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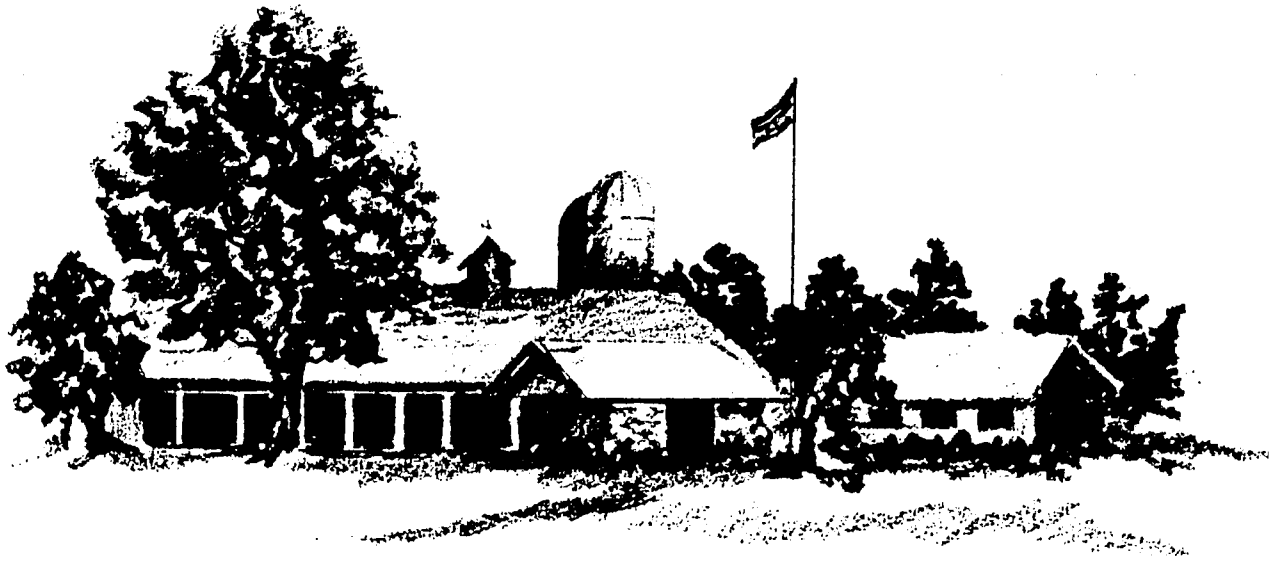

Winrock International Livestock Research & Training Center

Winrock International's basic mission is to support programs for the advancement of animal agriculture for the benefit of humans.

Winrock has its headquarters on Petit Jean Mountain in Arkansas (about seventy miles west of Little Rock). Extensive livestock facilities surrounding its offices were built by the late Winthrop Rockefeller, Governor of Arkansas from 1967 until 1971. It was Mr. Rockefeller's wish that the experimental operations he had begun would continue. Support was received from the Winthrop Rockefeller charitable trust to enable Winrock International to begin its operations in 1975.

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Proceedings of a Workshop

Appropriate Technology

December 1-5, 1978
Winrock International Conference Center
Morrilton, Arkansas

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Introduction

From December 1 to 5, 1978, two dozen leading practitioners of appropriate technology in the United States and abroad gathered at the Winrock International Conference Center near Little Rock, Arkansas, under funding from the Office of the U.S. Coordinator for the United Nations Conference on Science and Technology for Development. The meeting's discussions were wide ranging, analytical, descriptive and prescriptive, and hopefully they, and this report based upon them, will serve to advance their purpose: to help inform U.S. policy makers and guide national policy on appropriate technology in connection with the upcoming U.N. conference, to be held at Vienna, in August, 1979.

The term "appropriate technology" has come into increasing usage in recent years, signifying an alternative to what are seen as common characteristics of much of conventional technology. Because a good deal of the interest in appropriate technology has centered on applications in developing countries, it is likely that AT, as it is often referred to, will be at least an informal focus of discussion at the conference. Yet for all the currency of the term, appropriate technology remains for many either an unfamiliar or hazily defined conception or misconception.

At the least, the Winrock Workshop should dispel a frequent misconception. This is the notion that appropriate technology is basically old-fashioned technology, which is being offered to poorer countries while the richer ones keep advanced technology for themselves. Many of the workshop participants are involved in appropriate technology projects in the United States, and if there was one dominant theme of the discussions, it was that appropriate technology was in the advance not the rear guard of technological change, that it applied as much in developed countries as in developing, and that both shared a mutual interest in furthering its understanding and adoption everywhere.

Definition of "Appropriate Technology"

Appropriate Technology does not offer an absolute technological prescription but rather a process of choosing from among a broad range of options. The AT approach seeks to optimize solutions, wherever possible, through reliance on problem-solving capabilities of local people as well as a sensitivity to environmental and cultural impacts.

