUES, EXAMPLES AND RECOMMENDATIONS

A Working Paper

by

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for

The United States Agency for International Development

April 1976

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SUMMARY

This paper has been prepared at the request of the United States Agency for International Development (AID) as one of a series of working papers leading to a detailed proposal for carrying out the appropriate technology section of Section 107 of the Foreign Assistance Act. Of the funds made available for fiscal years 1976, 1977 and 1978, a total of $20,000,000 may be used for activities in this field of Appropriate Technology through grants in support of an expanded and coordinated private effort to promote the development and dissemination of technologies appropriate for developing countries.

The primary focus of this working paper is on the current state of the art in a number of countries in Asia. Initial attention is devoted to the need for a sound technological base or foundation in the lesser industrialized countries (LIC's), stressing the need for achieving technological self-reliance. In this context, particular attention is devoted to university-government interaction because of the outstanding bottlenecks in providing the necessary manpower skills and policies for generation and diffusion of appropriate technologies. Some examples of on-going activities in appropriate technology in countries in Asia are presented, summarizing who is doing what, and indicating government attitudes and policies as much as possible. The related need for technology information exchange systems, both inter-country and intra-country is examined. This is followed by brief attention to the interrelationships of appropriate technology and entrepreneurship. The paper concludes with recommendations to establish a global network of Adaptive or Appropriate Technology Centers (ATC's)

and related information exchange systems, including regional (multinational) data banks. The recommended ATC's would be integral components of existing institutions with demonstrated capability for the necessary research, development and dissemination.

I. INTRODUCTION

It is agreed that a sound technological base must be established as a key ingredient of economic and social development. Indeed, heads of government in many of the lesser industrialized countries (LIC's) have stressed the significant role that science and technology must assume in achieving national goals with an ultimate objective of the improvement of the "quality of life" of all the people. In many cases, advancements have been made in education, employment, health, and housing. Unfortunately, the facts demonstrate a worsening of man's plight in a large number of developing countries. There is an ever widening gap between the poor and rich countries, and an even wider gap between the poor and rich people in a given country. Today one notes increasing attention to the poor in the LIC's on the part of techncial assistance groups from the technologically advanced countries of the world. Indeed, the International Bank for Reconstruction and Development proposed a major strategy for rural development as a basis for its program for a second five-year plan for the years 1974 - 1978.[1] The major goal is to reduce the ever growing gap in living standards between the rich nations and the poor nations, and within the LIC's themselves.

It is the premise of this paper that the questions of technical assistance and concepts of technology transfer, technological leap-frogging, intermediate technology, adaptive technology and appropriate technology for the LIC's have been debated for too many years. The time has come for action. The action is the need for a global linkage of Appropriate Technology Centers (ATC's) for the necessary applied research

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[1]References

and development activities, including information exchange systems. This has decided implications on the roles of universities and governments.

One piece of wisdom distilled from the last 25 years of international attention focused on the developing areas of the world is that education and training play a critical role in the realization of even modest goals of economic and social development. Although the precise dimensions of the contributions of education and training to national economic and social goals are a continuing subject for intensive research, many studies suggest strongly that the economic return from educational investment is real and measurable.[2,3]

In the developing countries, experience indicates that attempts to accelerate economic and social growth have often floundered due to the lack of various types of trained manpower. The manpower problem can often be solved through greatly expanded or redirected educational and training programs. Concurrently, the social demand for education and training everywhere grows and requires fulfillment. These economic and social objectives point to the necessity for long-range educational planning by individual countries in order to assess and evaluate manpower requirements in terms of development. The role of education in development is further reinforced by the experience since World War II of the enormity of resources, both human and material, that have been expended to accelerate the process of economic growth in low-income countries. Unfortunately, progress has been slow and therefore expectations have frequently not been fulfilled. Indeed, many authorities have felt for quite some time that major changes will have to be made with regard to the strategies and policies that have guided economic development in the 1950's and 1960's.

For example, it is now generally agreed that the urgent problem of employment creation is not only due to the population explosion, but also to developmental strategies based largely on capital-intensive, labor saving technologies borrowed from Western countires. One aspect of this borrowing has been the adoption of Western educational and training systems. This has proven to be a major obstacle to the growth of skilled manpower since the transferred educational systems lack relevance to local conditions and needs. One consequence is the "brain drain" problem, which reflects the limitations of the transferred curricula as well as the general lack of relevance of most programs in Western universities to the needs of Asian students.

Internal population pressures and the effects of external events demand rapid economic and social development for many of the countries of Asia, Africa and Latin America. Central to such development is sound investment in an imaginative educational system oriented to produce necessary and relevant skills. In fact, planners at both national and regional levels are becoming more fully aware of the extent to which investment in relevant education and training contributes to the process of economic and social growth.[4,5] If a society is unable to develop its human resources, it cannot develop much else, be it technology, political or social institutions, material or cultural welfare, or its economy.

In recent years, a number of governments have formulated significant policies on the role of science and technology in development. However, these policies function in a vacuum unless there is viable interaction among government, the universities and the industrial sector.

The primary purpose of this paper is to present examples of ongoing and planned applied research and development activities in appropriate technologies in a number of ocuntries in Asia. Attention will also be devoted to the need for effective information systems, and agents of adoption and diffusion (entrepreneurs) of appropriate technologies. There are many interrelated issues and problems involved in the establishment of indigenous research and development activities comprehending appropriate technologies. Intitial attention will be given to the roles of the University and Government in providing the necessary technological capabilities for research and development of appropriate technologies.

II. THE ACHIEVEMENT OF TECHNOLOGICAL SELF-RELIANCE

Experience demonstrates the need for indigenous research and development program activities in economically-depressed areas which would adapt, innovate and diffuse technologies appropriate for local economic, social and cultural conditions. The choice of technology to be generated and diffused must be intimately related to priority development objectives, particularly increased employment opportunities, balanced income distribution and more efficient use of locally available materials, but at the same time the technology must be socially acceptable. Thus, the process of technology adaptation and innovation entails a major policy concern for reconciling the needs to generate increased employment opportunities as well as increased production.

Several significant issues are involved in the establishment of indigenous research and development activities. For example, it is

realized that a sound technological base must be established to promote economic and social growth in the developing countries. This has direct implications for national policies, and for the articulation of viable networks of public and private organizations, which focus on the development and effective utilization of indigenous scientific and engineering capabilities. However, there must also be considerable emphasis on development planning and development administration/management. It therefore follows that early attention must be given to education and training programs for developing indigenous skilled manpower for formulating and implementing national and regional development goals. This, in turn, requires upgrading and retaining faculty in institutions of higher learning in order to produce graduates qualified for, and interested in, problem-solving approaches to economic and social growth. This requires strengthening the capabilities of these institutions to provide relevant education, research and training. There is need for greater cooperation among university, government, industry and civic groups in order to maximize the contribution of each in the development process. Other significant issues include public policies regarding government support, tax incentives and import regulations. There is also urgent need for attention to small-scale entrepreneurship development in the context of the adoption and diffusion of employment-generating technologies. Finally, the role of regional cooperation must also be assessed.

In summary, if developing countries are to achieve technological growth as a basis for sound economic and social development, it is

imperative that they develop their own scientific and engineering capabilities. This problem area was the theme of a Seminar on Relevance in Engineering Education for Asian Needs with Workshop on Nature and Concept of Intermediate Technology held at the East-West Center in February 1972. The Seminar-Workshop involved a panel of eminent technologists from key Asian institutions of technology and American universities. The main result of this Seminar-Workshop was a summary of defining characteristics of intermediate technology:

1. low investment as compared to local income;
2. easy maintenance;
3. high employment potential;
4. high local content (low import content);
5. compatibility with local sociological conditions;
6. low dependence on complicated infrastructure;
7. better productivity than existing technology in the same field.

It is significant to note that the above criteria were obtained from Asian engineering educators and practitioners. It is of further interest to note that this same group recommended that the concept of "appropriate technology" be adopted rather than "intermediate technology." Figure 1 shows the necessary interrelationships for generation and diffusion of appropriate technologies.

EAST-WEST TECHNOLOGY AND DEVELOPMENT INSTITUTE

CONCEPT OF GENERATION AND DIFFUSION OF APPROPRIATE TECHNOLOGIES

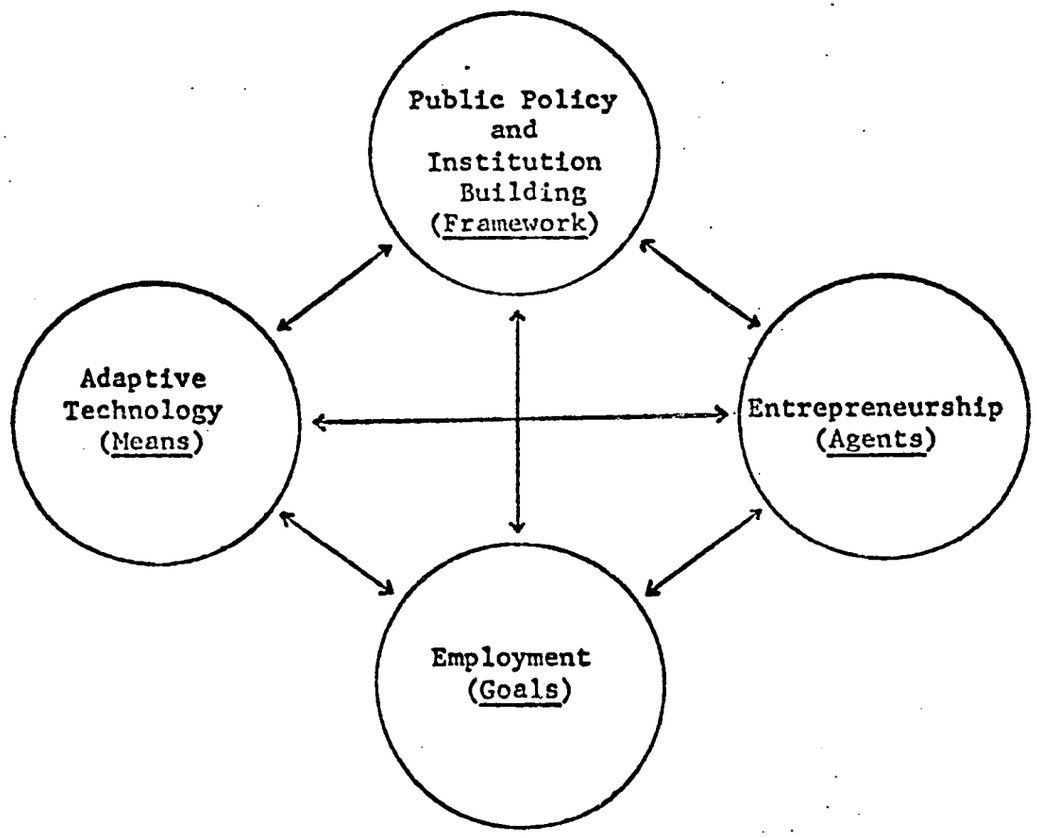

Figure 1

1. Appropriate Technology satisfies:

   a. low investment as compared to local income
   b. easy maintenance
   c. high employment potential; "job generating"
   d. high local content--low import content
   e. compatibility with local sociological conditions
   f. low dependence on complicated infrastructure
   g. better productivity than existing technology in the same field.

2. Public policies must provide a viable institutional framework conducive to the concept and practice of employment-generating technologies.

3. Indigenous entrepreneurs must adopt and diffuse such technologies to create more employment.

4. Some examples of projects on appropriate technology:

   a. Low-cost construction materials for housing, water supply and waste disposal systems, grain storage, etc.
   b. Decentralized power sources;
   c. Simple tools and equipment for agriculture and manufacturing.

II. THE ROLE OF THE UNIVERSITY

One can define the role of a University in almost any society simply in terms of two basic functions, namely, the provision of necessary human resources to serve the society and the provision of new knowledge. In these contexts and in terms of technological development of the lesser industrialized countries, one can identify the role of the University as follows:

1. Necessary human resources to serve the society.

   a. Appropriate fields of study. It is not uncommon to hear that in LIC's there are either too many lawyers, or pharmacists or even engineers. Most of these trained professionals never practice in the fields they pursued in the university, yet the universities continue to produce graduates in these fields. The LIC's, short as they are of trained human resources, can ill afford this extravagance or waste. The university, in its academic program planning judicious use of limited financial resources, must take into consideration national needs and national development.[6] If such national human manpower study plans are not available, the university must take steps to assist in the formulation of such plans. Taking time lag of perhaps 5 to 10 years into consideration, the university should provide counsel to new students on fields of study to be pursued so that each will find gainful employment upon graduation.

b. Relevance within appropriate fields of study. As pointed out earlier, the achievement of technological self-reliance is extremely important for the LIC's. Universities in LIC's simply cannot and should not copy the course contents nor curricula verbatim from those of the more industrialized nations. Perhaps unemployment of university graduates in LIC's is due to irrelevance in the course content as much as inappropriate field of study.[7]

c. Continuing Education. Often universities are accused of being ivory towers. Universities in the LIC's are not exempted from this. One way of measuring a university's involvement in the society to which it serves is the strength of its continuing education program. It is obvious that adult education is even more important in LIC's than the MIC's since a much higher percentage of the population in LIC's did not have the opportunity of higher education. Yet it seems that few universities in the LIC's are concerned with adult education nor continuing education. The university must constantly sponsor appropriate short courses, seminars, workshops and conferences which will serve to upgrade the adult population as well as keeping its graduates up to date. The provision of human resources is not limited to the supply of new graduates only.

d. Extension Service. With the emphasis on rural development today, the universities can effectively assist by encouraging its faculty and students to reach out into the rural areas through agricultural extension service, community development program, public health and family planning information, etc.

One university in Thailand provides such opportunities to its students during the long recess period between academic years. It should be pointed out that such efforts not only benefit the rural community, but likewise, the university itself. Only through constant contact with the real world can the university achieve its relevance.

2. New Knowledge

No university is complete without a research component to develop new knowledge. For LIC's, one extremely important area of research as discussed earlier is the development of appropriate technology. Such research, by its nature, can best be carried out by indigenous personnel. Unfortunately, a major problem in facilitating the role of technology in development is the lack of indigenous personnel who know their country and its ways and who understand how to adapt technology to existing conditions. It follows that local scientific and engineering expertise, with related supporting

facilities, constitutes a vital reservoir of skilled manpower to perform the research and development necessary to adapt and/or innovate technologies which have the ultimate objective of improving the quality of life in low-income countries. At the same time, in the context of the development process, multi-disciplinary teamwork involving the engineer, development planner and the development administrator/manager is of utmost importance. Attention must be given to the need for "technology by the people for the people." This does not suggest that people in the less developed countries should isolate themselves and reinvent the wheel. However, it does stress the importance of adapting existing technologies to local conditions and innovating appropriate technologies, with both adaptation and innovation by indigenous expertise.

An example of a specific role in technological development undertaken by three universities in different settings in Asia is examined in a recent TECHNOS paper.[8] This paper discusses the concept of a Regional Adaptive Technology Center (RATC) program as the guiding principle in the development of effective university-community interaction.

The RATC Project represents an emerging model of what cooperative efforts among interested institutions in the countries of East and West can do towards developing and improving indigenous institutional capabilities for development. The ultimate sucess of the project will depend upon the support provided by local and national government.

