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**NEW TECHNOLOGIES FOR FOOD CHAIN ACTIVITIES:
THE IMPERATIVE OF EQUITY FOR WOMEN**

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New Technologies for Food Chain Activities:

The Imperative of Equity for Women

Irene Tinker

The world's food supply has become a topic of international diplomacy. The World Food Conference in Rome in 1975 focussed the attention of the world on the increased demand of the growing world population on food resources. Generally there is optimism concerning the ability of the scientific establishment to respond to the food crisis with the new technologies capable of keeping food production ahead of consumption.¹ The World Food and Nutrition Study, completed by the National Research Council in 1977, emphasizes that

The most important requirement for the alleviation of malnutrition is for the developing countries to double their own food production by the end of the century. We are convinced that this can be done given the political will in the developing and higher-income countries.²

The basic strategy for rapid agricultural development, as outlined in the Rockefeller Foundation study To Feed This World is to increase both productivity and farmer's income. "Each agricultural development effort should have income generation through increased productivity as a primary objective."³ The importance of income in formerly subsistence economies increases as more and more crops and services be-

1. See for example Fred H. Sanderson, "The Great Food Fumble" in P. Abelson, Food: Politics, Nutrition, and Research. Washington, D.C.: AAAS, 1975.

2. National Research Council, World Food and Nutrition Study. Washington, D.C.: National Academy of Sciences, 1977.

3. Worthman, S. & R. Cummings, To Feed This World. Baltimore: Johns Hopkins Press, 1978, p. 235.

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come part of the monetary economy. It is widely recognized that increasing production is only part of the solution to world hunger; to provide food for the world it is necessary to reduce extreme poverty so that the hungry have money with which to buy food.⁴ Since the greatest concentration of poverty is among the rural people in the developing countries who have little or no access to land, there is increased attention to developing rural enterprises related both to the agriculture and to infrastructure.⁵

More recently, a third strategy has been added to the effort to alleviate world hunger and malnutrition: to reduce postharvest food loss. Conservative estimates indicate that 10 percent of durable crops such as cereal grains and grain legumes are lost between harvest and consumption; a comparable figure for nongrain staples such as yams or cassava and for other perishables including fish would be 20 percent or more.⁶ Technology applied to the storage, processing, and preservation of various foodstuffs should be able to reduce losses by 50 percent, automatically increasing available food on the world market by 10 percent.

These three strategies: increased production, greater income-producing activities, and a reduction in postharvest food losses are widely accepted among development planners as solutions for meeting the world food crisis. All three strategies start from the need for putting a platform under poverty, and for ensuring basic human needs become available for the world's poor. Yet nowhere in these prestigious works is there an acknowledgement that over half of the agricultural labor in the developing countries is provided by women, that women do most of the postharvest food processing and preservation, or that women cook most of the world's food.

Biases in Economic Development Theory

There are two unexamined biases in contemporary economic development theory which throw up psychological roadblocks to

4. A major theoretical framework for this view may be found in World Bank, The Assault on World Poverty. Baltimore: Johns Hopkins Press, 1975.

5. Current development strategies are reviewed in the World Bank Paper "Rural Enterprise and Nonfarm Employment." Washington, D.C., Jan. 1978.

6. National Academy of Sciences, Postharvest Food Losses in Developing Countries. Washington, D.C. 1978.

the inclusion of women as equal partners in development. The first is the continued perception of a dichotomy between the modern and the traditional sectors, between the economic activities done for money and those done as volunteer or citizen, between productive work and welfare activities. Statistics still tend only to reflect activities in the modern monetary economy; activities outside those boundaries are not considered productive, and hence not work. Clearly the role of an economic development planner is to modernize the country, to bring the agricultural sector into the modern sphere by crop specialization, surplus production, improved marketing facilities, and mechanization. An increase in the Gross National Product, it was argued for years, would bring a higher improved standard of living for everyone by trickling down. Now the argument includes income-generation at the bottom as well; but the basic tenets of the theory go unquestioned.