In the process of choosing an appropriate technology, economic priorities include: maintenance of balance among material, labor and capital supply, availability to the widest range of people, utilization of local materials, minimization of unemployment, gains for both producer and consumer. Environmental priorities include: renewable energy resources, natural resource conservation, recycling, replenishable raw materials, minimal pollutants, waste minimization, harmony with nature. Social priorities include: enhanced quality of life, creative work, elimination of alienation, maximum participation in decision-making, respect for cultural values and practices.

Characteristics of Appropriate Technology include:

- Can be simple, intermediate or high technology.
- Is selected based on dialogue and mutual respect between those who plan, produce, consume and are effected by technologies chosen.
- Relates to existing skills or those acquirable by training.
- Tends to distribute political and economic power more equitably.
- Uses all resources efficiently and keeps total-life costs low.
- Is understandable by, and accessible to, end-users.

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* This definition of Appropriate Technology is based on the UNEP report drafted by an expert group in 1975, the National Science Foundation Workshop on Appropriate Technology held in 1978, and the Winrock International Workshop on Appropriate Technology in 1978.

Why Appropriate Technology

> "Industrial history has made it quite clear how an unbridled expansion of scientific and technological development can run counter to human well-being, and can threaten the quality of life (e.g., pollution, industrial hazards, inhuman working conditions, urban conjestion, arms proliferation).
>
> The innovation process has, far too often, been solely motivated by objectives of economic growth and profitable markets, and sometimes by national prestige as well. Slowly it is dawning upon mankind that only an intergrated and balanced economic and social approach, based upon appropriate economic, social, human and moral values, can have the desired effect of accelerating development of man and society which, in turn, will generate new social and cultural values."*

While realizing that technology is the principal tool by which large numbers of people have attained physical comfort and freedom from want, we also acknowledge that this process has often created within many people a feeling that they have "lost control" of their lives in that they do not comprehend or understand the technologies affecting them and therefore experience a sense of helplessness and inevitability.

In fulfilling humanity's physical wants and desires, technology has often denied or even actually obstructed the fulfillment of higher values, needs and aspiration.

Even within the technical professions it is acknowledged that technological development often does not meet human goals; or that it produces undesirable side effects that often require additional technological patchwork to remedy.

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*From the national document of The Netherlands, now in preparation for the UNCSTD Conference. This statement and the following paragraphs were endorsed by Winrock participants as a common expression of aims and concerns.

The tolls of technology are perhaps most apparent in the most technologically advanced countries, where attempted remedies or ameliorations have spawned numerous and still proliferating bureaucracies--monitoring, enforcing and regulatory agencies that spend billions of dollars to "solve" problems created by technology.

The importance of AT rests ultimately in the hope that new applications and kinds of technology can grow out of our past technological "mistakes", and that the entire world can learn from our experience so that others -- as we are beginning now to do ourselves -- choose future technologies that truly serve humanity.

Case Studies

Participants in the Winrock Workshop described a number of appropriate technology programs, projects and organizations in the United States and abroad. These case studies illustrate the appropriate technology approach in concrete terms and indicate the breadth of potential AT applications.

As befitting an area in which decentralism and openness to alternatives are advocated, the case studies reflect no doctrinally neat, unifying pattern. Most involve small-scale operations, but one, a $50 million project, hardly qualifies as a micro-enterprise. Most are oriented toward poorer regions or communities, but significantly, in view of assertions that appropriate technology applies as much in developed as in developing countries, several programs have settings in both.

Some case studies employ what might be termed "intermediate" technology, less complex, perhaps less sophisticated than the more "advanced" brand, but several projects are operating at the forward edge of some of the most exciting technological frontiers of our time, including electronic micro-circuitry, solar energy and bio-technologies. Many of the case studies are on-going success stories, but some are only first chapters, some ambiguous.

One important common denominator does emerge, however, a conscious, and conscientious, effort to tailor systems, organizations, projects, machinery to specific needs and capabilities of specific people. There is also a practical recognition that technology in itself is no panacea, no matter

how well matched, no matter how appropriate. As one participant put it, technologies are "sterile" without managerial capabilities to effectively use them, or the financial resources to pay for and operate them. Throughout the case studies, there is, in other words, a combination of experimentation, what might be called intimate rather than abstract humanitarianism and hard practicality -- which form a definition themselves for appropriate technology.

AGRICULTURE

Small Farm Energy Project

One of the social and economic aims of appropriate technology is enhanced regional self-reliance through greater use of local resources to fill local needs. For most of history, agricultural technology by its very regional nature has tended to meet this criteria. But in recent decades, partly because of cheap petroleum, "advanced" farming methods have become highly energy-intensive and therefore increasingly dependent on a resource that, far from being locally available, may originate half a world away. Now, after a quadrupling of world petroleum prices in the last few years, and with supplies subject to abrupt interruption for political and other reasons, alternative agricultural technologies are being sought that are less dependent on remote, uncertain and increasingly costly sources.