IV. THE ROLE OF GOVERNMENT

Speaking of government, the tendency is to think in terms of the central or federal government only. This unnecessarily limits the role of the government. One should think in terms of all levels of governments. As the work "govern" implies, government has the authority and power to direct and administer. It does so mainly through the determination of policies and guidelines. In the case of LIC's, the influence the government has over the universities is often more pronounced than in the MIC's since most of the principal universities in LIC's are government financed.

With authority goes responsibility, the government in LIC's must therefore do everything possible in its power to enable the universities to fulfill their roles. The following are some examples of the role of the government:

1. Manpower study.

   The government must assume the responsibility for formulating development plans. Such plans will necessarily include the study on manpower demand. As mentioned earlier, the university must then take these studies into account in its academic planning.

   Realizing the pool of exceptional manpower available in the universities, the government should call on the universities to assist in the formulation of manpower studies as well as national development plans.[9]

2. Institution building.

For the university to perform its role effectively, the faculty and staff must receive appropriate renumeration and have proper working atmosphere. The existing civil service pay is unrealistic to expect the university to perform its roles as described. If holding an appointment at the university is only one of several jobs the professor assumes, one can only expect or ask for mediocre results. Some governments have taken action to remedy this, such as Korea Advanced Institute of Science (KAIS) in Korea.

3. Research funds.

To bring relevance into programs of study and research in the universities, the government can so encourage them by making available funds specifically identified for indigenous research.

4. Science policy.

In LIC's, the establishment of a science policy is still a fairly new thing. Such policies, if properly determined, can, of course, greatly assist in the development of appropriate human resources and indigenous research. There are two areas which deserve special attention by LIC's. They are "brain drain" and "Labor Intensive Technology." The government should set such policies which would minimize brain drain and maximize the use of

labor intensive technology. Both of these will have significant effect on the development of the professional schools in the universities.

V. SOME EXAMPLES OF APPROPRIATE TECHNOLOGY IN ASIA

This section of the paper summarizes a wide cross-section of examples of appropriate technology in 11 countries in Asia, encompassing a total of 29 institutions. The summaries are presented in the form of country profiles, in which network affiliations are indicated as follows:

TDI/LCH	:	The TDI Low-Cost Housing Network
RATC	:	Regional Adaptive Technology Centers
TECHNONET	:	Those institutions affiliated with TECHNONET Asia
SIDN	:	Small Industries Development Network

A major comprehensive statement of the on-going activities of each institution profiled can be found in the reference sections at the end of this paper.

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDONESIA

Action Center: Institute of Technology at Bandung (ITB)

Contact(s): Prof. Hasan Poerbo, Dr. Filino Harahap (DTC)

Network: TDI/LCH

Selected Activities:

1. Entrepreneurship development
2. Development of non-depletable power sources
3. Increase productivity of handicraft industry
4. Collaboration with Hasanuddin RATC
5. Technology transfer
6. Technology development (collaboration with TOOL, The Netherlands)
7. Low-Cost Housing
    a. Current Research Areas
        1. Linkages in wood-based industries as context for identifying what kind of wood-based components for housing can be developed.
        2. Product development: wood-based components for housing
    b. Related Programs
        1. Cooperating with Regional Housing Center in Bandung
        2. Survey on linkages in wood-based industries
        3. Survey on housing markets and construction methods
        4. Formulation of performance specification for wood-based components

(Indonesia - ITB - cont'd)

5. Development and Testing of wood-based components
6. Prospective field lab
7. Promoting components for production and marketing

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDONESIA

Action Center: Directorate of Building Research/United Nations Regional Housing Centre

Contact(s): Ir. Albert Kartahardja, Director

Network: TDI/LCH

Selected Activities:

1. Binding Materials
   a. Urea Formaldehyde Adhesives
   b. Tannin Formaldehyde for particle board manufacturing
   c. Tannin Production from mangrove species
   d. Latex as binding agent for building board manufacturing
2. Building Element/Component
   a. Wood-wool Board Production
   b. Development of prefab concrete building elements and components
   c. Particle board - a pilot plant using post-mature rubber wood as basic material; located 90 km from Bandung. (With Belgian aid)
3. Housing Units
   a. Prefabrication of Houses
   b. Prototype houses
4. Timber Construction
   a. Development of Prefabricated Timber Structures
5. Waste Materials
   a. Development of particle board from forestry waste material

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: KOREA

Action Center: Korea Institute of Science and Technology (KIST)

Contact(s): Dr. Sung Do Jang

Network: TDI/LCH

Selected Activities:

The following research projects are already underway at KIST:

1. Utilization of Coal Wastes for Building Materials - Ceramic Materials Lab
2. Utilization of Zeolite in Waste Treatment - Environmental Engineering Lab
3. Styrofoam Concrete for Building Components - Plastic Lab
4. Study on Thermal Insulation and Fuel Economy in Building Units - Chemical Process Development Lab
5. Design and Development of Lime-Sand Brick Manufacturing Plant
6. Process Development of Autoclaved Lightweight Concrete

The following projects are being planned:

1. Improvement of existing technology in terms of quality as well as productivity
2. Search for new low-cost building materials such as calcium silicate brick and unburned structural materials.
3. Design and development of low-cost housing unit making use of new materials such as light-weight aggregates and expanded clay products

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: PHILIPPINES

Action Center: University of the Philippines

Contact(s): Dr. Ernesto Tabujara

Network: TDI/LCH

Selected Activities:

1. Current Research
   a. Memorial parks as a multi-use element in the design of Philippine communities
   b. Information classification and building typology for typical house types in the Philippines
   c. The Barangay as an operational system in the disposal of solid waste in urban areas
   d. Application of methane gas/septic tank system in housing design and layouts
   e. Use requirement study of a prototype urban workers condominium in Metropolitan Manila

2. Planned Research
   a. Asphalt impregnated building material study
   b. Investigation of industrial wastes for building purposes
   c. Identification and locational analysis of inorganic building material sources in the Philippines

(Philippines - UP - cont'd)

d. Design of building and finishing hardware for low-cost housing

e. Evaluation of industrially produced laminates for building purposes

f. Adaptation of traditional multi-use concepts to the development of multi-family housing projects in urban areas of the Philippines.

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: THAILAND

Action Center: Asian Institute of Technology (AIT)

Contact(s): Dr. Tongchat Hongladaromp

Network: TDI/LCH

Selected Activities:

AIT carries out an active program of research in engineering directed towards the problems of Asia. The applied technology projects are divided into six categories:

a. Water Science and Engineering

b. Transportation Engineering

c. Structural Engineering and Mechanics

d. Environmental Engineering

e. Geotechnical Engineering

f. Systems Engineering and Management

The following projects, identified by number, are typical of those dealing with appropriate technology:

a. #2132 - Storage of Rainfall for Drinking Water

b. #4106 - Ferro-Cement Bins for Hermetic Storage of Rice

c. #5027A - Flotation as a Method of Harvesting Algae from Ponds

d. #5031 - Nutritive Value of Sewage Grown Algae

e. #5033 - A Study of Filtration Methods for Providing Inexpensive Potable Water to Small Communities

(Thailand - AIT - cont'd)

The following is a list of current R&D projects being undertaken at AIT under the direction of Dr. Tongchat Hongladaromp and Dr. Ricardo Pama.

1. Mechanical Properties of Bamboo Reinforced Slabs
2. Design and Evaluation Criteria for Low-Cost Housing
3. Design of Asbestos Cement Houses for Low-Income Families
4. Prefabrication in Low-Cost Housing
5. Mechanical Properties of Wood-Cement Composites
6. A Study of Bamboo as Reinforcement for Slabs on Grade
7. Evaluation of a Corrugated Asbestos Cement Roof Panel
8. A Design of Low-Cost Rural School Building
9. A Performance Evaluation of a Low-Income Multi-Family Housing Systems
10. Design of Low-Cost Houses for Lower-Middle Income Families
11. Performance Evaluation and Design of Asbestos Cement Low-Cost Houses

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDONESIA

Action Center: Hasanuddin University

Contact(s): Samuel Sangka

Network: RATC

Selected Activities:

1. The RATC team is concentrating its efforts on motorizing traditional Indonesian sailing vessels. They recognize the need to harmonize technological innovation with the traditional style of "proa" building.

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: KOREA

Action Center: Yeungnam University

Contact(s): Gyong Chan Kim

Network: RATC

Selected Activities:

They have identified the following broad areas of concentration:

1. Entrepreneurship extension
2. Technological innovation in small-scale industry
3. In-service training for entrepreneurs and other agents of change.

In particular, they have begun to investigate the auto parts and rubberware industries of the Daegu Region.

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: PHILIPPINES

Action Center: Mindanao State University

Contact(s): Edilberto Milan

Network: RATC

Selected Activities:

1. Ceramics Center serves as both training center and demonstration plant.
2. Research on soil-cement for low-cost housing (including 3 research papers).
3. Training and technical assistance to set up low-cost housing villages on a self-help basis by RATC team.
4. An integrated coconut charcoaling and copra drying plant (in cooperation with local entrepreneurs and DBP).
5. Marine fishery research unit (technology dissemination and entrepreneurship).
6. The Tugaya Brassware Center bring appropriate technology to a traditional folk art (with NSDB and MIDRC).
7. Joint program with UP/ISSI to develop a core of Filipino Muslim entrepreneurs (cf. under UP/ISSI).

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: THAILAND

Action Center: Khon Kaen University

Contact(s): Boontham Tesna

Network: RATC

Selected Activities:

1. Upgrading traditional textile industry
2. Solving the problems of salt production
3. Improving the quality control of Thai meat processing
4. Improving traditional methods of brick making

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: BANGLADESH

Action Center: Bangladesh Small Industries Corporation (BSIC)

Contact(s): write c/o The Director

Network: Technonet

Selected Activities:

1. Development activities in the public sector
2. Promotional activities in the private sector
3. Industrial Estates Programme
4. Small Industries Advisory Service
5. Handloom Goods Export Corporation

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: HONG KONG

Action Center: Hong Kong Productivity Centre (HKPC)

Contact(s): William Newton, Executive Director

Network: Technonet

Selected Activities:

1. Providing technical information and extension services in the plastic mouldmaking inudstry
2. Technical Information Service
3. An examination of the technical and economic aspects of the electroplating industry.

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDONESIA

Action Center: Departmer Perindustrian (DP)

Contact(s): Mr. B. Kodijak

Network: Technonet

Selected Activities:

1. BIPIK provides guidance and assistance to small businesses
2. Upgrades technological and management skills for small-scale industry
3. Product testing services
4. Information services
5. Training instructors for specific industrial sectors
6. Assists with credit applications
7. Encourages formation of industrial cooperatives
8. Quality control programs

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: KOREA

Action Center: Korea Scientific and Technical Information Centre (KORSTIC)

Contact(s): Lee Sun-Kyung

Network: Technonet

Selected Activities:

1. Provides technical information on contract basis
2. Technical Consultant Service for small enterprises
3. Train industrial liaison officers

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: MALAYSIA

Action Center: Majlis Amanah Ra'amat (MARA)

Contact(s): Encik Mold Rasil, bin Mohd Nawi

Network: Technonet

Selected Activities:

1. Training Centre in Ferrocement Technology
2. Review of Ceramics Industry in Malaysia
3. Full-scale assistance to Malaysian furniture factories
4. Industrial extension services, such as technical information, management, market and product design
5. Established "new entrepreneurs program"

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: MALAYSIA

Action Center: Standards and Industrial Research Institute of Malaysia SIRIM (Formerly NISIR)

Contact(s): Hussin bin Omar, Vincent Choong (Information Service)

Network: Technonet

Selected Activities:

1. Innovative bamboo cutting knife developed
2. Glue manufacturing productivity increased
3. Improved output (quantity and quality) of nuts and bolts factory
4. Assisted in electroplating industry
5. Co-sponsorship of Technical Information and Extension Training Centre
6. Technical Enquiry Service
7. Technical Awareness Program
8. Review of the Malaysian foundry industry

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: PHILIPPINES

Action Center: Economic Development Foundation (EDF)

Contact(s): Caesar Sarino

Network: Technonet

Selected Activities:

1. To organize and disseminate technical information for small- and medium-scale enterprises
2. To complement government efforts in this sector
3. Technical Information and Extension Services project
4. Survey of the Greater Manila area to assess overall information requirements

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: PHILIPPINES

Action Center: University of the Philippines Institute for Small-Scale Industries

Contact(s): Leon Chico, Director

Network: Technonet
SIDN

Selected Activities:

1. Promotion and development of small industries through technical and managerial improvement
2. Conducted State of the Art Reviews in the wood furniture-making and shoe-making industries, recommending the use of labor-intensive technologies and transfer of appropriate technologies
3. Provides relevant economic, scientific, industrial and technical information to assist the small entrepreneur:
    a. Current Awareness and Service Program
    b. Industrial Enquiry and Extension Service
    c. Selective Information Dissemination Service
    d. Technology Assistance Program
4. Co-sponsor (with MSU) of a program to develop a core of entrepreneurship trainers for prospective Filipino Muslim entrepreneurs.
5. Co-sponsorship of workshops on "Industrial Quality Control" and "Analysis and Evaluation of Industrial Projects."

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: SINGAPORE

Action Center: Singapore Institute for Standards and Industrial Research (SISIR)

Contact(s): Dr. Lee Kum Tat, Freddy Soon

Network: Technonet

Selected Activities:

These are seven principal fields of coverage in SISIR's extension programme:

1. Environmental pollution
2. Instrumentation and calibration
3. Product development and process improvement
4. Quality certification
5. Industrial design
6. Technical information service
7. Liaison with industry

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: SRI LANKA

Action Center: Industrial Development Board (IDB)

Contact(s): Roshini Mariam George

Network: Technonet

Selected Activities:

1. Regional Development Division:
   a. Modernize existing industries
   b. Study industrial opportunities
2. Technical Services Division:
   a. Assist industries with technical problems
   b. Train extension officers

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: THAILAND

Action Center: Industrial Service Institute - Department of Industrial Promotion (ISI-DIP)

Contact(s): Mr. Ari Indhasorn

Network: Technonet

Selected Activities:

1. Prototype furnace
2. Information on heat treatment of metals assembled for small-scale industries
3. Setting up demonstration projects using "small, inexpensive, appropriate machinery
4. Established an Industrial Technical Information Centre
5. Arranging for credit for small industries
6. Establishing industrial estates
7. Assisting in market development
8. DIP runs a sizable handicraft retail shop in Bangkok which helps to export goods abroad

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDIA

Action Center: The Appropriate Technology Cell of the Ministry of Industrial Development

Contact(s): Bepin Behari, Joint Director

Network: No network affiliation

A Division of the India government's Ministry of Industry and Civil Supplies

Selected Activities:

1. Road construction
2. House building
3. Shaft-kiln cement plant
4. Cow dung gas plant
5. Publication - Appropriate Technology for Balanced Regional Development

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDIA

Action Center: The Small Industry Extension Training Institute (SIET)

Contact(s): Dr. P. C. Alexander

Network: No network affiliation

Established in 1962 as a Government of India Society

Selected Activities:

1. Training
2. Consultancy Services
3. Research
4. Documentation

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: PAKISTAN

Action Center: Intermediate Technology centre (Planned)

Contact(s): Dr. Z. A. Hashmi

Selected Activities:

The Pakistan Science Foundation, supported by the Ministry of Finance, proposed establishing this center in 1974.

Areas of interest:

1. Non-conventional energy sources
2. Water harvesting and conservation
3. Food storage, preservation and dehydration
4. Improve efficiency of small farms
5. Provide social services through appropriate technology
6. Manufacture of chemicals and other products from agricultural wastes.