The second bias, the irrational stereotypes of appropriate roles for women which many men carry around with them, interrelates with and is reenforced by definitions of economic activity. Essentially, in this view, women don't "work", or if they do, they shouldn't; keeping women dependent on men is a boon to the male ego. Thus a draft of an AID agricultural policy paper done in 1977 could suggest that a measure of development would be reducing the number of women working in the fields. Almost anyone, male or female, would prefer less arduous work than weeding or harvesting in the hot sun, but only if alternative family income were provided either through new jobs for the woman or through doubling of the man's income. With neither alternative a part of the policy plan, the statement clearly reflected a bias about suitable occupations for woman: caring--non-economically--for husband and children.⁷

Informal Sector

These two unexamined biases have combined to skew development for poor men as well as poor women. First this emphasis on recording statistics only for the modern sector has

7. The USA Club of Rome is exploring the issue of male dominance through a project called "Masculine/Feminine Dimensions of World Problematique," under the leadership of Elizabeth Dodson Gray who has written "Masculine Consciousness and the Problem of Limiting Growth," 1973, mimeo. Dorothy Dinnerstein's The Mermaid and the Minotaur: Sexual Arrangements and Human Malaise. NY: Harper & Row, 1977. explores the male rule of our world and argues that the present inexorable creep toward self-destruction is a function of male psychosis.

obscured all activity in the informal sector. Thus planners for Africa were given data which tells them that only 5 percent of the woman work. It is too easy to forget that such a figure applies only to the modern sector and then to obliterate, for planning purposes, the fact that 60 to 80 percent of the agricultural labor is done by women in Africa, or that women dominate the marketing and processing of agricultural produce.

Men, too, find employment in this informal sector of the economy. Somehow that is seen, for men at least, as a transitional phase. Post-industrial societies are not supposed to have an informal sector. It took the National Institute of Mental Health to recognize the existence of an "irregular economy" in the United States and to fund studies of what the authors call "economic terra incognita." The concluding section of this study, "Potential Significance and Implications" notes

This study is clearly related to the alienation of groups, neighborhood-based, from larger structures of the society--in this case from the conventional production and distribution systems. Partly, the irregular economy arises from a lack of institutional response to a misallocation of goods and services, i.e., to a failure of the distribution and pricing systems to adjust and serve areas of unmet needs. In the main, the study attempts to identify these unmet needs and analyze the conditions under which neighborhood-based coping patterns develop.⁸

These comments clearly beg the question "what is work?" Kathleen Newland in her new book The Sisterhood of Man records how differently different countries define which activities are included in national income accounts. She describes the long work days of Iranian nomad women who, in addition to the care and feeding of the family,

...haul water into the camp on their backs. They milk and shear the animals, mostly sheep and goats. They collect such edible plants, berries, roots, and fungi as the surroundings afford. They churn

8. Berndt, Louise E., and Louis A. Ferman, "Irregular Economic: Cash Flow in the Informal Sector." Center for Metropolitan Problems, NIMH, 1977, mimeo. See also Dow, Leslie M. Jr., "High Weeds in Detroit: The Irregular Economy Among a Network of Appalachian Migrants." Urban Anthropology, Vol. 6, No. 2, 1977, pp. 111-128.

butter, make cheese and yogurt, and refine the left-over whey into the daily beverage. They spin the wool and goat hair into thread or press it into felt and make clothes, tent cloths, and carpets for their families' use. From each tent-household of an extended family a woman goes daily to collect firewood from the brush; on the average, she spends half a day at the task, plus another hour at the camp breaking the torn-off branches of thorn-bush into pieces small enough for the cooking fire.

In the national economic accounts of Iran...the only portion of the nomad woman's work that will show up even as subsistence production is her output of woolen textiles and dairy products. If she lived in the Congo Republic instead of Iran, the accountants would also include her food-processing activities in calculating the Gross Domestic Product, but they would omit her production of hand-crafted articles. Taiwan's bookkeepers also would leave out handicrafts; they would, however, assign economic value to the woman's water carrying and wood gathering. But in Nigeria, it would be argued that, in rural areas, wood and water are free goods, like air, and so omit the human efforts that make them useful.⁹

The inconsistencies of the present method of income accounts is increasingly apparent in the United States today. With the rise of two-income families, nearly half of the food consumed in America is eaten outside the home. Suddenly the effort to feed the family has been moved from an invisible category to economic activity. Many of the services to the sick and infirm which were formerly undertaken by compassionate volunteers, predominantly women, must now be paid for. While many women, as well as men, are anguished over the decline in volunteering, no one should be surprised. Money is the measure of success and status in the United States; non-productive activities are seen as peripheral and marginal--at least until they begin to disappear.