Such is the aim of the Small Farm Energy Project, a U.S. government-funded research and demonstration program set up in 1976 under which 24 farms in Cedar County, Nebraska, are attempting to see how far they can go in three years toward energy self-sufficiency. The goal not only is inspired by rising energy costs but stems from the farmers' traditional desire to be self-reliant. In the words of a project publication, a major purpose of the farmers in the project is "to begin declaring their independence from the nation's energy companies."

The project's farmers are experimenting with a variety of alternative energy sources, and alternative technologies to exploit these sources,

including solar energy heating, wind-powered generators and pumps, methane gas made from manure, and wood heating. Energy-saving techniques are also being employed to make all energy sources stretch as far as possible. Not only do such steps rely on locally available natural resources, they also employ the skills and ingenuities of the farmers themselves, rather than depending on outside specialists and technical experts. One project farmer, for instance, has constructed from materials available at local lumber yards a solar heat collector for drying grain in his storage bin. Previously the farmer has used a high-speed propane gas system to dry the grain. Records are being kept by all the participating farmers, and they indicate that the solar grain drier will pay for itself in five years in fuel savings.

All the participants in the project are fulltime farmers, with relatively low incomes; By midwestern U.S. standards, their farms, averaging 357 acres, are small. The farmers are all actively involved in testing and selecting new technologies. "They are the ones that make all the decisions," explained Roger Blobaum, who helped set up the Small Farm Energy Project. "They select systems, design them, build them, fix them, maintain and monitor them...The test of appropriateness is if the farmer is willing to do it or not." A methane digester, for example, was rejected by one farmer because in his judgement, it was too expensive, had a payback period that was unacceptable, and had operation and maintenance requirements he considered too demanding.

The Forestry Project

A tree-planting operation in Africa employs three pieces of heavy machinery, and the cost to establish one acre of trees runs around $1,900 (U.S.) an acre. Tree-planting under an afforestation program run by the Kweneng Rural Development Association, in Botswana, takes three men. Planting usually commences after the first rain and is done by hand: one man digs holes in a row, the second follows with seedlings, and the third waters the plants with a mixture of water and insecticide and then mulches them with grass. Total cost per acre: about $275.

In drawing this comparison, Robert Ntsima, head of the association's Forestry Project, said: "No attempt was made here to explicitly say what would be appropriate technology for the type of work KRDA is involved in. But it will be appreciated that under the given conditions--socio-economic, climate, etc.--this is a step in the right direction."

A community organization founded in 1969, the Kweneng Rural Development Association has taken a number of steps in the same direction, which, in the association's terms is aimed at "providing employment, increasing living standards, promoting district and national self-sufficiency and making the community aware of the need to conserve natural resources." The Forestry Project, has been one of the association's most successful undertakings in meeting these criteria, which are among those generally ascribed to appropriate technology.

Since the early 1970's, more than 100,000 trees have been planted. A labor-intensive operation, the project keeps about 45 people employed throughout the year, and the project both relies heavily upon local resources as its inputs and expects that its outputs will lessen dependence on imports. Instead of using imported chemical fertilizers, for example, the forestry nursery relies on locally available leaf-mold and manure to nourish tree seedlings. Protective sleeves are made out of old one-litre cartons of "chibuku", a local beer.

The trees that are now growing and being planted are expected to reduce a current reliance on neighboring states for small timbers used extensively for such purposes as powerline and telephone posts, fencing and rafters for grass thatched houses. The association also looks to its trees as a renewable, indigenous energy source, with the expectation that Botswanans will long continue to rely on wood burning for fuel and lighting.

Tropical Agriculture Research And Training Center

Conventional agricultural technology, with its emphasis on large-scale mechanization and heavy chemical applications, is largely irrelevant to small farmers who make up most of the developing world's agricultural population and who have neither the money nor the technical knowledge to take advantage of such methods. Two-thirds of the farmers in Central America fall into this neglected group, and their productivity has been hardly affected by the main tide of agricultural technology. It has little to offer in terms of their particular needs and possibilities.

The Tropical Agriculture Research and Training Center, based in Turrialba, Costa Rica, has been focusing on technologies that are appropriate. By a careful diagnosis of not only the more purely agricultural but the social and economic capabilities of such farmers, the Center has been able to help devise methods that have dramatically increased the productivity of small Central American farms the Center has worked with.

Improvements in the utilization of human, economic and physical resourses have been achieved through multiple-cropping techniques, rotational cropping, combinations of forest and crop farming, of crop and livestock production. In Nicaragua, for example, different spacing of ccrn and bean plantings has resulted in a 250 percent net income increase based on the same amount of labor and investment. In Honduras, one corn cropping season has traditionally been followed by another. It was found that interspersing corn crops with squash crops tripled net income. In Costa Rica, it was found that by planting corn at the same time as Gmelina, a fast-growing tree species, a net profit of $100 hectare could be realized. If corn and beans are planted with the Gmelina, the net profit rises to $1,000.