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDIA

Action Center: CSIR/Madras (Structural Engineering Research Center)

Contact(s): Prof. Ramaswamy, Dr. Rao

Selected Activities:

1. Development of prefab and industrialized building techniques
2. Manufacture of prestressed concrete railway sleepers
3. Structural use of burnt clay blocks
4. Concrete waffle shells for low cost roofing

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDIA

Action Center: Council of Scientific and Industrial Research (CSIR)

Contact(s): Bal Dev Singh, Director, Technology Transfer Section

Selected Activities:

1. Polytechnology clinics - to deal with the problems of small and medium scale entrepreneurs
2. Information centers - to supply data regarding imports, exports, production, technical information
3. Design, development and investigation centers
4. Engineering consultancy groups
5. Task project - to identify specific tasks which require R&D treatment.

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDIA

Action Center: Central Building Research Institute, Rorkee (CBRI)

Contact(s): Prof. Dinesh Mohan

Selected Activities:

1. R&D on a variety of low-cost building materials and components
2. Developing simple gadgets for major building operations
3. A prototype house of brick shell with mud mortar
4. A waterproofing technique for mud walls
5. A fireproofing technique for thatch
6. Anthropometric studies
7. Studies of the impact of physical parameters
8. Publication of CBRI Abstracts
9. A publication which summarizes the R&D being done in low-cost housing and related subjects

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: INDIA

Action Center: The Action Research Centre for Entrepreneurship, Bombay

Contact(s):

Network: Private, non-profit, non-affiliated

Selected Activities:

1. Survey of communities
2. Locating potential entrepreneurs
3. Training entrepreneurs in small enterprise management
4. Providing initial assistance for entrepreneurs

APPROPRIATE TECHNOLOGY CENTERS PROFILES

Country: PHILIPPINES

Action Center: National Cottage Industries Development Authority (NACIDA)

Contact(s):

Network: An agency of the Philippine government with no network affiliation

Selected Activities:

1. Gives assistance to project studies
2. Provides training for cottage industry workers
3. Helps the cottage industry practitioner in securing loans, marketing and research.

VI. INFORMATION EXCHANGE SYSTEMS

Introduction

Large-scale applied research and extension operations expend considerable money and manpower to acquire appropriate resource documents, and they usually employ sophisticated and costly strategies for capturing, cataloging, and retrieving such data, in order to make these resources usable to on-going research, development, extension and training. They also employ sophisticated and costly techniques to produce, package, and disseminate their results, carefully targeting output to well-identified potential audiences and/or end-users. In such institutions, one finds cadres of information managers (librarians, information specialists, publication specialists, documentationalists, etc.) and data manipulators (abstractors, EDP operators, dartographers, multi-media specialists, etc.) managing the hardware and software linkages that constitute the institution's resource information system.

When one examines, however, the information acquisition and dissemination practices of many small-scale, low-budget applied research and extension efforts, especially those found in the third world, it soon becomes apparent that almost no systematic coordinated attention is given to resource information management. The cost of acquiring and maintaining a minimally relevant body of secondary resource information in a single area of investigation could consume the entire budget for a small-scale research team with limited resources. Even where the input of secondary information resources is not crucial to research design formulation, the extraction, storage and manipulation of primary data often remain problematical for the

small-scale, low-budget team. Designing appropriate data extraction instruments, training field collection teams, compiling and processing data compound the information management problems. Add to this, problems associated with the "packaging" and dissemination of knowledge and information gained through applied research and extension is in evidence in the third world.

The priority problem that must be addressed when one considers establishment and maintenance of information exchange systems to support the work of Appropriate Technology Centers such as those inventories in Section V of this paper is that sufficient manpower, material and capital resources are unavailable at these action centers to participate in information exchange systems as anything but receivers of information. Although each ATC is potentially a powerful sender of information on appropriate technologies for development, they are unable to adequately participate in this role. Designers and planners of technology information exchange systems for institutions in less industrialized countries (LIC's) must consider strategies for energizing existent centers for research and extension on appropriate technologies in the LIC's to participate more fully as senders (sources of information). Until this happens, the information load of exchange systems will be dominated by documents and data provided by the more affluent and sophisticated sources of information i.e. more industrialized countries (MIC's). Where the ATC's are seen as users of high technology such information transfer systems (MIC to LIC) would be appropriate. But the ATC's are involved in utilizations of "ground gripping" intermediate technologies. The ATC's themselves are the best sources of information in this domain.

Local Centers for Appropriate Technology Information

Research workers, technologists and others in ATC environments are generating a significant body of information and experiences in the field of adaptive technology. However, mechanisms to facilitate the sharing of this information have not been adequately developed and implemented at this point. As a result, the insights gained by these indigenous research and development teams are not adequately shared with potential local clientele. Furthere, these potentially valuable bodies of information and experience are unavailable to interested researchers and practitioners outside the research and/or extension team's local setting.

To resolve these recognized communications bottlenecks it is necessary to blend appropriate information management and packaging skills into on-going applied research and extension activities in order to facilitate the diffusion of relevant locally generated information to wider audiences. Information and documentation specialists, with capabilities to acquire, process and disseminate appropriate information in both print and multimedia formats, are needed in the field of appropriate technology. These specialists should become part of any localized appropriate technology research and extension effort.

Information exchange system designs for ATC's must be built around the role of these centers as senders as well as receivers of appropriate technology information. This is a major departure from most information exchange strategies which are designed to transfer documents and data from information-rich environments to information-need environments. The strategy proposed here is to build an information exchange system from the ground up beginning with the incorporation of strategies at the localized

ATC's to collect, screen, process, transform, package and disseminate local documents and data pertaining to appropriate technology.

These Local Centers for Appropriate Technology Information should be in a position to provide the following types of information:

1. Data on current appropriate technology projects and progress in the local community;
2. Packaged case-studies of the most noteworthy examples of research studies and action projects in the locale, preferably in multi-media formats;
3. Local data banks containing locally produced reports, catalogues, statistics, etc. pertaining to appropriate technology;
4. Abstracts of current research, development and extension reports generated in the locals;
5. Profile of institutions and individuals in the reigon that may be reliable sources of information on appropriate technology.

These geographically dispersed data/document banks should hold locally generated research reports, position papers, planning documents, case studies, multi-media packages, etc. They should be bound into an effective extension-information resource network through coordinated document management and delivery practices, and compatible document exchange policies and would serve as components of a multi-national/regional/global document exchange network. The next two parts of this section suggests strategies for the aggregative local resource information on appropriate technology so that it may reach the widest possible appropriate audiences.

National Data Banks for Appropriate Technology Information

In spite of the many disadvantages of a centrally organized information exchange system (bureaucracy, cost, etc.) it is advisable to identify a single National Data Bank for each country, whose duties would be to collect, screen, process, transform, package, and disseminate all relevant information issuing from the local centers for appropriate technology in the nation it represents. In this way information from several ATC's in a country can be aggregated and transformed to be made available to wider audiences than would be possible by any singly ATC in the country.

These National Data Banks on Appropriate Technology should be in a position to provide the following types of information:

1. Compilations of data on current appropriate technology projects and programs in the nation, i.e., profiles of ATC's;
2. Abstracts of current and recently completed research studies and action projects at each ATC in the nation;
3. Files of personnel in the nation with special qualifications, experience or interests in the field of appropriate technology research and application;
4. Calendars of meetings, conferences and seminars on appropriate technology subjects in the nation;
5. Profiles of institutions and individuals within the nation that may be or are reliable information sources in the field of appropriate technology research and application;
6. Referral service for location of presently available and distributed research findings, books, periodicals, bibliographies, reference

works and multi-media materials (national).

In order for such National Data Banks to operate they must have the capacity to interface with local sources of information so that their information acquisition, processing and dissemination techniques as closely as possible be uniform with or adaptable to the majority of existing practices of localized information practices in their country. These National Data Banks must clearly recognize that the local centers are the primary source of the Banks' information and the primary in-country users of their output.

Strategies for Linking National Data Banks for Appropriate Technology Information

In order to globalize the sharing of information aggregated in the proposed National Data Banks it is necessary to develop a coordinating mechanism whereby all national data banks agree on a minimum set of document management and exchange policies. This is a difficult condition to achieve even on a national level, let alone a global scale. However, unless there is agreement on such matters as standardized subject headings and/or descriptors, uniform abstracting formats, compatible bibliographic formations and costs of exchanges, the transferability of information among nations will be severely limited. The development of concensus on these and other matters makes it advisable to identify two or three regional/supranational coordination centers whose function is to precipitate concensus on a regional level regarding uniform policies and practices for the mangement of appropriate technology information transfer on a global scale.

These Regional Information Transfer Coordinators should be in a position to provide the following types of support:

1. Coordination of global policy formation on the exchange of appropriate technology information
2. Stimulation for the division of labor among nations whereby each National Data Bank in addition to covering its own country's information on appropriate technology agrees to be the regional network clearing house for a particular subset of information (e.g. low-cost housing technology, agricultural machinery technology, etc.)
3. Production of an information resources handbook to serve as a guide to sources of appropriate technology information in the region.

It is envisioned that these coordinating centers be identified among the National Data Bank network and be charged with the additional coordinative responsibilities for the other National Data Banks.

VII. INTERRELATIONSHIPS: APPROPRIATE TECHNOLOGY AND ENTREPRENEURSHIP

An important link in the process of technology adaptation/innovation and employment creation is local entrepreneurship, especially those entrepreneurs in the small-scale labor-intensive industries, including cottage industries. This is clearly demonstrated in Figure 1 which shows the various interrelationships necessary to the successful generation and diffusion of appropriate technologies.

Development, by definition means change. To initiate change, there is need for change agents. Entrepreneurs perform the change agent functions among which are: the development of market opportunities, the decision and commitment to entry into an industry or development sector, command and marshalling of resources, and all the functions that generally require the assumptions of risks -- including technical, engineerng and managerial functions.

It takes entrepreneurial initiatives to apply new technologies for improved productivity just as it takes entrepreneurial initiatives to search and develop new markets. In the context of developing countries, the entrepreneurial functions must be viewed in terms of limited resources and limited markets. As a policy consequence, entrepreneurship formation must be based on the development of small to medium scale industries that not only conform to the criteria of appropriate technology and alleviate unemployment but also provide the wider opportunities for entrepreneurial challenge.

Many writers on entrepreneurship go back to Joseph Schumpeter, an economist who stressed the role of innovation in economic development and business cycles, for their definition. To Schumpeter the entrepreneur is

an innovator (not necessarily an inventor) who creates a "new production function" or carries out "new combinations"--which includes not only methods of manufacturing but also new products, new materials, new markets, new marketing methods and many other economic activities, so long as they are innovative.

> They have not accumulated any kind of goods, they have created no original means of production, but have employed existing means of production differently, more appropriately, more advantageously. They have 'carried out new combinations.' They are entrepreneurs. And their profit, the surplus, to which no liability corresponds, is an entrepreneurial profit. [10]

In the latter part of this quotation Schumpeter sets up his distinction between the entrepreneur (who earns a profit) and the provider of capital (who earns interest). Thus, the essence of Schumpeterial entrepreneurship lies in conceiving and trying out a new idea rather than in taking financial risk--although in some cases the same individual does both.

Absence of vigorous entrepreneurship, as a serious development bottleneck, is attributed in current assessments and syntheses of expert opinions to a combination of failures: (1) to recognize what entrepreneurial qualities there are in the population, (2) to identify the individuals who possess them and therefore further to develop them, and (3) to formulate appropriate policies conducive to the development of entrepreneurs and the initiation and promotion of new enterprises. These are failures of understandings. Overcoming these gaps in understanding will require systematic programs of field-oriented research and experimentation, in a variety of cultural, economic, and political settings.

Responding to the need for small-scale entrepreneurship development, the East-West Technology and Development Institute held a Research Planning

Workshop on Entrepreneurial Development in Low-Income Communities in May 1975. Senior scholars and practitioners from Inida, Indonesia, Malaysia, New Zealand, Philippines and the United States recommended an agenda of international research, consisting of seven action proposals. Working proposal number 6 is concerned with the development and transfer of appropriate technology, and is summarized below:

DEVELOPMENT AND TRANSFER OF APPROPRIATE TECHNOLOGY

1. Action Focus

   a. The identification and development of appropriate technologies building on entrepreneurial capabilities and consistent with the cost of labor, capital and size of the market in low-income regions.

   b. The identification of locus of problems in technology transfer: eco-sociological, economic and cultural.

2. Objectives

   a. Facilitate the development of appropriate technologies and their adaptation and transfer from firm to firm, region to region, and industry to industry

   b. Strengthen the capabilities and procedures of extension and advisory agencies in facilitating technology exchange.

3. Development Rationale

   The principal entrepreneurial support service needs are:

   a. Extension or advisory service

   b. Finance

   c. Policy support for the infant industry

The main function of extension service is to assist the entrepreneur to select the right industry and the apprpriate technology. This function arises in part because direct contacts between small enterprises in different regions are inherently difficult due to barriers of distance, contrasting social and economic conditions, and preoccupation with immediate business goals and constraints. Therefore, international as well as national agencies concerned with small enterprise promotion are devoting considerable effort to communication and intermediary functions in technology transfer. The present research project would experiment with new approaches to this process, especially with the active matching of small firms in different regions.

4. Research Concepts

The research seeks answers to questions like:

a. Is it possible to develop technologies that are "capital saving" and at the same time "capital forming", i.e., that can utilize the local labor force and available skills both as a substitute for imported capital and to build local capital for new job formation?

b. Is transfer of technology from one region to another and from one firm to another an effective way of stimulating indigeneous entrepreneurship in small farm regions and among low income urban groups?

c. To what extent is the entrepreneur who has the "know how" willing to help the new entrepreneur in another region or country? How can this process be strengthened?

d. What kind of inplant/in-firm training is necessary and in what form should this be for effective training of entrepreneurs in technology and other skills for effective transfer?

5. Scope

The focus of the project is on those types of industry in which a range of feasible technologies exists, offering opportunity for small and medium firms, oriented to relatively small markets, and permitting expansion through employment-generating production systems. Such potential exists in metal fabrication, agricultural implement industry, agro-servicing, compounding of fertilizers, processing of plastic end-products, and the like. The concept would also be applied for agro industries in regions where farms and markets are small, and productive facilities are not well developed.

6. Approach

Steps for development of "Appropriate Technologies":

a. Identify industry groups where the concept can be applied with advantage. Select a few ubiquitous industries for development in the first instance.

b. Make inventories of the technologies available for the industries identified. These inventories will help in identifying gaps in the range of technologies available so that equipment manufacturers could develop technologies to cover the entire required range, so that the entrepreneur will have a choice in making the selection to suit his needs.

c. Technology development from two sides:

i. Improving and modernizing indigenous technologies to make them more productive. This approach is most suitable for the development of artisans. Innovative entrepreneurs of artisan background tend to develop their own technologies which are capital saving. These can be identified, standardized and the entrepreneur encouraged to market them.

ii. Simplifying sophisticated technologies. This approach has been successfully applied in developing simple hand operated plastic machines, metal forming and cutting machines, food processing machines, etc.

d. Case studies of different technologies in a particular industry group so that data is developed to help the entrepreneur to make investment decision. The data generated would cover the relevant range of capital costs, labor costs and sizes of market. The case studies could also cover socio-cultural aspects of the input of a particular technology in the community in terms of utilizing the labor force.

