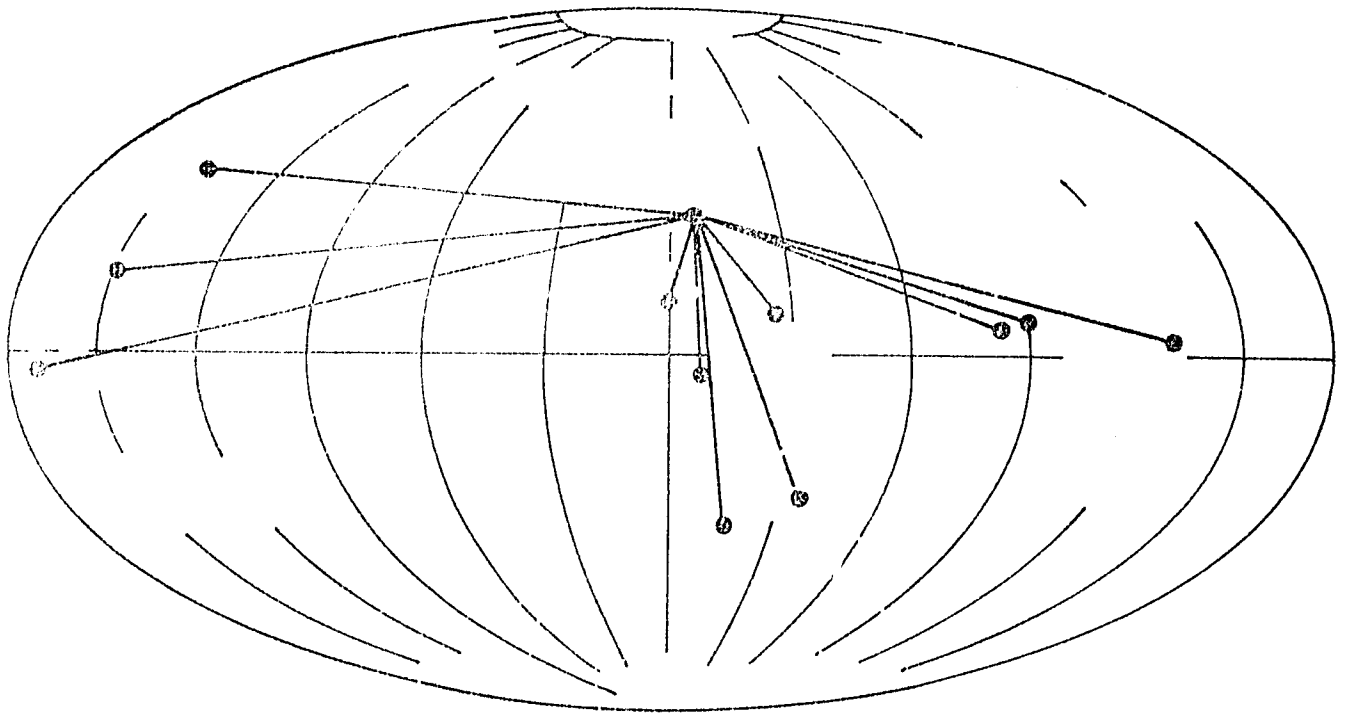


EMPLOYMENT GENERATION THROUGH STIMULATION OF SMALL INDUSTRIES



APPROPRIATE TECHNOLOGY AND THE LDCs

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332
U.S.A.

APPROPRIATE TECHNOLOGY AND THE LDCs

(Helping the Third World Through Appropriate Technology)

by

Ross W. Hammond

A farmer's wife operates a manually operated water pump located at a well in rural Nicaragua (Fig. 1). The pump is a low-cost, low-maintenance device which provides the family with clean, drinkable water. It is in place on a concrete pad on what was formerly an open well which was subject to contamination from rain runoff, animal and other waste, airborne bacteria, etc. The new pump installation provides healthy, bacteria-free, potable water for the farmer's family. It is an example of appropriate technology designed in the U.S. but adapted and manufactured in Nicaragua (Fig. 1).

A rice farmer in southeast Asia is running a small power tiller to till the rice fields before planting (Fig. 2). It is faster and easier than doing it by hand or utilizing water buffalo. It is lower in cost than imported competitors; it is manufactured in the country by local labor and is made of locally available components and material. It speeds up the rice growing cycle and, along with other devices, permits the planting and harvesting of more than one crop per year. The tiller is a piece of appropriate technology designed by the International Rice Research Institute, an organization which is financed, in part, by the United States.