All new techniques are intimately related to actual farming practices, explained Manuel Ruiz from the Center, are simple and low-cost and require full financial responsibility on the part of the individual farmer.

ECOSYSTEMS

New Alchemy Institute

Appropriate technology is frequently depicted by its detractors as involving crude, outmoded methods and equipment. But for a group based on Cape Cod called the New Alchemy Institute, appropriate technology calls for scientifically sophisticated and elegant advances beyond what, in the group's view, is the true crudeness of much of conventional industrial technology. The institute, whose 20 fulltime members include highly trained scientists and technical experts, seeks to design and test technologies, often biologically based, that harmonize with nature rather than trying to overwhelm it. Many of their technologies, moreover, are interconnected into mutually reinforcing systems that draw less out of and discharge less into the external environment. They are thus both more economical and more environmentally benign to operate.

The New Alchemists' technological phisosophy is embodied in two "arks" the group has designed and constructed, one at its Cape Cod center, one on Prince Edward Island, in Canada. Inside both buildings are plant and fish growing "microfarms". These integrated architectural, ecological and agricultural units are seen as models for both urban and rural counterparts in both developed and developing countries. In one of the chains of mutually reinforcing processes at work in the Institute's designs, solar heat is captured in the arks through translucent south walls; the sun's heat is absorbed by cylindrical tanks, which serve both as homes for growing fish

and means of storing heat for sunless hours; water from the tanks is used to help fertilize plants in the arks; and some of the plants are used to feed the fish. The whole operation sustains itself through northern winters with virtually no use of fossil fuels.

The small-scale, aquaculture techniques pioneered by the New Alchemists are proving capable of producing protein at substantially lower cost and much higher densities than conventional commercial aquaculture. Under a grant from the National Science Foundation, the Institute is currently using electronic monitors and microcomputers to examine and analyze the interaction of variables affecting fish production. The group also envisions the use of microcomputers to help run small-scale food production systems such as theirs, and they foresee the possibility of such systems being capable of feeding and housing a family of four for an initial investment of about $50,000, or about what it now costs to build a residence alone in the U.S.

The New Alchemists recently have expanded their visions, too, from family or small-group-sized units to integrated villages; they are working on designs for communities within which power is provided by indigenous and renewable sources; waste treatment is tied to water and heating cycles; nutrient and aquatic components are linked to both waste manufacturing and food production.

The New Alchemy Institute's co-founder and chief philosopher, John Todd, described the even broader vision of technological appropriateness that guides the institute's and many appropriate technologists' work:

"..Our understanding of how human communities can be sustained is being transformed in fundamental ways. The intellectual underpinnings...are the theory of systems and ecology...A science for design is emerging out of the synthesis. This science emulates the workings of nature to create a design framework for human communities. It looks to ecosystem strategies rather than to machines for its model of organization, for the former carries the traits of long-term adaptability and enhancement.

"The first technological manifestations have come to be known as appropriate technologies. As in all fundamental changes or paradigm shifts, most of the new forms appear crude, lacking as yet the guiding hand of refinement. But if viewed as part of a larger design context the potential of appropriate technologies for improving the physical and spiritual well-being of humans is great. They have qualities which make them equally applicable in both the developed and developing world and can serve both human and environmental needs. They can be made participatory. They integrate energy, food and shelter as the basic functional units of society. They result in a reduction in scale, decentralization and process miniaturization. They emphasize a (bio) regional basis for implementation without negating the universality of the knowledge and strategies. They can be primarily powered from the wind, sun and biofuels, thereby reducing regional or national energy disparities. And in carrying out the basic work of society, they substitute information and biological processes for current capital-intensive and fuel-consuming machines. Inherent in ecological development and appropriate technology is the replacement of exploitive and extractive technologies with nurturing bio-technologies.

"In varying degrees all societies face fundamental changes as the post-petroleum era approaches. One of the great legacies of the industrial age has been the knowledge it has unlocked. The application of this knowledge is undergoing rapid change, and at its core are appropriate technologies."

Solar Aquasystems

In a time of heightened environmental consciousness, one of the fastest expanding technological areas is the designing, production and operation of systems to minimize air and water pollution. Yet ironically, these efforts to enhance the supply of two increasingly scarce resources --clean air and clean water -- are often achieved only at the expense of two others -- capital and energy. Modern "advanced treatment" sewage facilities, for instance, often require highly capital-intensive and energy-intensive mechanical and chemical processes. Ironically, too, they are beginning to be a troubling source of waste themselves: the residue of treatment systems is often highly toxic and bulky, and it is not obvious in many cases what to do with this residue.

Techniques using natural ecological processes are therefore being increasingly looked to as a more appropriate way of treating waste water. One of the first full-fledged systems to use such techniques is scheduled to begin operating this spring in the town of Hercules, California, 30 miles northeast of San Francisco.