- Transfer of technology and development of indigenous entrepreneurship

This is essentially action research proposal to study the process and problem of technology transfer. The technology transfer could be of different types depending on the complexity of the technology. Some of the suggested methods are:

a. Transfer through mail exchange of data

b. Transfer through the visit of receiving entrepreneur to the donor entrepreneur and getting training

c. Transfer through the visit and assistance of the donor in setting up the industry

d. Transfer involving royalty and other considerations

e. Transfer in the area of:

i. know-how or design

ii. material or components

- The approach in the technology transfer exercise would be:

a. To prepare a list of transferable technologies and classify them into different categories based on their complexities

b. To prepare a list of donor entrepreneurs and receiving entrepreneurs and match their needs and initiate the process.

The extension agency will have to play an important part, as an intermediary, and should insure that the communication is not distorted. Otherwise the whole exercise will not yield any fruitful results.

- The built-in evaluation process in the action-research proposal would help in understanding the following problem areas:

a. What are the socio-cultural and economic constraints in Technology Transfer?

b. How Technology Transfer can best be done with less imbalances and maximum speed?

c. How to prevent negative side effects such as ecological imbalances as a result of disfunctional applications of Technology Transfer?

d. What are the most effective policies, incentives and promotional measureas necessary to facilitate Technology Transfer?

7. Personal and/or Institutional Participation

Participants from the following institutions and countries have shown interest in this proposal:

Small Industry Extension Training Institute, India

Indian Institute of Management, Ahmedabad, India

Department of Industry, Indonesia

Institute Pertanian Bogor, Indonesia

Development Technology Center, Bandung, Indonesia

MARA, Malaysia

Development Academy of the Philippines

Institute for Small-Scale Industries, Philippines

International Rice Research Institute, Philippines

East-West Technology and Development Institute, U.S.A.

The workshop recommends that the Small Industry Extension Training Institute serve as lead institution, refining the working proposal and seeking collaborative inputs of other interested institutions to finalize and launch the research project.

8. Coordinating Requirements

a. For development of technology: interdisciplinary approach between engineers/technologists, management specialists, economists, and sociologists. Each technology project could be undertaken by a single institution, or several cooperating institutions.

b. For technology transfer from one country to another: requires close collaboration of extension agencies or field level agencies in the participating countries. In addition to exchange of data, the extension agencies will identify the industry, the donor, and the recipient entrepreneur and catalyze the process. Cooperating institutions involved in technology transfer in the different countries would study promotion of the selected technologies in the context of socio-cultural implications.

c. Based on the experience of appropriate technology development and transfer, it may be possible to establish a clearing house for technology developing countries of Asia and other countries with low income communities.

VIII. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that there is indeed a relatively large number of research and development (R&D) activities comprehending a wide cross section of appropriate technologies in many countries in Asia. This is readily apparent in the country profiles discussed in Section V. Of equal interest, it is further noted that the government is providing some support for these R&D activities in the majority of cases examined. Unfortunately, one of the outstanding problems is the lack of a major coordinated effort to maximize available resources. Another outstanding bottleneck is the lack of viable information systems, both inter-country and intra-country. This results in duplication of R&D in some instances, with attendant inefficient utilization of available resources.

It is recommended that a coordinated global network of Appropriate Technology Centers (ATC's) be established. This should be accomplished by further strengthening those institutions (national or private centers of excellence) which have demonstrated capability for this type R&D. In-country linkages should be encouraged with regional (sub-national) or non-metropolitan institutions to maximize multiplying effects within a given country. Provision must be made for viable information exchange systems that will link local Appropriate Technology Centers in a network which emphasizes the exchange of documents and data provided by the ATC's with each sharing the responsibility of being an information source. It is further recommended that these local information resources be aggregated in national data banks which are coordinated on a regional (multi-national) level to insure uniform exchange policies and practices.

REFERENCE SECTION I:

NETWORKS OF COOPERATING INSTITUTIONS

TECHNONET ASIA - SINGAPORE

The purpose of TECHNONET is to provide solutions to technical problems and to insure implementation of these solutions by providing for the necessary industrial extension (a cooperative joint effort to build up extension services for industry in Southeast Asia).

Cooperating Institutions:

1. The Hong Kong Productivity Center (HKPC), Hong Kong
   Mr. S. K. Chan, Mr. Louis T. P. Law

2. Departemen Perindustrien (DP), Jakarta, Indonesia
   Mr. B. Kodijat

3. Standards and Industrial Research Institute of Malaysia (SIRIM), Selangor, Malaysia
   Mr. Teh Hock Heng, Mr. Vincent Choong

4. Majlis Amanah Ra'ayat (MARA), Kuala Lumpur, Malaysia
   Encik Mohd Rasli, bin Mohd Nawi

5. Institute for Small Scale Industries (ISSI), Quezon City, Philippines
   Mr. Leon V. Chico

6. Economic Development Foundation (EDF), Rizal, Philippines
   Mr. Cesar Sarino, Mrs. Purita M. Festin

7. Singapore Institute of Standards and Industrial Research (SISIR), Singapore
   Dr. Lee Kum Tat, Freddy Soon

8. Industrial Service Institute (ISI), Bangkok, Thailand
   Mr. Ari Indhasorn

9. Bangladesh Small Industries Corp., Bangladesh

10. Industrial Development Board, Sri Lanka
    Roshini Mariam Goerge

11. Korea Scientific and Technological Information Center (KORSTIC)
    Lee Sun-Kyung

Support:

1. IDRC - A public corporation established by the Canadian government (1970) which deals with "the means for applying and adapting scientific, technical and other knowledge" to the economic and social development of the world's developing regions. IDRC sees its role in TECHNONET as that of "a catalyst and a provider of certain basic resources." (Contact: W. David Hopper)

2. NCR/TIS - The Technical Information Service of the National Research Council (Canada) has a mandate to help train industrial enquiry and extension workers from TECHNONET participating organizations. ("... information and extension must go together. Provision of technical information may give leads for extension.")

TECHNONET Activities:

1. TECHNONET Newsletter - (Inaugural edition: March 1974.) Designed to highlight the work currently being done in the field by industrial extension engineers "to develop an appreciation of their common purpose and of the importance of this new profession to industrial and economic development. (Contact: William Gall)

2. Training

   a. TECHNONET has arranged training visits for three network organization staff members to NCR/TID - "following the return

of its two officers SISIR established Industrial Technical Information Services (ITIS) ... based largely on the NCR/TIS model."

b. TECHNONET sponsored the "Industrial Extension Training Course for Engineers" at the Small Industries Extension Training Institute, Hyderabad, India (1974). This course, the first aimed at the engineer involved in industrial extension, was developed by the TECHNONET administrator and SIET staff.

3. State of the Art Reviews - TECHNONET has encouraged and supported national initiatives in three countries (Hong Kong, Philippines, Thailand) to conduct state of the art reviews in order to identify the levels of technology which exist in the various industrial sectors within each country. This information will be a valuable input for the data bank being established at TECHNONET Centre ... "Such reviews can contribute much to the development of a true network for industrial information transfer among the participating countries, as well as to foster direct communication between national institutions in the region."

4. Other

a. The TECHNONET Secretariat - 5 full time staff (Singapore) - "its role will be that of coordination and liaison" (Lung Wong).

b. TECHNONET Consultative Council - comprised of the heads of the network organizations - meet priodically to evaluate and plan.

c. UNIDO and TECHNONET have agreed to collaborate closely in the field of industrial information transfer in Asia.

d. TECH-BRIEFS - a series of relevant technical articles prepared by NCR/TIS - available on Microfiche.

e. Technical Enquiry Service - "In general, recipients found the information provided very useful. For some it provided a basis for redirecting their plans; for others it opened up possibilities they never thought existed..."

Financial Assistance:

1. TECHNONET sent five Thai Packaging Association representatives to the Australian National Packaging Exhibition ... "I can now work with my design and production section to offer new products and services suitable for the Australian market."

2. TECHNONET grant to help establish APIC (Asian Packaging Information Center) to assemble, store and disseminate information on packaging materials processes and equipment relevant to Asia's needs.

3. ISSI, with TECHNONET financial assistance, established an Industrial Technology Division -- Transfer of Technology (TOT) Program: "A State of the Art Report (STAR) will establish the technological parameters of the particular industry; determine its level of technology; recommend the most profitable technology. The TOT project will then assist the local industrialist in planning, adapting and evaluating the new technology." (Contact: Leon Chico)

HKPC (Hong Kong Productivity Centre) -- William Newton, Executive Director

1. A STAR on the plastic mould making industry in Hong Kong has revealed that the industry does not have adequate access to technical information, resulting in problems in the field of production and quality control. This review demonstrates the need for techncial information and extension services.

2. Technical Information Service (TIS) - staffed by a team of specialists who make intensive studies into publications and abstract selective articles from more than 90 publications to keep industry informed of the latest developments in management and manufacturing techniques. (A series of comments from Hong Kong industry subscribers to TIS - every kind of enterprise from a wig factory to a candy company - indicate that "TIS is one of the fastest and most useful means of keeping abreast of the latest developments.")

3. A STAR on the Electroplating Industry -- an examination of the total economic picture, as well as techncial aspects. It was discovered that except for a few relatively modern establishments, "the industry needs up to date technical information and should welcome the provision of technical information services." Recommendations include programs for upgrading workers skills and for implementing information extension.

SIRIM (Standards and Industrial Research Institute of Malaysia) -- Hussin bin Omar

"Many visits to industries have been conducted and we are happy with interest shown by many industries in our Industrial Information Exchange Service." The following are examples of current extension work:

1. Bamboo Cutting Knife: an improved knife with six (instead of two) cutting edges was designed and disseminated (D&D)
2. Glue Mixer: Glue manufacturing productivity increased by D&D of a mechanical mixer.
3. Nuts and Bolts: Difficulty experienced because the quality of these products did not meet international standard specifications. SIRIM obtained information concerning the correct raw materials and the necessary treatment to obtain an acceptable result.
4. Electroplating Process: Provided information on electroplating process to assist the dockyard managers (at Kuala Trengganu) in attempts to obtain good quality parts and to reduce manufacturing cost.
5. A STAR is being conducted on the Malaysian foundry industry, with assistance from TECHNONET Mechanical Engineer, C. Janardaman.
6. A factory making iron moulds for spun pipes was experiencing difficulty with heavy tool wear and eccentric boxes. TECHNONET Centre's Mechanical Engineer and SIRIM's extension officer examined the problem and recommended the use of a sand core (instead of a solid core) and the addition of cold tar or wood flour to the sand core. The foundry's management was quite pleased

with the results and has approached SIRIM for further technical assistance in foundry technology.

Problems:

1. A need for more Information and Extension Service Personnel.
2. Gaining the trust of suspicious small-scale entrepreneurs.

SIRIM's Industrial Information Service (Vincent Choong)

1. They are sending out brochures and following up with personal visits, stressing their store of technical and industrial information (this is the Enquiry Service).
2. Extension officers also carried out techncial trouble-shooting on the spot. They then came back and helped the Information Officer formulate answers to technical enquiries.
3. In addition to the Enquiry Service, a Technical Awareness Program is being launched, based on an intensive scanning of Tech-Briefs and 170 other scientific and technical journals.
4. TECHNONET sponsored a Technical Information and Extention Training Course, conducted by Gerry Kirouso (Chief, NCR/TIS), in Malaysia -- SIRIM, MARA and four other Malaysian organizations participated -- "designed to develop thinking as to how practical information and extension services can be offered to Malaysian industry." (Nov. 4-11, 1974).

MARA (Majlis Amanah Ra'Ayat)

1. Training Centre in Ferrocement Technology.

While ferrocement technology has to-date been mostly applied to boat construction, it has excellent agricultural and industrial application possibilities. (For example, containers or vessels, that either hold water or material in, or out could be constructed.) Generally, ¼" steel rods are welded together in the shape of the final product ("framing"), covered by 4 to 8 layers of hexagonal or square wire mesh ("meshing") and the meshed frame filled with cement ("plastering").

Ferrocement construction advantages: ingredients widely available in developing countries; application versatility; technology freely available; skills easily acquired; production almost entirely hand -- main equipment only a small welding set and cement mixer; low maintenance costs for products (especially boats.)

The Centre has sold most of the troughs and the tanks that it has made, and orders keep coming in.

MARA's "Ferrocement Development Committee", chaired by Syed Abdul Rahman b Idros, Deputy Director of MARA's Industry and Commerce Division, has just commissioned an in-depth market study which, if positive, will lead to support of commercial ventures AND more training.

2. TECHNONET engineer C. Janardana assisted MARA in its selection of foundry equipment for its vocational training school in Kuala Lumpur.

3. A STAR of the Ceramic Industry in West Malaysia to "identify measures which could be taken by MARA to improve the industry's efficiency, modernize its processes and generally assist in the development of small-scale units for the manufacture of ceramic products."

4. Furniture factory -- A small furniture factory, plagued by lack of electricity, shortage of working capital and inadequate knowledge of bookkeeping, contacted MARA for assistance. MARA's extension officers arranged the demonstration and loan of portable electric generators with portable power tools. The need for higher productivitiy and better product quality was emphasized and graphic examples of contemporary furniture were furnished as guidelines for design improvement. This resulted in gradual improvements both to the factory's productivity, product quality and designs. Market demand for its output subsequently increased to such an extent that further expansion became feasible.

   Acting upon advice given by MARA's extension officers, the factory was later moved to Batu Pahat where electricity supply was available. MARA advised on the choice of suitable machinery, factory layout and proper use and care of wood-working machines newly acquired. In addition, MARA had also provided a substantive loan and advice on proper management and accounting practices.

   As a result of the various forms of advice and assistance given, this factory has now been able to expand its business activities to include joinery works, manufacture of concrete blocks, drains and pipes and building construction.

UP/ISSI (Institute for Small-Scale Industries) -- Leon Chico

1. 2 STARs - Wood Furniture-Making and Shoe-Making Industries:
   a. Emphasis on the use of labor-intensive technologies and transfer of appropriate technologies
   b. These two industries are "still basically in the manual and semi-mechanized stage of technology."
   c. A need for high quality materials, improved production operations ("adaptive technologies"), better information dissemination.

2. Co-sponsor of Entrepreneurship Development Programme:

   EDP is a nationwide project launched late last year by three government agencies to develop entrepreneurial activities in the rural areas of the Philippines. Involved in the promotion and development of small industries to hasten economic growth, the sponsoring institutions expect to generate self-employment schemes for potential entrepreneurs and also provide employment for others.

EDF (Economic Development Foundation) -- Cesar Sarino

EDF established a Technical Information Service for the following reasons:

1. To organize and disseminate vital technical information for small and medium scale enterprises.

2. To complement, not duplicate, government efforts to render assistance to these sectors (EDF is non-governmental).

As a first step, they surveyed the Greater Manila Area to assess overall information requirements ("survey feedback disclosed the dearth of technical knowledge among the entrepreneurs, and the need for a technical information service for national industrial development.")

One factor uncovered by the survey is the existence of numerous cottage industries in the Greater Manila Area which are in dire need of technical assistance. While there are several government agencies extending assistance to these sectors, the services are inadequate to meet the demands, prompting EDF to extend the benefits of the information service to cottage industries.