In Ghana, a pyrolytic convertor is being built to use sawdust as its raw material. In a controlled combustion process the sawdust will be converted into alternative energy sources -- charcoal, oil, and gas (Fig. 3). These fuels will be used to fire kilns for producing bricks for the construction industry. These products derived from a waste material (sawdust) eliminate the need to burn scarce wood or expensive petroleum products to fire

the kilns. The pyrolytic convertor made with local materials by Ghanaians is an example of appropriate technology which has been adapted from a U.S. technology (Fig. 3).

What, then, is appropriate technology? There are many definitions, some simple, some extremely detailed. For the purpose of this discussion, however, appropriate technology is defined as "that level of technology best suited to solving an identified problem or satisfying a perceived need."

Appropriate technology is a process which has been going on for centuries in the sense that it is the intelligent selection of the best technology for a given task. Sometimes when the selection of the technology to be used has been incorrect and the results have been unsatisfactory, inappropriate technology has been used. A classic example occurred in Africa: after an entrepreneur purchased equipment which required three-phase power, he found that the available electrical service was single-phase and there were no plans to provide three-phase power. The equipment sat idle for years. Numerous other examples could be given of the improper selection of technology.

The popularization of the concept of appropriate technology is due in considerable measure to E. F. Schumacher's widely read book Small is Beautiful. In the book, he writes about the need to "humanize" man's activities by reducing the scale of man's enterprises, and to consider that many small-scale activities may have more merit than a few giant enterprises, especially in the context of social and cultural values. Because the book is philosophical in tone, it tends to lend a certain "mystique" to appropriate technology.

In utilizing appropriate technology to deal with real-world problems, however, the essence of the approach is simplicity and practicality. The characteristics of appropriate technology are well known and have been documented in a number of publications. While some differences appear among

these compilations of characteristics, most observers agree on the following criteria:

1. Appropriate technologies are generally low-cost and labor-intensive in manufacture and usage (Fig. 4). Hence, such technologies are particularly important in the developing countries, where capital is limited and labor is abundant.

2. Technology is seldom directly transferable without adaptation to suit different social, cultural, economic, and other conditions. Figure 5 shows a rice thresher which was adapted.

3. To the maximum extent possible, appropriate technology utilizes locally available materials, resources, and manpower. This is especially important in the developing countries because foreign exchange for imports is generally in short supply and imports are frequently more expensive. Figure 6 shows how empty oil drums are used for a chimney in Korea.

4. Appropriate technology should encourage and stimulate indigenous initiative and innovation. It is not sufficient to buy and transfer technology without incorporating features which will build local capability to adapt and manufacture the technology. U.S.-designed water pumps are manufactured in Costa Rica with excellent quality (Fig. 7).

5. Logistical support systems, such as maintenance services and spare parts availability, are essential to the successful utilization of appropriate technology. A Nigerian bakery which imported a modern electric oven for baking bread found it useless when it broke down and no spare parts were available in the country.

In the United States there are a growing number of organizations involved in various aspects of appropriate technology. The Georgia Institute of Technology (Georgia Tech) has been active in the design and construction of

appropriate technology domestically and in many countries. VITA (Volunteers in Technical Assistance) is a well-known organization, with a central staff but largely volunteer in nature, which has been active in the field. A new organization in Montana, the National Center for Appropriate Technology, has promise of substantial involvement in domestic appropriate technology. The U.S. Congress, in amending the Foreign Aid Bill, has set aside a substantial amount (\$20 million) for programs in this area. A new organization, Appropriate Technology International, has been formed to manage this program, working closely with the Agency for International Development. In the agricultural, industrial and energy fields, a number of organizations are producing appropriate technologies, especially in agricultural machinery, industrial problem solving, and solar, wind, and biomass conversion energy applications. Many public and private sector organizations, with relatively little experience but considerable latent capability, are considering such programs.

The interest and activity in the United States and other countries of the world have led to the presentation of many conferences, seminars, and workshops to discuss this emerging concern, to the documentation of appropriate technology activities by a number of organizations, and to the publication of hundreds of articles on the subject.

Significantly, there now appears to be developing a more systematic approach to documenting the appropriate technology activities of both national and international organizations. The process of selection of appropriate technology also is becoming more systematized. (See Box of Seven Steps to Appropriate Technology Selection/Design utilized by one practitioner organization.)