The system was designed by Solar Aquasystems, a young company based in Encinitas, California. Chris Alsten, one of the company's principal figures, described both the company's approach to water treatment and the application of this approach to Hercules.

Water hyacinths, for instance, can be harvested and in combination with sewage sludge can be composted into a rich organic plant nutrient. Not the least of the system's valuable byproducts will be usable water itself. In water-scarce California, resale of purified water from the system, which is capable of returning waste water to drinkable cleanliness, may be enough to pay for the cost of running the system.

The Hercules facility initially will treat enough waste water to service a community of 3,500 people and will be expanded to one with nearly seven times this capacity. By working "in tune with nature", as Alsten put it, the system is expected to save enough over conventional treatment costs to pay for itself several times during a 30-year life cycle. The Hercules project was recently cited by the state of California as the state's most appropriate technology project of the year.

SMALL BUSINESS

ACCION/AITEC

Integrally interwoven in the appropriate technology approach to development is the small business enterprise. For, as contrasted to conventional technologies, appropriate technologies tend to be small-scale and to lend themselves to small operations. Small businesses and appropriate technologies, moreover, are seen as addressing a number of common social and economic problems and potentials.

Most important of all, they can be efficient job producers, in a time when unemployment and underemployment of large and intractable proportions plague many countries, both developed and developing. Very small enterprises, "micro-businesses", tend to be particularly labor-intensive. One study found that a loan or an investment of $1,000 in such enterprises could create a new job, whereas in medium or large industry as much as 20 times that amount is needed per job. Micro-businesses in poor areas, many of which are family run and have survived for years, also tend to closely fit the needs and capabilities of their communities; in many cases they are the only enterprises that exist in such areas.

These are among the findings of a small voluntary organization called AITEC, a division of ACCION International, which is specializing in the development of micro-businesses. And it is significant in terms of the claimed applicability of the AT-small business approach to both developed and developing

countries, that AITEC, having worked for many years in Latin America, recently started a program in Somerset County, Maine.

As AITEC's executive director, John Hammock, explained his organization's experience in Latin America "is relevant to the needs of the United States to assist economic activity which emphasizes labor intensity, small production units and a cohesive community relationship between producers and consumer."

The group, which began in the barrios of Caracas in 1961, has two main objectives: (1) to generate employment and income among the unskilled urban and rural poor through existing micro-scale businesses and (2) to establish mechanisms for micro-business, government and private corporations to work together in economic and social development.

One of AITEC's principal Latin American programs is based in the city of Recife, in northeastern Brazil. Generally, the businesses AITEC has helped there are family owned, had less than $5,000 in assets, fewer than 10 employees and total sales of less than $30,000 a year. Efforts to aid these enterprises have focused on:

(1) Obtaining credit for them from regular lending institutions. Banks tend to shy away from micro-businesses in poor urban and rural areas, as much because of the high cost of administering small loans as because of the high risks thought to be involved.

(2) Management assistance in areas ranging from business tools, accounting, finance, personnel, to production technology and relationships with the existing economic system.

(3) Assistance, through a non-profit agency, in business diagnosis, planning and bank relationships plus follow-up management assistance. This agency works closely with private sector leaders, banks and government agencies. It is funded primarily by private corporate and foundation donations, government grants and interest charged to micro-businesses.

The AITEC program in Recife has facilitated approximately 1,000 loans in five years at an average of $1,100 per loan. It has secured these loans in part through a loan-guarantee fund. The loss ratio has been two percent, and approximately 1,600 new jobs have been generated.

In 1977, AITEC began exploring the applicability of its micro-business-oriented approach to the many sections of the United States that have not shared in the nation's overall affluence. It focused on Somerset County in central Maine, a mostly rural, economically depressed region that is seen as sharing many characteristics with poor areas of Latin America, including stubborn unemployment and underemployment, increased dependence on government subsidies and the flight of skilled laborers, entrepreneurs and youth to the large cities.

A study of 82 micro-businesses in this region shows that they share a lack of access to credit and to management assistance. Primarily family concerns, these businesses average total sales of under $60,000 a year, have an average of four employees and assets of around $20,000. At present, AITEC's program is in the organizational phase, of getting government and private sector leaders and bankers together to provide basic services to micro-enterprises.

Trinidad and Tobago Development Foundation

"It occurred to me recently for the first time that what we have is an appropriate technology organization". Gerard Pantin, founder and executive director of the Trindad and Tobago Development Foundation, made this observation about his group. He was reflecting the fact that appropriate technology as a development approach did not, of course, spring up wholecloth but has evolved from and frequently merges with a general concern over reaching regions and populations that conventional industrial technology seems invariably to pass by. Thus some projects and groups such as Pantin's have been appropriate-technology oriented without knowing it.

The foundation, established in 1973, aims to help small grassroots enterprises to become self-supporting. Like AITEC, it does so in part by helping these enterprises get credit from banks, except that it works with community organizations as well as private businesses and helps new enterprises start up as well as aiding established ones.