"Contrary to expectation, the survey respondents are responsive to the idea of extension work. A few entrepreneurs have even requested investigative visits by the service staff so that areas needing improvement could be pinpointed. Ironically, some were totally unaware of the existence of technical problems within their plants.....Meanwhile, local government officials have risen enthusiastically to the occasion, serving as liaison between the EDF extension staff and the entrepreneurs of each locality. A top-ranking province leader has signified willingness to co-sponsor seminars in each of his towns, in the hope of bringing modern technology to the rural areas.....EDF is aware that the information service, although still in its infant stage, has great potential. The picture has become clear: dissemination of vital technical information to those who need it is of singular importance, but for it to have more impact it should be coupled with dynamic extension work." (From Technonet Newsletter)

ISI-DIP (Industrial Service Institute - Dept. of Industrial Promotion) (Thailand)

The following activities are among those listed by DIP:

1. Monthon Suthiam has developed a prototype furnace, as well as assembling information on heat treatment of metals, for use by small-scale industries - intermediate technology.

2. In the Siam Metals Industry, an improved method of die design and hardening, as well as more efficient working methods, have been implemented as a result of ISI extension work.

3. One of ISI's primary thrusts has been "examining the feasibility of setting up a demonstration of certain industrial processes using small, inexpensive and 'appropriate' machinery."

4. TECHNONET sent two of DIP's staff to study SISIR's Industrial Technical Information Service in order to ascertain the feasibility of establishing their own, in order to benefit Thai industry and to enable DIP to contribute more to the TECHNONET network (Newsletter no. 4) .... DIP established such a service soon after, using the NCR/TIS Tech-Briefs as its starting base. (Newsletter no. 5)

TECHNONET sponsored the First Asian Industrial Extension Officers Conference (FAIEOC) from November 5-10, 1975 in Manila, co-hosted by ISSI and EDF. Twenty-six extension officers from the network participated. Several arrived from Ottawa, where they had just completed a six week course.

They unanimously agreed to form their own association, in order to:

1. promote industrial extension as a profession
2. assist the extension officer in his work
3. promote harmony and cooperation among extension officers.

Two groups of officers were selected: one as a consultative body, the other as an "executive" group.

The heads of the TECHNONET organizations were meeting in Manila at the same time and they declared that the new association "should not, at this stage, have a formal, legal, independent personality of its own, but under the umbrella of TECHNONET Asia, serve as a means for the exchange of ideas and experience to strengthen the industrial extension officers abilities and capabilities." They also decided:

1. That because of the great variety of needs and conditions at network institutions, TECHNONET Centre will assist in the development of training at interested institutions.
2. That each organization will develop a plan for industrial information and extension, indicating TECHNONET Centre support is needed. TECHNONET Centre will meanwhile continue to develop as a referral point for information within TECHNONET and develop information sources outside the network.

The following are summaries of the country papers presented at the FAIEOC Conference.

BSIC (Bangladesh)

The two main function of BSIC are:

1. Development activities in the public sector such as land, road, power, water, drainage and building in industrial estates.
2. Promotional activities for the private sector which include raw material supply, working capital to existing small industries, new industries development and counselling and advisory service including extension services.

BSIC's initial Industrial Estate Programme comprises 18 industrial estates set up in the 1960's. These estates remain largely empty due to lack of essential entrepreneurial resources such as financing and manpower training. The two other programmes are Small Industries Advisory Service (SIAS) and Handloom Goods Export Corporation - BSIC's subsidiary. All three programmes currently suffer a shortage of technically trained and experienced personnel. To overcome this, establishment of a Small Industries Training Institute is planned.

DP (Indonesia)

The Ministry of Industry's special programme for small industries (BIPIK) provides guidance and assistance to small industries.

BIPIK aims to provide extension services by specially trained

officers to upgrade the skill fo those working in small-scale industries both in the fields of technology and management. To supplement this work, product testing facilities and information services - embracing technique, technological, commercial and financial information - are also made available.

Many officers in all 26 provinces - including heads of regional offices - have already undergone orientation training to ensure that extension services are performed in the proper manner, and that the characteristics of small industries are taken into account. Instructors for specific sectors of industry - such as food, textile, building, wood, leather, rubber industries - are also being trained so that they can in turn pass on the specific skills to the industry concerned. Moreover, special training and service programmes are being arranged to encourage the natural concentration of certain industries in certain regions so that cooperatives or associations may eventually be established. Besides the already described activities, BIPIK also gives assistance with credit applications, quality control programmes and promote products by publishing a monthly trade magazine.

KORSTIC (Korea)

One third of KORSTIC's clients is now from the industrial sector, comprised equally of large and small enterprises.

KORSTIC currently provides technical information, on contract, to industrial cooperatives or associations such as the pharmaceutical, plastic, electric and automobile industries. The information is usually obtained from foreign sources and disseminated in simplified

form, through regularly published bulletins, which are directed and distributed to each group.

In Janaury 1975, the Technical Consultant Service was established to help the small enterprises which do not belong to any group of industries having information service contracts with KORSTIC. Moreover, KORSTIC plans to train industrial liaison officers who will visit small industry groups to help identify their information requirements and technical problems and to maintain close contact with them.

SIRIM (Malaysia)

SIRIM is composed of Administrative, Research and Standards Divisions. The Research Division is composed of Applied Chemistry, Engineering, and Techno-Economic and Advisory Services (TEAS) Sections. Extension and Information SErvice is carried out under the TEAS Section. Response to the 1974 'technical awareness programme' was initially very poor, reasons being limited resources and lack of experience and the small industries' failure to recognize the value of information plus their negative attitude and strong resistance to change. It has since been recognized that the most effective service is attained through plant visits by extension officers where personal contact is made and technical problems are identified together with the clients. As a result the way becomes open for further expert advice and information, and also for other services such as physical and analytical testing and, to a limited degree, research and product design.

SIRIM has now completed its first State-of-The Art Review (STAR)

on the foundry industry which will be used as the focal point from which to orientate the development programme for this industry. Meanwhile, although SIRIM suffers from shortage of qualified and experienced officers, it looks to TECHNONET to provide the necessary material and training support for its undertakings, so that it may "help others to help themselves."

MARA (Malaysia)

Among MARA's eight divisions is the Advisory Services and Enterprise Development Division which provides industrial extension services such as technical information, management, marketing and product design.

District officers are normally approached by clients, otherwise field officers may visit them. Field officers have the support of specialists at headquarters in the fields of, among others, industrial engineering, marketing, accountancy, commercial design, product design, technical information and research.

Creation of a "new entrepreneurs programme" was begun in 1973 whereby development officers can recommend feasible projects for soft loan support. Officers of various essential disciplines such as engineering, marketing and management would then participate in extension work which follows.

Essential difficulties in industrial extension lie in the entrepreneurs' lack of an appreciation of the importance of technical advice -- which retards the transfer process. Moreover, lack of necessary resources such as experts and information service equipment,

and also work communication problems, all combine to make heavy the task at hand.

The Philippines

The Commission on Small and Medium Scale Industries (CSMI) comprises 12 agencies, each partly involved with small and medium industries development programmes. Of these, the following four agencies are involved in training or in giving direct assistance in terms of extension services:

1. University of the Philippines Institute for Small-Scale Industries (UP-ISSI) renders integrated assistance to promote and develop new, as well as existing, small industries through technical and managerial improvement. Services include workstudy, production and management audit, and methods engineering as well as running training courses.
2. National Cottage Industries Development Authority (NACIDA) gives assistance to project studies, worker training, securing of loans, marketing and research.
3. Medium and Small-Scale Industries Co-ordinated Action Programme (MASICAP), whose field officers identify and follow-up on an industrial project's technical and financial needs.
4. Development Academy of the Philippines (DAP) complements MASICAP's work by training project developemnt advisers of provincial governors and city mayors.

The Economic Development Foundation (EDF) is a private entity and complements CSMI's efforts. It provides technical information and extension services to help small and medium-scale industries solve technical and operational problems. EDF's Technical Information and Extension Service's (TIES) pilot project, directed at a group of producers in Bulacan Province, is already making impressive progress.

SISIR (Singapore)

SISIR's integrated range of services is offered to small, medium as well large industries. These services include industrial research and development projects, product development, process improvement, testing and consultancy and are backed by several laboratories, workshops, a techno-scientific library and technical information service. The extension services are provided on an institutional basis whereby the technical and scientific resources from diverse fields are pooled together to identify and solve industrial problems. There are seven principal fields of coverage in SISIR's extension programme:

1. Environmental Pollution
2. Instrumentation and Calibration
3. Product Development and Process Improvement
4. Quality Certification
5. Industrial Design
6. Technical Information Service
7. Liaison with Industry

Everyone of SISIR's officers provides extension services to industry. They undergo continuous training besides on-the-job training and, from time to time, consultants and experts are engaged to develop

staff expertise in specific programmes. These officers are still learning new ways and improving their approach to reach industry which is often quite resistant to change.

IDB (Sri Lanka)

IDB has five divisions -- Planning, Documentation and Publication, Marketing, Regional Development (RDD) and Technical Services -- and is represented in eight regional offices. IDB officers are only given on-the-job training in specific fields of technology to which they are assigned.

RDD's work comprises of establishing new and modernization of existing industries, and making studies on industrial opportunities.

The Technical Services Division (TSD) performs the principal extension service by assisting industries with technical problems such as layout, machinery selection and local fabrication, installation, repair and maintenance.

Extension officers have often met with the problem of clients who are suspicious and strongly resist necessary innovations or who are not suitably qualified to manage their enterprises. The officers therefore have been taught to be tactful, helpful and persuasive.

IDB believes in the principle, however, that "no aid is where the recipient does not become self-reliant."

DIP (Thailand)

The Industrial Service Institute (ISI) together with Thailand Management Development Productivity Centre (TMDPC) were set up within DIP to provide to industry comprehensive services which include:

1. Rendering technical extension and advisory services to small industries, providing assistance in the training of managers and skilled workers and also assisting in the development and expansion of industries in general.
2. Arranging for credit assistance for small industries through another sister organization.
3. Establishing industrial estates well equipped with essential utilities and services.
4. Assisting in market development. DIP currently runs a sizable handicraft retail shop in Bangkok which helps to export goods abroad. Moreover, it has set up an Industrial Product Design Centre which serves as an institution for traditional and contemporary handicrafts and industrial products design.

Problems encountered include high staff turnover which is attributed to a very low government pay scale. Also ISI's budget is inadequate for effectively servicing its many clients. A very significant obstacle, however, is the negative and suspicious attitude of prospective clients who are often unwilling to co-operate with extension officers.

INDEXTRAC '76

TECHNONET sponsored its Third Industrial Extension Officers' Training Course (INDEXTRAC '76) in Manila 27 January to 24 March 1976. The trainees were introduced to diagnostic and problem-solving techniques and practical strategies for industrial extension work. Sri Bhattacharjee, Extension Education Department Director from the SIET Institute, Hyderabad, India, highlighted the key concepts and objectives of industrial extension services. He also lectured on well-proven extension practices and tools such as the art and methods of effective communication.

INDEXTRAC '76 modelled on the more successful features of the two previous TECHNONET-sponsored training courses held in 1974 and 1975 at the SIET Institute, was the first such course to be conducted by a TECHNONET Participating Organization (UP-ISSI) in a 'TECHNONET country'.

INDUSTRIAL DEVELOPMENT DIVISION

GEORGIA TECH

A. SMALL INDUSTRY DEVELOPMENT NETWORK - Newsletter

IDD began publishing this newsletter in 1974 to publicize the work of its cooperating institutions involved in the growth and expansion of the small-scale industry section of developing countries. There is an associate editor at each network institution. The following reasons were given:

1. To communicate with institutions already involved in this field particularly in the network, in order to share new approaches, techniques, methodologies
2. To help the busy entrepreneur to maintain current awareness of business conditions which vitally affect him.
3. "Hopefully duplication of effort can be avoided in some instances through this communication medium." - Ross Hammond

Georgia Tech's AID Grant Activities: First Year in Capsule (from newsletter)

The SIDN program is directed by Ross W. Hammond, chief of the Industrial Development Division of the Engineering Experiment Station at Georgia Tech, but it is an interdisciplinary project involving several other units of Tech. The other main participants are the School of Industrial and Systems Engineering, the College of Industrial Management, and Southern Technical Institute.

The Georgia Institute of Technology is conducting a five-year (1973-78) program in industrial development research, training, and linkages under an institutional grant from the Agency for International Development. The

purpose of the program is to strengthen and broaden Georgia Tech's existing capabilities in employment generation and small-scale industry development, primarily in rural areas, through activities involving less developed countries. This program relates to the institution's ongoing commitment to international education and development.

Besides the work with the six counterpart institutions in the developing countries, over the globe, the program involves a graduate curriculum in small industry development at Georgia Tech and short-term training programs in the field, research and data collection on economic development techniques and experience in the less developed countries, and conferences and seminars.

Although the first year involved mainly planning and organizational work in getting the various project activities started, several major goals were accomplished.

Counterpart Institutions and Other Linkages. After screening 30 possible counterparts, Georgia Tech signed formal agreements with five educational institutions (including Soong Jun and UP/ISSI) and government organizations to work cooperatively on programs related to employment and small-scale industries. An informal linkage was arranged with a sixth organization. Tech also established communications with international development organizations engaged in programs similar to its own. The Georgia Tech AID grant activity has been partially responsible for the start-up of small industry research and technical assistance centers at Soong Jun University. The counterpart institutions are serving as real-world laboratories for testing alternative approaches to industrialization.

Education and Testing. An important accomplishment is development of a new graduate curriculum in the School of Industrial and Systems Engineering at Georgia Tech, leading to a Master of Science degree. Dr. David Fyffe is in charge of this activity. Begun in the fall quarter of 1974, the study program focuses on small industry development. A new course developed for this curriculum has already been presented, entitled "Analysis and Evaluation of Industrial Project."

Seminars. Eight formal and three informal international development seminars were held during the first grant year. Speakers were from Cornell University, UNIDO, Soong Jun University (Korea), Massachusetts Institute of Technology, Organization of American States, East-West Center (Hawaii), International Bank for Reconstruction and Development and Colorado State University.

B. SOONG JUN UNIVERSITY (Korea) INTEGRATED DEVELOPMENT CENTER (IDC)

Overview

The basic ideas and concepts underlying the establishment of the Integrated Development Center (IDC) were in a sense transplanted from the experiences of Dr. Hahn Been Lee during his directorship of Technology and Development Institute, the East-West Center in Honolulu, Hawaii from 1970 through 1972.

Immediately after Dr. Lee assumed the presidency of Soong Jun University in March, 1973, he perceived the need for an instrument of catalytic agent like the Technology and Development Institute through which Soong Jun

University could promote productive interaction with surrounding communities. In order to meet this need, IDC was created with the approval of The Board of Trustees in July 1973. In March 1974, Dr. Yoon Bae Ouh became Director of IDC.

The main concern of IDC is to develop and offer (1) research, (2) problem solving methods and services, (3) information, and (4) training and education services in connection with the following four interrelated problem areas:

(a) adaptive technology and entrepreneurship development for employment generation and income increase;

(b) urban, regional, and environmental planning;

(c) population and social planning; and

(d) institution building for development.

Activities

1. Seminars for Project Development

The grant ($7,500) Soong Jun University obtained in March 1973 from The Commission for the Advancement of Christian Higher Education in Asia (CACHEA) enabled IDC to organize and conduct a series of seminars, workshops and surveys for the conceptualization of IDC programs and project development.

2. Asia Foundation Project: "A Preliminary Study on the Potentials of Small and Medium Industries in the Regional Development of Taejon Area."

The project was intended (1) to analyze the current development problems in Korea's small and medium sized cities and to

spell out their perspectives for the regional development of Taejon area as well as for the small and medium industries in Taejon area, (2) to identify the potentials in this area, (3) to make an inquiry into various strategies to make use of these potentials and possibilities, if any, for the development of Taejon area and small industries; and (4) to make a broad yet feasible recommendation for the development policy of the local region and small and medium industries in Korea.