Seven Steps to Appropriate Technology
Selection and Design

1. Problem or need identification
2. Investigation of alternative technologies and resources
3. Analysis and identification of the appropriate technology
4. Design of technology, including adaptation
5. Construction of prototypes
6. Testing, evaluation, and modification of prototypes
7. Manufacture and marketing of commercial models

A large part of appropriate technology activity to date has focused on the agricultural sector for food production and utilization, since food remains one of the major problems of many parts of the world.

Another all-pervasive problem is caused by the rising costs and diminishing supplies of fossil fuels which have precipitated the energy crisis. Appropriate technology applied to alternative sources of energy holds promise of easing the demand for fossil fuels. Much applied research is being conducted in the United States on solar applications which can be used in the Third World (Fig. 8).

Another obvious sector where appropriate technology is applicable is the small industry sector, where technology can improve productivity, quality control, profits, and job creation (Figs. 9 and 10).

There are, of course, other aspects of appropriate technology. Most of the examples cited are hardware items -- machines, equipment, etc. -- but appropriate technology has a software side as well. Plans, programs, and strategies which have the characteristics of appropriate technology may be AT software.

For example, a number of developing countries have mounted programs of rural village development in an effort to make the rural environment more

attractive and to stem the migration of rural people to urban sectors.

An excellent example of this kind of program is the Saemaul (or "new community") movement in South Korea. This government program is basically a self-help and cooperative activity in which rural villagers are encouraged to work together on projects of mutual benefit. The national government provides assistance to villagers for a number of activities. An incentive program exists for industry to locate in villages, to help create employment. Villagers are provided assistance in building irrigation and drainage ditches, installing water lines, constructing community meeting halls, and similar activities which improve the living conditions of the people. Other programs promote community cleanliness, health, and sanitary conditions. In addition, there are conservation aspects (e.g., energy saving, reuse of old items). More than a million and a half thatched roofs have been replaced with colorful tile roofs, greatly enhancing community appearance.

The numbers in this program are impressive. By 1976, farmers had built roads totaling more than 41,000 kilometers. More than 1½ million households now have electricity. By 1976, water supply systems had been installed in more than 4,500 villages.

With such results, it is, nevertheless, a relatively low-cost program, utilizing local resources and manpower in a labor-intensive manner. In fact, when one analyzes the Saemaul program, it fits the criteria which are associated with appropriate technology very well. One may conclude that Saemaul is a kind of software appropriate technology program, even though it is not customary to call community development programs by this name.

A number of people oppose the concept of appropriate technology for various reasons. Some say that it is nothing new. Some say it does not

deserve a separate identification, others that capital-intensive activities have greater potential benefits to developing country economies. Still others look upon appropriate technology as an intermediate step between primitive and advanced technologies.

However, when one considers the rural areas of many countries, where infrastructure may be lacking or deficient, markets are primarily local or regional in nature, capital is in short supply, enterprises are almost invariably small in scale, and human resources are limited in education and skills, appropriate technology does seem to be an approach with some promise. Simple and practical approaches to human activities are needed in such situations. The necessary technologies are available in the United States and many other nations. With some modification or adaptation to suit the social, cultural, economic, and technical conditions where it is to be used, appropriate technology can help resolve the problems of the Third World, and in doing so, help create employment and a better distribution of income. Particularly suited to the rural environment, appropriate technology has application in the urban areas as well.

Whether one is for or against appropriate technology principles and applications, the widespread interest and activity in the field indicates that we will be hearing much more about it in future years.



Figure 1. A U.S.-designed pump installed at a Nicaraguan well provides potable water to nearby residents.



Figure 2. A power tiller based on the designs of the International Rice Research Institute for use in wetland rice farming.

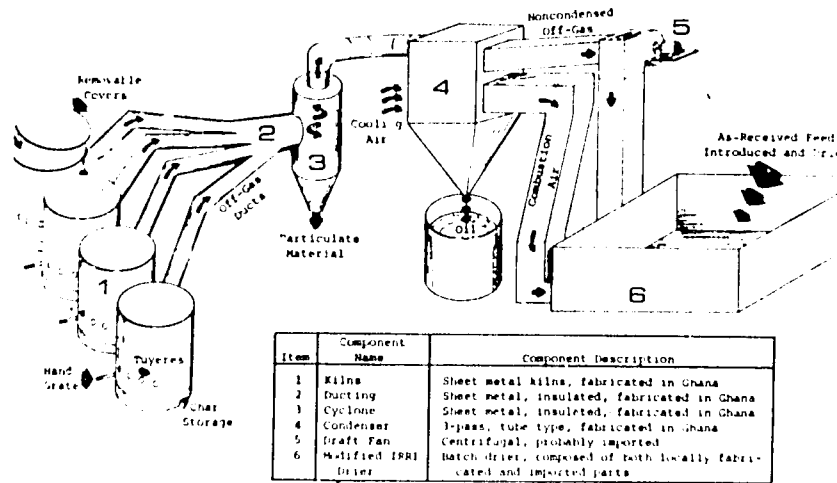


Figure 3. A schematic drawing of a U.S.-designed unit to produce charcoal, oil, and gas from waste sawdust.