Central to the foundation's philosophy is identifying and responding to local needs as the people in the localities themselves perceive them, not to impose standards from without. Nor does the foundation feel that outside expertise is needed but that "once the project really comes from the community there is ipso facto enough indigenous expertise."

Only three questions are asked in considering whether to help an undertaking:

(1) Is it really a project that has come from the community?
(2) Is the community able and willing to pay for the project?
(3) Is the only problem that the community cannot obtain a loan from the commercial banks?

If the answer to these questions is yes, the foundation asks members of the community to sign their personal guarantees and then proceed to guarantee the loan at a commercial bank. Some 21 projects have been funded over five years for a total of $150,000 -- the highest being $18,000 for a cooperative shop and the lowest $380 for a nursery school. Other financial help has gone toward purchase of a pick-up truck by a transport co-operative, equipment and materials by a handicraft group, plants and chemicals by an agricultural association, paving materials by a sports club. The repayment rate for loans to date has been 94 percent.

The foundation considers one of its most successful backings to be the loan of $10,000 to set up a food store in rural Tobago three years ago. Not only has the loan been repaid, but the cooperative is now operating with an unsecured $50,000 overdraft with the bank with no foundation guarantees. The cooperative has successfully broken into the credit system of the nation. "They don't need us. They don't need anybody. They're independent."

HEALTH

Health Care Institute

Health care often is not part of the catalog of concerns in discussions about appropriate technology, but it belongs there. It is increasingly an object of one of the main complaints of appropriate technologists: that expensive and complex systems have tended to grow up and to go in their own direction without benefitting -- sometimes actually harming the people they are supposed to serve. A "lack of fit" is one way the connection between health care techniques, delivery systems and the needs of patients has been described.

In aggregate terms, Americans today spend almost 10 percent of their GNP for health care, an average of $700 each per year. This amount is growing rapidly, with more and more of it being spent on high-technology medical diagnosis and treatment. Yet there is little corresponding increase in health.

A broadly innovative effort to lower health costs while increasing well being, and to do so by making professional practices more closely correspond to patient needs, is the aim of a new $50 million center in Detroit, the Health Care Institute, which opened its doors in 1978. As part of achieving this goal, Harold H. Gardner, executive director of the institute, seeks to "de-technicalize" health care. "We need to talk less about technology and more about appropriate personal services."

The heart of the institute is a joint ambulatory care facility associated with, but administratively independent from, Wayne State University and five inner city hospitals. When it is operating full scale, starting in 1979, the facility will be a major source of ambulatory care service for the city of Detroit; it also will serve as a training center for primary care providers.

Near the philosophical heart of the institute is the determination to move away from a "system that was heretofore exclusively physican oriented" and toward one in which primary care is provided by a range of specialists, including nurse clinicians, health educators, social workers, nutritionists, pharmacists. These specialists would not be "para-professionals", adjuncts to doctors, but would be autonomous providers in their own right. A major financial innovation being pioneered by the institute underlies the ability of other specialists to stand alongside the physician. They will be directly reimbursed instead of being reimbursed, as is customary, through the physician.

This approach will, it is believed, foster an optimum level of health care and encourage preventive and maintenance aspects of such care. It is expected to reduce unnecessary treatment and expenses as well, replacing a "medical model of care employing highly paid physicians to render services that can appropriately be rendered by other types of providers....a model of care....characterized by a high frequency of follow-up visits, referrals to secondary and tertiary levels of care and heavy use of ancillary services such as lab and x-ray."

For example, a person needing only health education or psychological counselling would not, as customary, automatically see a physician or be given a medical examination. Nurses are expected to be able to assess and treat complaints of many patients without reference to a doctor, an expectation based on data that show that 50 percent of visits to doctors do not involve serious medical problems. It is also expected that pressures for hospitalization will be minimized, pressures that now grow out of insurance patterns and the institutional linkage of primary care to hospitals. The overall goal: that "the patient's needs, not institutional, organizational or technological patterns, determine the provider type, the service mix and the intensity of care."

FOOD PRESERVATION

Food Processing Center

In a time when chronic food shortages are a harsh fact of life in many parts of the world, small-scale food-preserving technology is widely desired for humanitarian as well as hard economic reasons. Rural areas often cannot take advantage of even the limited amounts of the food they are able to produce because of spoilage. They are too far from urban food-preserving operations, yet their own output often is too small to warrant their own centers, given the large scale of most commercial food-processing equipment.