The project was executed by Regional Development Institute at Soong Jun University's Taejon campus, of which Dr. Hahn Been Lee is Director. The final report was turned in to Asia Foundation in both Korean and English in June, 1974.

3. Survey of Small Industries in Youngdungpo Area

Youngdungpo District, where the main campus of Soong Jun University is located, is the center of industries in Seoul metropolitan area with 1,500,000 population, roughly one-fourth of Seoul's total population. There are more than 2,000 industrial firms of which it is reported 95% of them fall into the category of small and medium industries.

IDC staff members and half a dozen faculties of the College of Engineering undertook separtely extensive surveys on the various aspects of small industries during the period from the summer to the end of the year, 1973.

Review of Soong Jun/Georgia Tech Joint Project

In July, 1973, IDC representing Soong Jun University, entered an agreement with Industrial Development Division (IDD), Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Georgia to form a joint team for the achievement of the following objectives:

(a) to develop programs which will accelerate the expansion of existing small industries and the creation of new small industries so that more employment opportunities will be created;

(b) to demonstrate and document the impact of alternative approaches to the stimulation of small industry;

(c) to create in the appropriate government industrial and financial sectors of small industry an awareness of potentials and ways to maximize these potentials; and

(d) simultaneously to build a model for other institutions to follow.

(1) Outline of Soong Jun/Georgia Tech Joint Project Proposal to AID

Under the general title of the joint project "Employment Generation Through the Stimulation of Small Industry," four major program areas were planned on the basis of researches and surveys relating to small industries.

a. Small-Scale Industry Information Center (SSIIC)

Soong Jun/Georgia Tech proposed to set up SSIIC at IDC for collecting and disseminating managerial and technical information appropriate to small industries.

b. Industrial Extension Activities

The following were planned:

For technical assistance to small industries:

- scientific and engineering consulting
- information dissemination
- general production advice
- industrial engineering

For managerial assistance:

- bookkeeping and accounting consulting
- legal problems
- job analysis and evaluation
- inventory control
- supply and distribution resources
- marketing
- industrial management

c. Industrial Training and Education

In order to furnish entrepreneurs, managers, engineers, and technicians with scientific and technological information and management practices of current development, the following activities were initially thought to be helpful:

- short-term courses, seminars, and workshops on such topics as engineering design and problem-solving techniques, accounting and record-keeping, manufacturing processes and machinery, etc.
- programs for retraining workers for the higher level of skills required by more advanced manufacturing techniques.

- seminars and workshops for entrepreneurial development.

d. Educational Activities

Feedback effects of extension work on the univeristy's course offerings, and instructional methods were expected from the beginning. For the productive linkages between the university and industry, the following methods were suggested:

- the use of technical advisory committees
- the encouragement of short-term employment of students and faculty in industry
- the creation of faculty - industry advisory teams
- investigating the possible use of industrial adjunct professors.

(2) Comments

1. Significant results are visible at least in technical assistance activities (cf. 1st and 2nd quarter reports).
2. To build up Small-Scale Industry Information Center (SSIIC), much effort has been made in the first year to collect materials and information appropriate to small industries. For this service to be dependable more funds and technical assistance from GIT should be allocated in the next few years.
3. Feedback effects of extension activities on the educational program are noticeable especially in introducing a new course for the engineering faculties and students; Industrial Engineering. A proposal for the creation of an I.E. Department has been submitted

to the Ministry of Education in June 1974.

4. Preliminary surveys were conducted during summer vacation to find out what types of educational and training programs were most needed by small industries. A short-term educational program will be made available to small industries in Youngdungpo area before the end of this year.

Major Activities - First Quarter, 1974

1. Survey of several small-scale machine industries in Youngdungpo district - seminars were also organized with entrepreneurs, engineers and officials of the industrial park concerning the future role of Soong Jun in technical and managerial extension services.
2. Youngdungpo Demographic Study - to determine movement and settlement of workers.
3. Seminars for managers and entrepreneurs at Taejon - topics included credit management, industrial management, marketing.

(The second quarter report is a much more detailed amplification, concentrating on a case by case survey.)

IDC-GIT Interaction

Two members of the faculty of the Georgia Institute of Technology -- Ben James, head of the Engineering Experiment Station's Industrial Extension Service, and Herbert Eller, Coordinator of the Evening Division at Southern Technical Institute -- were at Soong Jun University in Seoul, Korea for seven weeks, April-June, 1974, working on projects funded by the U.S. Agency for International Development. Professor Eller advised the Soong Jun

engineering faculty on curriculum development and performed an industrial engineering analysis of a Saemaul factory under Georgia Tech's 211(d) institutional research grant, while Mr. James provided guidance to Soong Jun in Developing its industrial extension activities under a small-industry technical assistance grant.

The other main activity of the Georgia Tech team also involved adaptive technology. Professor Eller, assisted by Mr. James, performed an industrial engineering analysis of a bamboo fishing pole factory which was established under the Saemaul (New Village) movement. The Saemaul movement was begun by the government in 1971 to slow the rate of migration to the overpopulated cities, and the Yong Jak Company is one of the many firms assisted by the government under this program in order to stimulate employment in rural areas.

The owner of the firm had asked for an evaluation of his operation and recommendations for increasing its productivity. Although the company employed about 50 persons, its production methods could aptly be described as cottage industry or handicraft operations. The 14 recommendations to increase efficiency and profitability of the venture ranged from changes in plant layout and materials flow to designs for simple tooling to facilitate standardization of the sizes of the bamboo sections, thus decreasing trial-and-error hand fitting. Two SJU engineering professors who had assisted in the analysis will follow-up on the recommendations. They will help the factory management to implement methods improvement programs, including the fabrication and installation of various sizing tools.

In turn, three members of the Soong Jun University engineering faculty

visited Georgia Tech June 29-August 3, discussing the various aspects of industrial development with IDD staff members. The visit included two weeks of field trips throughout Georgia, during which time they observed the activities of the IDD/EES field offices and accompanied area development personnel on industrial plant visits.

C. UNIVERSITY OF THE PHILIPPINES INSTITUTE FOR SMALL SCALE INDUSTRIES

The University of the Philippines Institute for Small-Scale Industries (UP/ISSI) renders integrated assistance to promote and develop new and existing small industries through technical and managerial improvement. Services include workstudy, production and management audit, methods engineering and training courses. The following list is representative of the broad range of activities being conducted at this institution.

1. UP/ISSI will soon launch a modified concept of service to small entrepreneurs through the newly created Industrial Information and Technology Department (IITD). This move is in line with the Institute's policy of providing more concrete assistance that will more directly answer the needs of small industries. It works on the premise that it is not enough that an entrepreneur has all the necessary factors of production at his disposal. He needs relevant information -- economic, scientific, industrial and technological -- to guide him in his operations. This information can be meaningful and effective only if it is accurate, up-to-date, modified to suit the user's needs, and supplied at the right time and place to the right users.

The unit expects to deliver the following services:

a. Current Awareness Service Program

b. Industrial Inquiry and Extension Service

c. Selective Info Dissemination Service

d. Technology Assistance Program

2. UP/ISSI and GIT co-sponsored a seminar-workshop on "Analysis and evaluation of Industrial Projects." This program was planned to develop the participants ability to conduct feasibility analyses for proposed industrial ventures and to appraise the investment risks of such ventures. It was aimed specifically at three groups:

   a. potential entrepreneurs

   b. industrial development professionals

   c. loan officers of lending agencies making small business loans

   A pragmatic, "learning by doing" approach was utilized to maximize the learning impact and utility of the course content. The training program covered four main subject areas: market analysis, technical analysis, financial analysis and appraisal of investment proposals. Each subject area was introduced through a group work session in which participants had to perform tasks involved in an actual feasibility analysis of a specific project.

3. UP/ISSI recently graduated 19 Muslims, all professionals and scholars from the Philippine Amanah Bank (PAB) and the Mindanao State University (MSU), and three Christians from the UP/ISSI from a special training course it designed to develop a core of

entrepreneurship trainers for prospective Filipino Muslim entrepreneurs. This effort hopes to achieve the following results: to promote the development of small enterprises in the rural areas; to generate self-employment schemes for potential entrepreneurs and provide employment for others; to encourage and develop the processing of local materials into finished or semi-finished goods for domestic consumption as well as for export; and to encourage the use of modern technology in small-scale manufacturing to increase productivity. The goal is to develop Filipino Muslim entrepreneurial qualities and attitudes to bring about significant change in the rural Muslim areas of the Philippines.

4. A workshop on Industrial Quality Control was held at UP/ISSI on February 16-27, 1976. The program, organized by the United Nations Industrial Development Organization (UNIDO), in cooperation with the SIDA (Swedish International Development Authority), the SAF (Swedish Employers' Confederation), and the UP/ISSI, attempted to broaden and upgrade the participants' knowledge and expertise in quality control procedures.

D. Guidelines for Industrial Extension Personnel

In November 1974, IDD published this volume (editor: Robert Collier) which provides an excellent resource for the extension offices in the field. Thorough yet reasonably concise, it presents its advice systematically according to the following outline:

1. An Approach to Furnishing Industrial Extension Services to Small-Scale Industry
2. The Generation and Evaluation of Venture Ideas
3. Selection of Appropriate Technology
4. Resource and Technical Analysis
5. Advising the Prospective Entrepreneur on Going into Business
6. A Systematic Approach to Small-Scale Industry Growth
7. The Presentation of Investment Proposals
8. Factors in Plant Layout
9. A Simplified Cost and Control System for Small Industrial Concern
10. Inventory Control for Small-Scale Manufacturing
11. Production Planning and Control for Small-Scale Manufacturing
12. How to Use a Private Management Consultant
13. Selected Bibliography.

TECHNOLOGY AND DEVELOPMENT INSTITUTE
LOW-COST HOUSING NETWORK

(TDI/LCH)

The initial priorities of this project are concerned with adapting, innovating, and diffusing low-cost construction materials and design concepts for low-income family housing units in different socio-economic environments. The major objective is to enhance the capabilities of participating institutions to develop their R&D programs more effectively through collaborative study and exchange of common problems and solutions.

The vehicle to accomplish overall project objectives is a network of cooperating institutions in Asia and the United States to work as partners on the necessary research and development. The project deals primarily, but not exclusively with the production aspect of housing as part of the formative processes in the development of human settlements. The prime objectives are (a) the provision of better housing and (b) the reduction of costs, through action-oriented R&D by research insitutions in cooperation with other bodies associated with housing. Utilization of local materials and skills, innovative designs, and application of the most appropriate technologies are central foci of the project. In-country linkages with national housing authorities, relevant construction industries and financial institutions are essential and are to be developed. Of equal importance, plans must be formulated and implemented for relevant information exchange within the network and with other organizations involved with similar activities in different parts of the world.

The following is a list of the network cooperating institutions:

1. Asian Institute of Technology, Bangkok, Thailand
2. Institute of Technology, Bandung, Indonesia
3. Korea Institute of Science and Technology, Seoul, Korea
4. University of the Philippines, Manila, Philippines
5. University of Hawaii, Honolulu, Hawaii
6. Cornell University, Ithaca, New York
7. Directorate of Building Research/U.N. Regional Housing Centre, Bandung, Indonesia
8. Hawaii Community Design Center, Honolulu, Hawaii
9. Korea National Housing Corporation
10. University of Singapore

THAILAND - Asian Institute of Technology (AIT)

The following is a list of current R&D projects being undertaken at AIT under the direction of Dr. Tongchat Hongladaromp and Dr. Ricardo Pama.

1. Mechanical Properties of Bamboo Reinforced Slabs
2. Design and Evaluation Criteria for Low-Cost Housing
3. Design of Asbestos Cement Houses for Low-Income Families
4. Prefabrication in Low-Cost Housing
5. Mechanical Properties of Wood-Cement Composites
6. A Study of Bamboo as Reinforcement for Slabs on Grade
7. Evaluation of a Corrugated Asbestos Cement Roof Panel
8. A Design of Low-Cost Rural School Building
9. A Performance Evaluation of a Low-Income Multi-Family Housing Systems
10. Design of Low-Cost Houses for Lower-Middle Income Families
11. Performance Evaluation and Design of Asbestos Cement Low-Cost Houses

KOREA - Korea Institute of Science and Technology (KIST)

The following research projects are already underway at KIST:

1. Utilization of Coal Wastes for Building Materials - Ceramics Materials Lab
2. Utilization of Zeolite in Waste Treatment - Environmental Engineering Lab
3. Styrofoam Concrete for Building Components - Plastic Lab
4. Study on Thermal Insulation and Fuel Economy in Building Units - Chemical Process Development Lab.

In addition, two other research projects are in the planning stage:

1. Design and Development of Lime-Sand Brick Manufacturing Plant
2. Process Development of Autoclaved Lightweight Concrete

Dr. Sung Do Jang, the project director from KIST, suggested that after the information exchange system is established, the following projects might be undertaken in cooperation with the cooperating institutions:

1. Software Research
   a. Each cooperating institute conducts a follow-up study on its on-going projects.
   b. A methodology is worked out for transferring a developed technology into practice by local people.

2. Hardware Research

   a. Improvement of existing technology in terms of quality as well as productivity

   b. Search for new low-cost building materials such as calcium silicate brick and unburned structural materials

   c. Design and development of low-cost housing unit making use of new materials such as light-weight aggregates and expanded clay products.

INDONESIA - Institute of Technology, Bandung (ITB) / Development Technology Centre (DTC)

Prof. Hasan Poerbo has indicated that the Indonesian project team at ITB will continue to pursue the following project goals:

1. Current Research Areas
   a. Linkages in wood-based industries as context for identifying what kind of wood-based components for housing can be developed.
   b. Product development: wood-based components for housing.

2. Related Programs
   a. Cooperating with Regional Housing Centre in Bandung
   b. Survey on linkages in wood-based industries
   c. Survey on housing markets and construction methods
   d. Formulation of performance specification for wood-based components
   e. Development and Testing of wood-based components
   f. Prospective field lab
   g. Promoting components for production and marketing

INDONESIA - Directorate of Building Research/U.N. Regional Housing Centre

Ir. Albert Kartahardja, Director of DBR/UNRHC has submitted the following research and development projects:

1. Binding Materials
   a. Urea Formaldehyde Adhesives
   b. Tannin Formaldehyde for Particle Board Manufacturing
   c. Tannin Production from Mangrove Species
   d. Latex as Binding Agent for Building Board Manufacturing

2. Building Element/Component
   a. Wood-wool Board Production
   b. Development of Prefab Concrete Building Elements and Components
   c. Particle Board - a pilot plant using post-mature rubber wood as basic material; located 90 km from Bandung. (With Belgian aid).

3. Housing Units
   a. Prefabrication of Houses
   b. Prototype Houses

4. Timber Construction
   a. Development of Prefabricated Timber Structure

5. Waste Materials
   a. Development of Particle Board from Forestry Waste Material

PHILIPPINES - University of the Philippines (UP)

Dr. Ernesto Tabujara, the Philippines project director, has enumerated the following current and planned projects:

1. Current Research
   a. Memorial parks as a multi-use element in the design of Philippine communities
   b. Information classificaiton and building typology for typical house types in the Philippines
   c. The Barangay as an operational system in the disposal of solid waste in urban areas
   d. Application of methane gas/septic tank system in housing design and layouts
   e. Usage requirement study of a prototype urban workers condominium in Metropolitan Manila.