Figure 4. One of the main features of appropriate technology is labor-intensive practices, such as shown here.

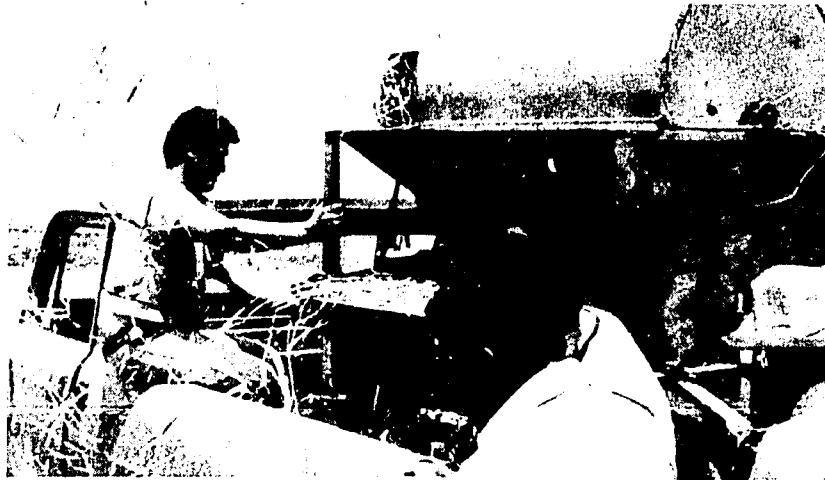


Figure 5. In Ecuador, an axial flow rice thresher designed in the Philippines, was adapted to handle other kinds of crops by U.S. engineers.

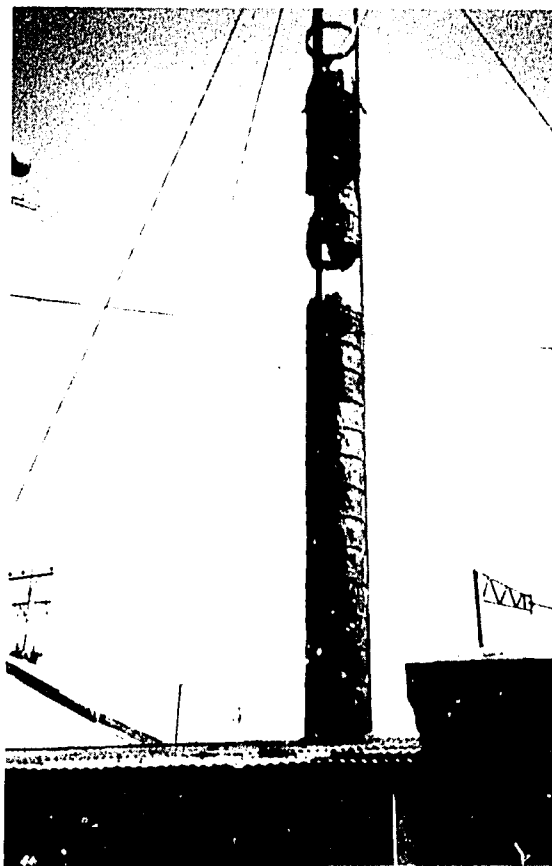


Figure 6. Oil drum chimney in factory near Seoul, Korea. A low-cost use of an available material.