Since the early 1960's, the Ball Corporation, a large manufacturer of containers for food preserving and other products, has been exploring the manufacture and marketing of equipment for a cannery that could be "afforded and operated by a small community group." The object was to design a system that would be versatile, simple, durable and inexpensive enough for unskilled, relatively poor people to own and operate. By 1970 Ball had developed what is called the Food Processing Center, designed to sell for under $4,000, which seemed to fit the bill. So far, 140 facilities have been set up using this equipment. Most are in the U.S., in poorer regions such as Appalachia; less than 20 are overseas, even though the company originally had developing countries primarily in mind for the equipment. The Food Preservation Center apparently works well, after many refinements, but according the Mike Mehrer, former director of Ball's Food Preservation Program, now head of its Building Systems Division, the Company's program is considered unsuccessful.

Why? A number of factors are involved. While Ball has been willing to subsidize the Food Preservation Center for a number of years, partly for philanthopic reasons, the program has never been profitable or even reached the modest goal of paying for itself. Also, as far as its users go, explained Mehrer, the mini-canneries within the United States have rarely been bought or operated without subsidies of one sort or another. "Very few are breaking even," and those that are do so through the use of volunteer labor. Many purchases involved public funds.

The basic equipment was originally designed to sell for below $4,000, but prospective customers frequently wanted everything to be included that was necessary for immediate operation, in effect a turnkey package. "So it ended up that the basic unit was costing $10,000. Even that is a ridiculously low price for a complete canning plant. But it is still far removed from village level technology. The equipment is suitable for a market which is not at all well defined, which might now be in an emerging phase, and which demands great patience and staying power for the would-be seller."

Another complication, and one that is a common risk in small business development, is the shortage of skilled management to assure a successful operation. In all, a sound and appropriate technological approach to small-scale food processing appears to be undermined by an incomplete understanding of the operative market forces both among U.S. customers and in developing countries. Yet it should be noted that the case is not yet closed on the Food Processing Center.

Productive Women of San Juan Boxco

By contrast to the Ball Corporation's experience, a women's cooperative canning operation in San Juan Boxco, in southern Honduras, has been relatively successful. The operation uses equipment that is both more modest and more specialized than the Ball design. Fabricated in the village itself, and incorporating a wood stove, it cost about $500 and is used solely to make and can a mango puree. Prior to its construction, farmers either discarded surplus mangoes or sold them at no profit.

An outside technician helped in designing the equipment, adapting knowledge he had gained while working on a community canning project in Vermont that used Ball equipment. But, explained Kim Conroy, who worked with the co-operative as a Community Development Foundation project coordinator, "the people really built it. He just made sure they did it right and that they knew how to operate and repair everything." The 22 people working in the cooperative were instructed in food processing, internal organization and administration, but they had considerable previous experience in organizing themselves and working as a group. The fact that the enterprise and the equipment were owned and understood by the group, Conroy said, has been critical to their success. But it has not been a total success in terms of the goals of the enterprise. "It did not provide cheaper food for the people themselves because canned goods happen to be rather expensive, largely because of the cost of the container." The puree is sold, mainly

as a speciality food to schools, hospitals and city supermarkets. But the cannery did bring in income, created jobs, and employed an overabundant natural resource using a technology, that the community could both afford and operate on its own.

Strategy Factors in Appropriate Technology

As a strategy for development, AT is relevant in all primary sectors of human activity, including food and agriculture, health and human services, industry, commerce and economic activity, transportation and communication. In each of these sectors, this AT strategy has four crucial components: 1) People, 2) Financing, 3) Training, Education and Skills, 4) Organization.

1) PEOPLE

People, end-users, are at the center of the AT strategy. Several key factors define the strategy of working with people:

a) Need must be defined by end-users. This definition of need is situation-specific and builds from where people are.

b) Proper diagnosis of problems should be made and presented by the local people as a prerequisite for acceptance of the project.

c) Interest and participation are self-defined; outside resources are at the disposition of the end-users.

d) Risk is accepted and taken by people, end-users. This implies direct venture participation, and excludes welfare orientations and hand-outs.

e) People's direct participation begins with program choice, planning and design, and continues through program implementation and evaluation.

f) Special emphasis should be given to encouraging participation by women and others traditionally excluded from program planning and implementation.

2) FUNDING

Funding mechanisms have a direct bearing upon the implementation of AT and thus become a key factor in overall strategy of AT. The following factors define this strategy:

a) Financing of AT can be multi-source, tapping private, government and international resources. Emphasis is on a mix of funds which will ensure the independence of end-users.

b) Financing of AT can be multi-faceted, i.e., grants, loans, services, aides. Start-up development costs must be built into all programs; the important factor is that these funds provide subsidies only as long as necessary to ensure project viability.

c) Financing must be as direct as possible to project participants.

d) Since financing is not administered or distributed in a vacuum, there must be at least some minimal government awareness to ensure legitimacy.

e) Financing levels should meet the needs of the end-users small or large-scale funding is situation-specific; over-funding should be avoided.

f) It is important that the participants in a project contribute either finance or labor or both--to ensure their close identification with the project.

g) Financing must be flexible, requiring as little paperwork and bureaucracy as possible. Emphasis should be given to more small-scale financing.