2. Research Proposals
   a. Asphalt impregnated building material study
      1. Selection of candidate materials (newspaper, palm parts, corn leaves, abaca stalk andleaf, banana stalk and leaf, gobi leaf, water hyacinths).
      2. Identify a low-cost, labor intensive process for retaining the leaf/stalk veins and matrix. By directional lamination, impregnate matrix with asphalt or any locally produced latex. Layers of waste aluminum foil can be added.

3. Component design for added strength and durability
4. Systems designs for building use as roofing or exterior walling

b. Investigation of industrial waste materials for building purposes
   1. Rubber duct from tire recapping
   2. Tailings from mining operations
   3. Sulphur blocks from oil refining

c. Identification and locational analysis of inorganic building material sources in the Philippines

d. Design of building and finishing hardware for low-income housing

e. Evaluation of industrially produced bamboo laminates for building purposes
   1. Long-term physical porperties of KAWOOD
   2. Effectiveness of component designs of KAWMAT

f. Adaptation of traditionally multi-use ocncepts to the development of multi-family housing projects in urbanized areas of the Philippines

UNITED STATES - Cornell University

Dr. Floyd Slate has submitted the following research activities currently underway at Cornell University in the field of Low-cost housing for developing countries.

1. Study of ways to organize, teach, and conduct research in a multi-disciplinary mode for low-cost housing.
2. Design of adobe and rammed earth houses to resist earthquakes.
3. Modification of existing adobe and rammed earth houses to resist earthquakes.
4. Use of coconut hull fibers to make fibrous concrete for houses.
5. Survey of a Limon, Costa Rica squatter colony to be resettled to determine demographic information and such things as housing preference, ability for self-help, and their suggestions for solving housing problems.
6. Housing delivery systems in Ghana.
7. Rural and urban basic housing systems in Ghana.

This list does not include the large number of one-semester projects (or research) being done by teams of advanced students as part of their course work.

UNITED STATES - Hawaii Community Design Center (HCDC)

The following design and construction projects were submitted by David Firth, Executive Director; they are representative of the 59 projects completed in 1975. (HCDC provides architectural and planning services for many low-income residents of Hawaii who have expressed a need and a desire for low-cost housing.)

1. The Minimim House is a single-wall post-and-beam constructed house, designed to be easy to construct and maintain. The 3-bedroom house, which meets all building codes, is available to anyone for approximately $6,000. A modular construction system is used so that each family can choose its own floor plan and make other design changes to suit its needs. A building manual demonstrating the step-by-step construction has been compiled, allowing a family with no construction experience to build its own home. Construction and work teams are based on the OHANA concept, which means that help is forthcoming from the extended family as well as from friends; this situation is indigenous to the Hawaiian Islands, and familiar to most low-income people.

   The low cost of this unit is due to a simplified process of construction which eliminates the needless over-reinforcement of conventional housing, in addition to labor costs. Another method of cutting costs is to use smaller pieces of wood (the wood is fir and cedar). Also, modular stock pieces are used to eliminate waste. It should be emphasized that there is absolute minimal wastage of materials. Furthermore, the Minimim House makes use of natural ventilation, lighting and other energy savers.

2. Waianae Self-Help Housing Proposal. A self-help housing funding and operational proposal for Model Cities Housing Task Force to construct 180 houses in Waianae.

3. Kokokahi YWCA Cottages Renovation. Using Community Quest Students help in repairing existing cottages, steps, handrails, lanai and windows.

4. Kahuku Housing Corp. Plan. General planning assistance to aid residents in maintaining life-style community and housing for eventual construction of 244 self-help houses.

5. Solar Energy Proposal. Research and evaluation of different solar water heating systems for a CAP proposal for 240 houses on Molokai.

UNITED STATES - Cooperative

A tripartite relationship involving TDI, the University of Hawaii Department of Civil Engineering (UH-CE) and the Hawaii Community Design Center (HCDC) has resulted from a series of meetings catalyzed by Roving Workshop I. Plans are underway to design and construct a prototype soil-cement house on State property utilizing a self-help approach. This house will cost approximately $4,000 in an area where low-cost housing starts at $25,000. This represents an excellent example of West learning form East (soil-cement housing has, of course, been developed extensively in the Philippines. In fact, it was through contact with the Philippines delegation at Roving Workshop I that HCDC first conceived the idea of soil-cement housing for the State of Hawaii.)

TDI, UH-CE, and HCDC feel that soil-cement housing has great potential in the State of Hawaii for the development of low-cost housing. In addition to providing a different type of housing, it will conserve land and energy (this type of house can be clustered, thus it is ideal for an urban setting), make use of cheaper building materials (and eliminate the cost of transporting building materials), maintain current life-styles (design of the house is extremely versatile), and will make use of ecological utility systems (in addition to providing excellent insulation, thus avoiding energy consumption for cooling, and eliminating the normal upkeep of a wood house).

The labor force which will construct the houses will be composed of individuals from low-income community groups. Commitments have been received from low-income groups and individuals to do the actual construction

work. In addition, the Project participants hope that low-income people from their respective communities will come out and take part in the program.

Roving Workshops

One of the most successful features of this cooperative project has been the concept of a Roving Workshop. The primary intent of the Roving Workshop is to provide on-the-spot observations of actual research and development activities underway at each of the Institutions in the cooperative network and to exmaine the capability and potential of each to participate in an information exchange network. Roving Workshop I took place in January 1975, and included a core group of representatives from each of the five institutions involved in the embryonic cooperative network. This core group along with two TDI staff members, one senior fellow and a participant from Cornell University spent approximately five days each in Indonesia, the Philippines and the State of Hawaii.

Roving Workshop II took place in October 1975 with visits and seminars in Thailand, Korea and Honolulu. These activities were evaluated by the participants as highly successful in (1) providing on-the-spot exchange of R&D results, (2) further strengthening the solidarity of the network, (3) pulling together the various groups from public and private sectors to assure implementation of relevant R&D results, (4) confirming the need for establishing an effective information exchange system, and (5) creating an awareness fo the need for attention to sociological factors in supplying low-cost housing for low-income families.

Annotated Bibliography

Purpose of the Bibliography:

The main purpose of the Annotated Bibliography was to compile a list of the published LCH material, in order to facilitate research, avoid duplication of effort, and provide in one place, a listing of these materials for use by TDI staff and participants, and by members of the University of Hawaii and the community interested in the subject. This material would also be made available to the cooperating institutions in TDI's LCH network, as well as other agencies concerned with the low-cost housing problem.

Current Status:

The first edition of the bibliography has been prepared, containing approximately 500 entries divided into seventeen general topic headings. Other available sources were also used in compiling the bibliography in order to avoid duplication of effort and have been so acknowledged.

Future Plans:

It is hoped that every six months or so, the bibliography will be revised and new material added to the list.

It is also hoped that six master copies will be prepared in loose leaf binders and sent to the LCH network institutions so that each can include their own materials and thus complete the information available at each location. Then by exchanging this information, each of the institutions would be able to ascertain what information is available at other sources. Then, hopefully, an exchange of information would proceed. This will prevent duplication of efforts in research.

Documentation

The importance of multi-media documentation for successful implementation of the Low-Cost Housing project has been recognized by the cooperating institutions of the network. Each of these institutions sent a representative to TDI's TRIAD (Technology Resource Information Acquisition and Dissemination) Planning Workshop in June, at which time the foundation for a viable information exchange system was established. The techniques of "tracking," in which a project is periodically documented through its various phases over a period of time, is especially important because it vividly reveals the process by which a given reality has evolved. If the project is successful, the structural elements of this process (e.g., the need to establish linkages, the involvement of indigenous manpower and materials) can be successfully incorporated into a variety of projects. With the increasing dissemination of multi-media documentation materials, much of the present uncoordinated research and development in both developing and developed countries can be eliminated, and interested participants can begin to experience graphically solutions which may be adapted to their own situations.

With this in mind, TDI has placed before the United Nations Environment Programme (UNEP) a proposal for funding an eight (8) week training workshop for managers of technology resource information at each of the network institutions. The participants would first evaluate available print and multi-media documents at TDI and then update these files with materials brought from the field. These files would then become the basis for the cooperative design and production of several multi-media information packages.

It is proposed that the participants travel to Vancouver for Habitat, the United Nations Conference on Human Settlements, to present their multi-media packages and evaluate the effectiveness of similar presentations of other groups and agencies from different parts of the world.

It is hoped that this workshop will result in the realization of the following objectives:

1. Several prototype multi-media materials that demonstrate information packaging techniques useful at network institutions (newsletters, flyers, slide presentations, pictorial reports and displays, videotape presentations);
2. A cooperatively developed manual of procedures and policies for information exchange among network institutions; and
3. A complete set of the five-country network information packages for use by U.N.E.P.

In-Country Linkages

In order to implement the results of the research being carried out, it is a vital concern of all the network institutions to establish in-country linkages. This area has been one of the principal bottlenecks in attempts by many countries to provide adequate housing on a substantial scale for low-income families. It is agreed that there must be a viable linkage between R&D institutions and relevant organizations in that particular country concerned with the totality of the housing problem such as national housing authorities, construction industries, and financial or lending institutions.

It is gratifying to report that in-country linkages are now emerging due to the stimulation of the roving workshop approach, particularly through the in-country seminars which constitute an integral component of this experience.

In addition to the formal participation in the TDI network of the additional institutions from Indonesia and Korea, thus forming strong in-country linkages in those countries, informal in-country linkages were initiated or strengthened by the Roving Workshops. For example, in Thailand, through the medium of the Roving Workshop seminars, meaningful dialogue was started between government agencies and private industry on problems of low-cost housing, and a "consumer" group from a slum met for the first time with other interested groups in Bangkok during the seminars. Such informal in-country linkages as these may well prove to be most important, and of great future value.

RATC NETWORK

(Regional Adaptive Technology Centers)

The following article is taken from the SIDN Newsletter, vol. 1, no. 1:

Seminar Evaluates Regional Adaptive Technology Centers (1974)

Culminating a year of feasibility study and intensive planning, representatives of three nonmetropolitan unviersities in Asia and the Pacific met at the East-West Center in Honolulu, Hawaii from May 27 through June 15 to present, evaluate, and formalize plans for establishing Regional Adaptive Technology Centers (RATC) in Korea, Indonesia, and the Philippines. The RATC program, initiated by the East-West Center's Technology and Development Institute (TDI), is designed to link the technological capabilities of nonmetropolitan educational institutions with the needs of small and medium industries in the communities and regions which they serve.

Presentations of feasibility results and program plans were made by team leaders from the three universities participating in the initial phase of the RATC program: Prof. Gyong-chan Kim, Associate Dean of the College of Engineering, Yeungnam University, Gyongsan, Korea; Prof. Samuel Sangka, Dean of the Faculty of Engineering, Hasanuddin University, Ujung Padang, South Sulawesi, Indonesia; and Prof. Rufino Ignacio, Assistant Vice-President and Dean of the College of Engineering, Mindanao State University, Marawi City, Philippines.

Evaluative reactions to the program plans of the three nonmetropolitan universities were provided by members of the TDI project team and by invited representatives of development agencies and institutions during the main seminar sessions on June 3-7. In addition to TDI senior fellows and degree scholar participants, the TDI team included Dr. Young-whan Hahn, Dr. Bruce Koppel, Prof. Louis J. Goodman, Mr. Richard Morse and Mr. Fred Burian. Invited resource persons and program evaluators were Mr. Martin Bell, Senior Fellow at the University of Sussex, England, represnting the International Development Research Centre, Ottawa, Canada; Mr. Jerry L. Lewis, Industrial Development Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta; and Dr. Robert Meehan, Office of Regional Development, Bureau for Supporting Assistance, AID, Washington.

Khon Kaen University in Thailand became a member of the RATC network of cooperating institutions in 1975.

TDI sees its role as that of "catalyst and coordinator" of the project, (in contrast to the IDD statement) emphasizing "multinational sharing" of research and activity regarding the process of adapting technology to regional development.

Activities:

1. February-March 1975 - Seminar on field problems in industrial extension.
2. April 1975 - a workshop to develop a quasi-experimental research design for use by RATC field teams.
3. May-June 1975 - a research seminar on Entrepreneurship Training Curriculum Development.
4. A Research Training Internship Program for Documentation Strategies was executed simultaneously with these other activities. Participants have produced two newsletters (with the editorship rotating among participant institutions), and acquired a variety of documentation skills to serve the needs of their institutions.

Outside Assistance:

In a meeting with IDRC, January 5-9, 1975:

1. IDRC agreed to give priority consideration to RATC proposals
2. IDRC agreed to provide staff travel for the professional development of RATC personnel
3. IDRC agreed to provide funds for a newsletter to act as a medium for exchanging information and experiences among cooperating network institutions.

The following country reports indicated the current status of the individual RATC teams:

HASANUDDIN UNIVERSITY (Indonesia)

1. The RATC has been officially recognized by the university and placed in a favorable position for future budgetary considerations.
2. Motorized sailing vessels
   a. For a variety of reasons, traditional sailing vessels are still quite prominent in South Sulawesi
   b. The RATC wants to mount engine power in these crafts which can at least act as an auxilliary system in times of unfavorable weather conditions
   c. The owners of these craft (traditional entrepreneurs) are in need of extension assistance to run their businesses more efficiently
   d. There is need to harmonize the technological innovation with the traditional folk-craft of proa building.

KHON KAEN UNIVERSITY (Thailand)

1. Textile - formerly a cottage industry, now becoming industrialized. The RATC will concentrate on local materials and patterns which conform to the traditions of the people.
2. Salt production - There are large deposits of rocksalt in Northeast Thailand but industries resulting from it are under-developed. The RATC will try to solve the problems of fuel used in the evaporation process and the corrosion of pumps.

3. Meat Processing - Thai meat products have high export value if the quality, packing and sanitation aspects are improved.
4. Brick Making - although there are abundant clay deposits, traditionally made bricks are of low quality. The RATC will attempt to introduce improved methods of clay mixing, molding and heating.

YEUNGNAM UNIVERSITY (Korea)

1. Research into entrepreneurship extension and technology innovation
2. In-service training programs
3. Survey of rubberware and auto parts industries in Daegu

MINDANAO STATE UNIVERSITY (Philippines)

1. A Ceramics Center serves both as a training center and a demonstration plant. Ceramics making is another local industry which utilizes indigenous resources and has been identified by the RATC as one of its target industries.
2. An integrated coconut charcoaling and copra drying plant, invented by a local artisan, is further improved by the University through the RATC. In cooperation with private entrepreneurs, the Development Bank of the Philippines and the Philippine Coconut Authority, installation of an integrated charcoal and copra plants in feasible areas in the region is being worked out by the RATC.
3. A marine fishery research unit of the University, the Naawan Fisheries Station, which made a breakthrough in the spawning and culture of prawns (jumbo shrimps) conducts training to the local fishermen

following the RATC concept of technology dissemination and entrepreneurship development.

4. The Tugaya Brassware Center, established in cooperation with the National Science Development Board and Metal Industries Development Research Center, attempts to bring intermediate technological innovations to a traditional folk art, hoping to improve efficiency while maintaining the integrity of the process.

5. The MSU concept of training centers is an interesting one. In the Ceramics Center, for example, they discovered in Lanano del Sur an abundance of cottage industries, a universial orientation to crafts, and plenty of raw materials. Rather than disrupting this basic organization, they worked with it, seeking to make life easier for the practitioners (e.g. providing graphic illustration for illiterate people) without destroying their unique life style.