Women's Contributions to Family Survival

A second factor largely ignored is the importance of the woman's economic activity to family survival. Among the poor, every family member that is able must contribute to the family support. Such support becomes even more crucial as

9. Newland, Kathleen, The Sisterhood of Man. NY: Norton, 1977, pp. 129-130.

modernization pushes the poor family to the margin. Ann Stoler has analyzed women's economic activities in Java in relationship to the family budget and finds that the women in landless and near landless families earn one-third of the household's total income, a much larger share than contributed by wives from larger landholding classes.¹⁰ In Mexico the contribution of women to their families' budgets varies by cultural group as well as class.¹¹ Not only do women contribute to family income, but because of their responsibilities to the family they often are more adaptable in crisis situations.¹²

Particularly in Africa, the persistence of sex segregation both in occupation and responsibilities means that every woman is expected to provide food, clothes, and education for her children and food for her husband from her own separate budget. During the Sahelian drought, many observers noted that if the sauce to the millet gruel had only a single piece of meat, that was the share of the husband who of course ate first. Peace Corps volunteers urged women to grind the meat so that some protein might be left for the children; they did not presume to suggest that the man contribute money to buy the food.¹³ As men's earnings have increased through cash crops or urban employment, they often feel no obligation to increase their share of child support. Recently a Kenyan woman sued her urban-dwelling husband in District Court for school fees for their son. His defense was that he had provided her with a piece of land; she was responsible for the care and schooling of the children. Surprisingly the judge found for the woman who had argued that the size of the land made it impossible for her to save enough money for fees; besides, the husband was well-employed.

Because African women provided the bulk of family support, modern industry and plantations were able to siphon off the men without paying them wages sufficient to provide for

10. "Class Structure and Female Autonomy in Rural Java," Signs, Vol. 3., No. 1 (Autumn 1977), pp. 74-89.

11. Elmendorf, Mary, "Mexico: The Many Worlds of Women," in Janet Zollinger Gale & Audrey Chapman Smock, Women: Roles and Status in Eight Countries. NY: John Wiley & Sons, 1977, Chapter 4.

12. See, for example, Marilyn Hoskins, "Vietnamese Women in a Changing Society," 1973, mimeo; and Stoler, op. cit.

13. Personal interview, October 1978.

the entire family. A recent UN report comments this "functional relationship between the subsistence and the modern sector" in Lesotho, South Africa provides 95 percent of the cash earned in Lesotho. At any given time, close to 40 percent of the working-age male population resides in South Africa, thereby leaving the villages with a substantial numerical predominance of women. Since the men's earnings are not sufficient, the subsistence output provided by women is necessary for family survival.¹⁴

The pressures on the family of such migration patterns have clearly contributed to the increased numbers of women-headed households around the world. Economic development policies which have left women behind in the subsistence economy while pushing men into the modern sector encourage the disintegration of the family.¹⁵ Today between 25 and 33 percent of all households are de facto headed by a woman due to divorce, death, desertion, long term migration, or because she never married. These female-headed households constitute the poorest group in every country.¹⁶

Poor women, whatever their living arrangements, must work to survive. Being invisible to development planners, and being the poorest of the poor, they have as a group been most adversely affected by development.¹⁷ Perdita Huston quotes their own words in her book Third World Women Speak Out: "Life is more difficult than before."¹⁸

14. United Nations, "Development and International Economic Co-operation: Effective mobilization of women in development." A/33/253, 26 October 1978, p. 21.

15. For a longer exposition, see Tinker, I, "Development and the Disintegration of the Family," Assignment Children. UNICEF, 36, October-December, 1976.

16. Germaine, Adrienne, "Poor Rural Women: A Policy Perspective," Journal of International Affairs, Vol. 20, No. 2, Fall-Winter 1976-77. Such figures are extrapolated from micro-studies. An attempt to project this data to the national level may be found in Buvinic, M. and N. Youssef, "Women-headed Households: The Ignored Factor in Development Planning," a report submitted to AID/WID, March 1978, mimeo.

17. I have spelled this process out in "The Adverse Impact of Development on Women," in Tinker, I. and Michele So Bransen, eds., Women and World Development. Washington, D.C.: Overseas Development Council, 1977.

18. Chapter 2. NY: Praeger, 1979.

Women and the Food Crisis

The three major strategies for meeting the world's food crisis--increased production, greater income-producing activities, and a reduction in postharvest food losses--are also strategies for aiding the rural poor women. Women in Asia and Africa provide between 60 and 80 percent of agricultural labor; they produce 95 percent of the village food supply in Kenya. Indeed, poor women everywhere work in the fields, though such labor is often denied because of the status implications.¹⁹ Women's participation in processing, preserving, and preparing food is even greater than their participation in production. Women's responsibilities to help feed their families are becoming harder to fulfill as modernization restricts traditional activities which enabled women to grow or earn food. Greater income-producing activities for women will have a more immediate impact on providing basic food and health to the poor than similar activities aimed only at men.