3) TRAINING, EDUCATION AND SKILLS

AT's strategy of working directly from people's interests, needs and risks requires a complementary factor: the build-up of specific skills, talents and human resources. This factor is further refined:

a) Skills are program-specific, though they tend to divide into technical, managerial, organizational and leadership.

b) Skill models may be imported, from other regions or nations, if controlled locally, but the essential goal and product is the development of indigenous models.

c) The social, cultural, educational, and skill-learning level of people involved must be the starting point for program development.

d) Emphasis should be placed on "hands-on" training and educational-training exchanges between existing AT groups.

4) ORGANIZATION

AT can work through institutions and structures, either private or public, to ensure continuity and replicability; but it can also operate on a people-to-people basis.

a) Institutions must be as close to working directly with people as possible. This ensures that they will be responsive to, and representative of, the local community. These institutions include cooperatives, not-for-profit agencies, small businesses, local village and municipal governments, decentralized government agencies.

b) AT organizations can, and should, through boards of directors, advisory committees, local councils, bring together representatives of a cross-section of the community, including government, end-users, service organizations and the private sector. Sectors with specific resources, such as funding and skills, should be incorporated and effectively utilized.

Relationship of the New International Economic Order and A T

In international discussions, the New International Economic Order has been portrayed up to now almost entirely in terms of developed countries doing more for developing countries. In the context of technology, the demand has been that the products of advanced research and development be made available on easier, freer terms than has been the case in the past when they have been bound up with copyrights, patents, licensing laws, and franchising.

The NIEO, therefore, is seen as a system of relationships based on a sense of access and equity. At the intranational level, such a system includes "extending the benefits and technological advances beyond a few privileged sectors to the entire population, including areas both rural and urban, that have so far not shared in the process of economic growth...(It) aims also at the creation of indigenous technologies corresponding to original forms of development based on self-reliance and endogenous growth."* In this context of access and equity, appropriate technology as we have defined it involves a wider range of choices. This broadening requires improvements in:

- An awareness by people of the choices open to them; and
- A feeling of, and a real involvement in, the planning process (planning to be seen as a dialogue).

Appropriate technology and the NIEO are mutually supportive. A just system of international relations would create more congenial conditions for the development of AT and, alternatively, the evolution of AT, by fostering the self-reliance of developing countries, will in turn lay the foundation for the development of the NIEO.

* U.N. General Assembly document A/CONF.81/PC/L.2, dated 24 Jan. 1978

Proposals for the Further Advancement of Appropriate Technology

- Appropriate technology should be placed on the UNCSTD Agenda.

- The U.S. Delegation should include at least four AT delegates working in the development of appropriate technologies.

- U.S.A.I.D. should review technology in all its projects as well as the technology used by A.I.D. employees who are working in developing countries.

- Evaluations should be made which assess the impact of technologies provided through U.N. or U.S. assistance programs in fields such as irrigation, health, agriculture, housing energy and transportation.

- Mechanisms should be developed by organizations such as A.I.D. and other U.S., international and regional organizations engaged in AT programs to provide for on-site visits and training with other AT efforts. Among the mechanisms might be U.N. travelling fellowships in appropriate technology.

- Mechanisms for funding AT at the regional level should be established by appropriate specialized agencies of the U.N.

- Funding for AT activities in developing countries should be channeled through AT networks, not government agencies.

- Individuals and business enterprises have conducted considerable research on technologies which have proved not profitable in their particular application. On the assumption that such technologies

might be applied with success in other situations under other conditions, efforts should be made by institutions such as ATI, VITA, BRACE, GRET, TOOL, and ITDG to collect and analyze these case histories in order that these technologies may be considered for more promising introductions avoiding errors of earlier applications.

- Prior to the introduction of a new technology in an LDC provision funding should be made by the donor agency, multinational corporation or host government, whichever is appropriate, to prepare an initial assessment of its potential impact upon development goals of that country.

- AT projects should be designed to ensure that control rests with local communities and should be provided with the means to share the experience of AT practitioners conducting similar activities elsewhere.

Considerations for the U.S. Delegation to UNCSTD

- Application of appropriate technology is as important for the United States as it is for other countries, and all language that suggests paternalism should be removed.

- Appropriate technology is a legitimate technology alternative and should not be viewed or described by such terms as backward, second-rate or low-level.

- Appropriate technology utilizes the best of both old and new technology and should be viewed and described as a modern approach.

- All appropriate technology introduced into a country should take account of the national development plan of that country. In connection with this, account must be taken of a country's social, cultural and educational policies.

- The United States should give equal weight to economic, social and environmental priorities involved in applying appropriate technology.

- Technical cooperation between developing nations would be greatly enhanced by careful selection of AT advisors who are culturally acceptable to the country involved.

- The United States should emphasize, encourage, support and strengthen simplified and decentralized mechanisms for small-sum funding, accessible to small groups or individuals who may lack "official" status and who have not qualified before for funding by mainstream sources of development finance.

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