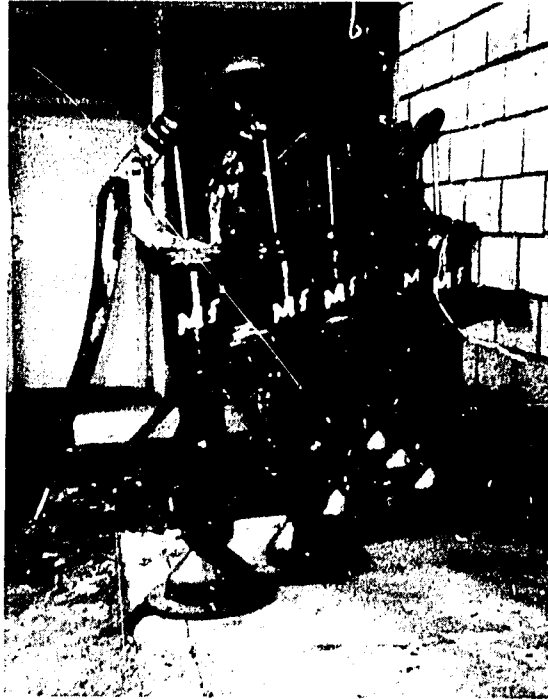


Figure 7. It was found that U.S.-designed water pumps could be manufactured successfully in Nicaragua and Costa Rica.

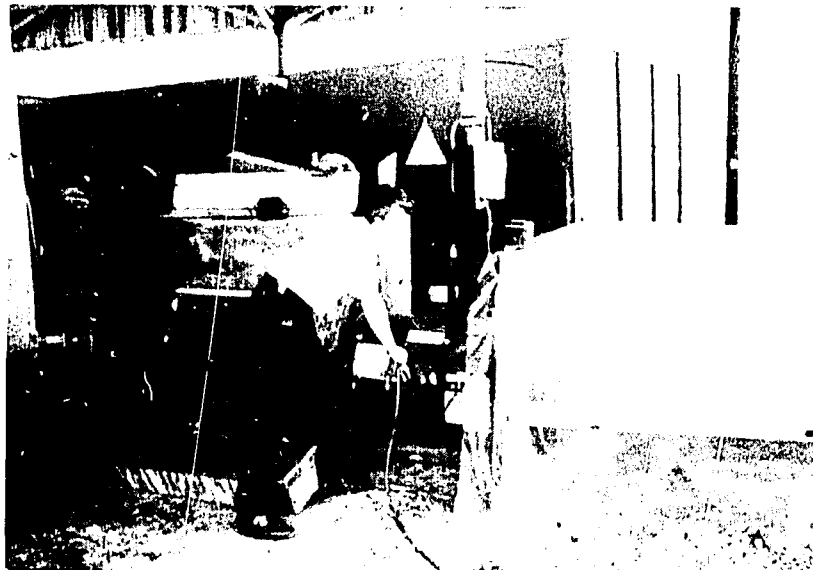


Figure 8. Solar heating of air saved a south Georgia peanut farmer many dollars in drying peanuts at this installation. The method has wide potential application.

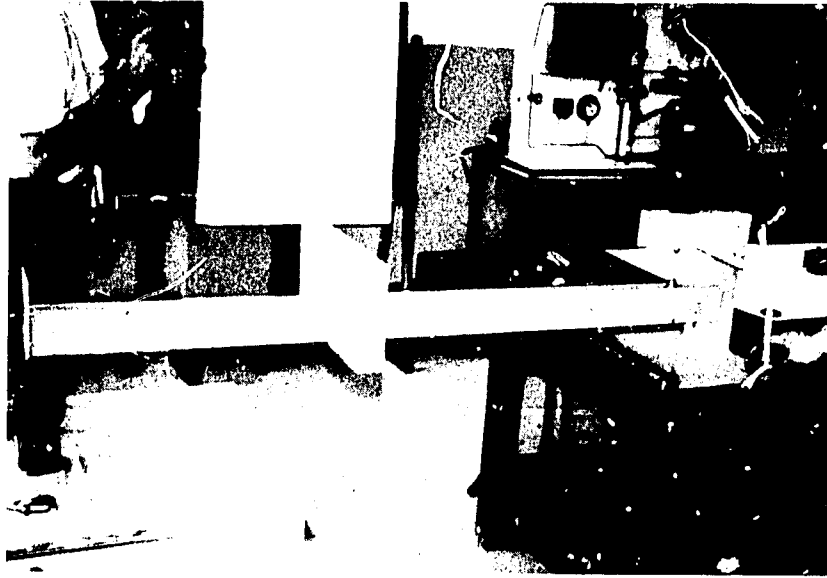


Figure 9. This low-cost tensile strength tester produced in Korea to U.S. specifications is low-cost and hence available to small-scale enterprises.



Figure 10. In rural Korea, the traditional backpack for carrying agricultural and other loads can be replaced by this U.S.-designed substitute. The wheel assembly supports 75% of the load while retaining the cultural aspect of backpacking.