6. A low-cost housing technology project, initiated by the MSU College of Engineering, is being spread out to the community by the RATC group through training and technical assistance to set up low-cost housing villages on self help basis.

The soil cement research at MSU provides an excellent case study of intermediate technology application, which involves cooperation among university, government, local community, and private construction industry. This project was stimulated by Prof. L. J. Goodman during his tenure as a Ford Foundation Consultant at MSU from 1968-1971. It was a direct result of an initial research project investigating theuse of soil cement as a low-cost building material. A pilot two-bedroom house was designed and constructed of soil-cement

building blocks and tiles. The total cost excluding land was approximately $600. The house has a floor area of 45 sq. meters and can accomodate a family of 5-6 persons.

An experimental village of soil-cement houses was built, named the L. J. Goodman Village. A local builder has expressed interest in constructing a full-scale village using this material. MSU has received a grant from the Philippine government (NSDB) to continue R&D on soil-cement.

The follwoing papers indicate the extent to which soil-cement R&D has been pursued:

1. "Soil-Cement Research at MSU (1968-71)" - George Padilla

   The concern with the socio-economic conditions of society's less-privileged groups as a motivation for engineering research is explained. The variety of ways in which soil cement can be used to benefit the residents of the MINSUPALA region of the Philippines is outlined. A suggestion is made favoring a labor-intensive approach to house construction rather than a "pre-fab" approach which requires substantial capital investment. Self-help construction and utilization of indigenous materials, such as soil cement, are also seen as ways of reducing costs.

2. "Structural Characteristics and Suitability of Soil-Cement" - Ephinio Grengia.

   This paper attempts to establish the structural and economic feasibility of soil cement as a low-cost construction material.

Distinct economic benefits include the elimination of transportation costs (since the soil exists at the construction site), the lesser proportion of cement required, and the labor intensiveness of the process. From a cost standpoint, the use of soil cement blocks results in a 30% saving, and the possibility of replacing the manually operated Cinva Ram machine with a mechanical production system could reduce costs still further.
It is recommended that future research concentrate on hollow soil cement blocks which could accomodate bamboo reinforcement.

3. "The Behavior of Soil-Cement Wall Panels Under Lateral Static Load" - Vincente Alferez
   It is stressed that the development of soil-cement as a suitable construction material is a continuous process, which can be revised and improved upon during the actual construction phase.

MSU is also involved in other types of intermediate technology research. Examples:

1. There is a paper by George Padilla and Vincente Empig which deals with the properties of compacted carbide sludge.
2. There is also concern for the need for low-cost technologies to insure water potability.

Midwest Universities Consortium for International Activities, Inc.

(MUCIA)

MUCIA is working out a model for appropriate technology research which is similar to that of the RATC netowrk. The following papers indicate the direction for their present and proposed projects:

1. Donald Emerson has written an article, available on mimeo from the University of Wisconsin, which deals with the socio-political appropriateness of new fishing technology introduced in Muncar, Indonesia.

2. Mitchell Silver - The Use of Hydraulic Rams in Nepal (University of Wisconsin). Describes a "simple, low maintenance, non-polluting device" which can be used to deliver water to the high elevation villages of Nepal.

3. Merle L. Esmay - Post Production Technology for Rice (Michigan State University). Systems modeling and field measurements will be undertaken in an attempt to make this process more efficient. Factors to be considered include labor utilization, inequitable income distribution, cultural patterns, equipment performance and energy utilization.

4. Mung-wu Wu and Merle L. Esmay - Adoption of the Drum Thresher for New Varieties of Rice in Asia (Michigan State University). This paper presents a strategy for minimizing the losses in overall rice production due to "shattering" of the higher yield varieties. Adoption of a foot-pedal, drum-type thresher in the field near the point of harvest is recommended.

REFERENCE SECTION II:

SELECTED INDIVIDUAL COUNTRY REPORTS

INDIA

I. Government Sector:

(Based on a paper deliverd at a TDI conference by Bal Dev Singh, Director, Technology Transfer Section, Council of Scientific and Industrial Research (CSIR)). He makes a basic distinction between the large-scale outward looking scientific approach of the developed nations and the need of less developed countries to use science and technology to improve the quality of life of their people. He warns his Western-educated fellow scientists that they must "come out of their ivory towers and have a confrontation with the living reality around them, however unpalatable it may be." He then outlines a CSIR approach toward a use of more appropriate technologies:

1. Polytechnology Clinics - to deal with the problems of small- and medium-scale entrepreneurs. "The scientist/engineer in charge of the clinic will be provided with information and documentation wherewithal of the type required by the entrepreneur, reports of the small-scale industries that can be set up, sources of equipment and materials, etc."
2. Information Centres - to supply data regarding imports, exports, production, sources of information on technical know how and its availability.
3. Design, Development and Investigation Centres: These centres would essentially act as engineering consultancy groups but would be provided with facilities for investigations related to raw materials, mineral products, testing, etc.

4. Engineering Consultancy Groups: "They will undertake basic design engineering, techno-economic feasibility reports, project engineering reports, help in purchasing equipment." These services would enable a higher percentage of R&D results to be translated into industrial production.
5. Task Project - to identify the specific tasks which require R&D treatment.

II. CSIR/Madras (Structural Engineering Research Center)

(From a memo to L. Goodman from Dr. Rao - 3/8/76). Contacts: Dr. Rao and Prof. A. S. Ramaswamy.

1. The development of prefabrication and industrialized building techniques: structural use of burnt clay hollow blocks, aerate lightweight concrete, and laeterite aggregate for concrete.
2. One of the successful technologies developed concerns the use of high strength deformed bars as concrete reinforcement -- this innovation has proved quite popular with India's practicing engineers since it facilitates a considerable saving (up to 40%) in the use of steel.
3. "The transfer of technology in other fields includes manufacture of prestressed concrete railway sleepers, structural use of burnt clay blocks, concrete waffle shells for low-cost roofing, etc."

III. Innovative Technology Applications for Human Settlements

(Prof. Dinesh Mohan, Central Building Research Institute, Rorkee (CBRI))

1. R&D is being conducted on the following building materials: bricks

and other clay products, lime, fly ash, and agro-industrial wastes (coconut fibres, rice husks, etc.) - All indigenous and low cost.

2. CBRI is actively involved in research on a variety of locally acceptable building components, including: brick and stone masonry, concrete and brick skeleton systems, structural clay units, prefab flooring/roofing schemes, prefab brick panel system.

3. Technology - urban

   a. CBRI has developed simple gadgets for major building operations which increase productivity (about 25%) and improve quality.

   b. Considerable work has been done on short-bored under-reamed pile foundations for use in black cotton soil areas.

4. Technology - rural

   a. Sarvogram - a prototype hosue consisting of brick shell with mud mortar (no concrete or reinforcing) has been built.

   b. A bitumen spray has been developed for waterproofing mud walls.

   c. A technique has been developed to make thatch free from fire hazards by using a chemical solution.

5. Planning

   a. Anthropometric studies have helped to determine minimum space standards.

   b. CBRI has studied the impact of physical parameters like density, land use, environmental impact, economic factors, cost of land and development.

Conclusion: "We are trying to devise ways and means of improving the quality of our building environment with indigenous materials and available skills."

(Note: Mohan gives more specific technical analyses concerning these basic points in his article in the book Roofing in Developing Countries. There isn't enough new material to require a separate treatment.)

CBRI has published a slender volume called "CBRI Abstracts" which is of great interest for two reasons:

1. It is full of specific kinds of small-scale technologies in materials;
2. It is an attempt on their part at information exchange: it includes abstracts, book reviews, technical translations, etc.

They have also compiled a very valuable document which summarizes the most important research projects being undertaken "in the field of low-cost housing and allied subjects." The stated purpose of this document is to encourage researchers to initiate contacts with others engaged in similar activity. The primary emphasis is on materials and designs, but it also includes attention to documentation, communication, sociological factors (e.g. squatters), cultural factors (e.g. space requirements). Emphasis on low-cost and intermediate technology. (62 summaries, Sept. '75.)

IV. The Small Industry Extension Training (SIET) Institute was established as a Government of India Society in 1962 to assist in the promotion and modernization of small industries by undertaking training, research, and consultancy activities in the three related fields of small industry development, management, and extension education. In 1971, a fourth

department was set up to cater to the information needs of the small industry sector.

Activities:

a. Training

b. Consultancy Services

c. Research

d. Documentation

(Dr. P. C. Alexander)

V. The Appropriate Technology Cell in the Ministry of Industrial Development, besides its other regular work-programme, has at present been engaged in a publication entitled "Appropriate Technology for Balanced Regional Development" which includes four group reports on Road Construction, House Building, Shaft-kiln Cement Plant and Cow Dung Gas Plant; it also includes a large number of articles and papers recently published in India and prepared on the subject of Appropriate Technology under Indian Conditions. It will also contain records and proceedings of the Second National Seminar on Appropriate Technology held last year, which discussed three important problems: (i) Concept and methodology, (ii) Technology in the Fifth Five Year Plan of India, (iii) Institutional arrangement for the introduction and development of appropriate technology. (Bepin Behari, Joint Director, Appropriate Technology Cell, Ministry of Industry and Civil Supplies, India.)

VI. The Vaikunthbhai Mehta Smarak Centre is receiving publications from agencies which are advocating intermediate and low-cost technologies in agriculture and industries. The quarterly Documentation Bulletin which the Centre is bringing out contains annotated and abstracted lists of publications received in the Centre. It has two sections: Section I is devoted to detailed reports on low-cost technologies useful for rural areas, and Section II covers an annotated and abstracted list of publications. (Documentation Officer, Vaikunthbhai Mehta Smarak Trust, 5th Floor, NKM International House, 178, Backbay Reclamation, Bombay 500-020, India.)

VII. The Action Research Centre for Entrepreneurship is a non-profit organization in Bombay India, which has been established to encourage entrepreneurship at the grass-root or community level. Its approach involves four steps:

a. To survey the community regarding its unfulfilled economic needs

b. To locate individuals within the community who have skills and orientation to meet these needs

c. To train those selected in small enterprise management

d. To give the entrepreneurs initial market and moral support for one year.

THAILAND

ASIAN INSTITUTE OF TECHNOLOGY

AIT carries out an active program of research in engineering directed towards the problems of Asia. Research is funded by the Institute itself and, to an increasing extent, through research contracts and grants offered by outside organizations, both public and private sector. The January 1973 Research Summary contains a plethora of examples of projects undertaken by both graduate students and faculty in the field of applied technology. The projects are divided into six categories:

a. Water Science and Engineering

b. Transportation Engineering

c. Structural Engineering and Mechanics

d. Environmental Engineering

e. Geotechnical Engineering

f. Systems Engineering and Management

The following projects are typical examples of those dealing with appropriate technology:

1. #2132 - Storage of Rainfall for Drinking Water

   - Dr. Subin Pinkarpan (a faculty project in progress)

   The purpose of this study is to find methods whereby an individual family or small community can store surplus rainwater to provide drinking water during the dry season.

2. #4106 - Ferro-Cement for Henmetic Storage of Rice

   - Dr. R. B. L. Smith and Mr. S. Boon-Tong (a completed faculty research project)

Describes the development of a cheap, airtight bin made of ferro-cement, to hold about 3.5 tons of rice, with a minimum requirement for skilled labor. The moisture content of rice is maintained, and the insect damage is minimal.

3. #5027A - Flotation as a Method of Harvesting Algae from Ponds

   - Dr. M. G. McGarry and Mr. S. M. A. Durrani (a completed faculty research project)

The production of algal protein as produced in the high rate oxidation pond by treating domestic sewage is being studied by the Applied Scientific Research Corp. of Thailand in cooperation with AIT. Flotation has been studied as a method of removing algae from the pond water. The purpose of this study was to establish prototype plant design criteria for full scale operation.

4. #5031 - Nutritive Value of Sewage Grown Algae

   - Dr. M. G. McGarry and Dr. Prateap Rachapaetarphom (Faculty research project in progress)

As part of research into the treatment of sewage and production of protein through the mass culture of algae, an investigation into the nutritive value of the algal product to chickens was conducted by the Department of Animal Science at Kasetsart University.

5. #5033 - A Study of Filtration Methods for Providing Inexpensive Potable Water to Small Communities

- Alberto Mevilla, supervised by Dr. Richard J. Frankel

(a completed gradute student thesis)

This study was designed to determine in the laboratory the effectiveness of using two or more filters in series as a simple inexpensive water treatment system for small communities in place of the conventional treatment system.

6. Dr. Frankel mentions the value of the previous project in his own research on water filtration. The following is an abstract of his study:

> A water treatment filter capable of supplying drinking water to small units in the field has been developed and successfully treated over a limited range of field conditions in Thailand. The filter unit contained shredded coconut fibre and burnt rice husks as filter media, two readily available and inexpensive materials found throughout most of Southeast Asia. The clarity of the treated water was generally less than 5 units of turbidity (JTU) and color free. Disinfection with 1 mg/l chlorine or less is necessary to insure USPHS Drinking Water Standards. A water treatment canister designed for the individual soldier in the field and using the same filter media, was built and tested in the laboratory. Using the canister intermittently wet-dry-wet-dry appears to be workable and produces a satisfactory water quality. Further testing is needed however, but final design and operating criteria can be recommended.

(Note: Research performed by the AIT team in the field of low-cost housing technology is listed under the TDI network.)

PAKISTAN

In 1974, TDI received a request from the Pakistan Science Foundation expressing interest in technology transfer and requesting funds to establish an Intermediate Technology Centre. They indicate that the government's Minister of Finance has made it a top priority project. There is no need to go into the detailed rhetorical rationale behind the project (the failure of capital intensive development efforts, the need to up-grade the quality of life of rural people, etc.) since it is the same as others have articulated. The Centre hoped to benefit from such existing resources as the Pakistan Scientific and Technical Information Centre (information and documentation), universities, research institutes, government agencies and programs, cooperative societies, etc.

The following is a list of preliminary areas of interest:

1. ENERGY: Non-conventional sources such as wind, solar and bio-gas as well as small hydroelectric projects, other feasible conventional sources for local consumption where transmission is not possible.

2. WATER: Water harvesting and conservation, creation of small reservoirs, tube wells, shallow wells, desalination of water through solar energy.

3. FOOD & AGRICULTURE:

   a. Food storage, preservation and dehydration- fortified wheat flour and Nan. Development of processed livestock feed.

   b. Fish curing

c. Agriculture and animal husbandry practices, machinery and implements suited to small farms.

4. WORKS:

a. Building construction: utilization of mud and lime, and redesigning of houses for comfortable living conditions in terms of temperature and humidity appropriate to each area. Improved precast material, bricks and brick kilns and provision of lime kilns, etc.

b. Soil stabilized village roads, and culverts. These can be constructed from material avialable locally.

c. Health and Sanitation: Safe drinking water, village drainage and sewerage disposal and other connected facilities.

5. INDUSTRIAL CHEMICALS: Manufacutre of chemical and products from agricultural wastes, such as rice husk, wheat straw, banana pulp and fibre. Mini fertilizer and insecticide plants. Setting up mini-plants and local leather industry.

By establishing the Center they expect to:

1. Significantly increase employment opportunities
2. Reduce rural-urban migration
3. Provide cheaper and better housing
4. Provide low-cost energy to rural areas
5. Reclaim eroded lands and desert areas at low cost and high employment
6. Ensure some basic consumer goods

7. Improve communication to rural areas
8. Provide low cost health facilities
9. Improve food food situation by preserving food and increasing production.

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