In order for the food crisis strategies to accomplish their goal of feeding the world, women must not only be included in planning, they must be central to it. Since development is essential to the introduction of new technologies, women must be consulted in the selection of new technologies, trained in their use, and given means to control those most related to their spheres of economic activity.

Below I will review the impact of current development policies and new technologies on women's work in the production, processing, preservation, and preparation of food, emphasizing positive change while noting cases where women's traditional activities have been undermined. Because the fetching of wood and the drawing of water are necessary to carry out many of these food-chain activities, I will also discuss household energy needs and the requirements of a safe water supply. Many technologies have long been available to increase the efficiency of these activities, even to providing surpluses for sale. I will argue that the low priority assigned to them is directly related to the two unexamined biases under discussion.

19. Dulansey, Maryanne, "Can Technology Help Women Feed Their Families?" Report on the AAAS Workshop on Women and Development, May 1979.

New Technologies and Women

Almost universally, new technologies for food-chain activities have been introduced to men regardless of women's contributions. Technology, because it is modern, is somehow assumed to be appropriate and understandable only for men, not women. Besides, rural poor women are usually illiterate, and so presumed unable to alter custom to adopt new technologies. Further, rural credit is scarce enough, and seldom is extended to women because they lack assets for collateral. Land is the major rural asset, and colonial governments registered communal land in the man's name.

Women's uncertain access to land, credit, and education prevents their access to and control of new technologies which might help them out of the mire of poverty so that they could afford land, credit, and education. This vicious circle had intensified women's dependency on men in rural areas and undoubtedly encourages urban migration. With fragile marriage patterns the rule rather than the exception, women have little incentive to improve their use of land either for production or for fuel-gathering. Given their incredibly long workdays, poor rural women have almost no spare time which they might use to learn new processing or preservation techniques. Living at the margin, fearful that any change would further reduce their ability to feed their families, women are rightly suspicious of new technology. Interventions must not only reduce the workday, but must also provide sufficient income to buy the food or services which the woman stops providing, and to pay for the cost of the technology.

To date, most new technologies introduced into agricultural production have had a deleterious effect on poor rural women. Small machines for processing agricultural products and new techniques for improved preservation have had mixed impacts. Technologies to relieve the drudgery of collecting wood and refuse for cooking are only now being seriously considered as the environmental impact of current usage patterns becomes apparent. The provision of water for cooking and other household use has taken second place to water for irrigation regardless of the Water for Peace campaign in the 1960s and the more recent agreements at the UN Water Conference of 1977 on clean water for everyone by 1990.

I will briefly discuss each of these elements in the food chain: production, processing, preservation, and preparation, illustrating the types of impact that new technologies have had on women as differentiated from men. These various activities are part of a continuous process; successful intervention in one area can trigger change in another. Often

the spark vital for the first change came from new access to credit, or land, or training frequently made possible through women's networks or organizations. Strategies for increasing women's access to and control of new technologies will be presented in the final section along with a discussion of delivery systems. Where possible I will note the varying impact which technology has had on different classes of women as modernization contributes to increased social stratification. My focus, however, is always on the rural poor women. Yet even among this group distinctions are appearing.²⁰ Thus while I argue throughout this paper that women as a group are bypassed by modernization and technology, I wish to stress the importance of refining the target groups whenever projects are undertaken to ameliorate their position.

Production

Women play a major role in all developing countries in the different aspects of agricultural production: subsistence crops, cash crops, market gardens, and small animal and fish culture. The greatest impacts of technology in agricultural production have been on cash crops such as bananas, cotton, pineapples, rubber, tea, coffee, sugar cane, peanuts, and sisal. While many of these crops are edible, they are seldom part of the local diet. Even where eating peanuts was traditional, for example, the demand on the international market has pushed up the price to a point where local consumption has dropped. The nutritional consequence of exporting this high protein source have been widely noted. In fact, both Asia and Africa are net exporters of high-protein foods and net importers of high-carbohydrate foods.²¹

Cash crops have competed for land and labor with food crops. Until recently little research went into improving food crops. Only as wheat and rice became exchange commodities in the international market have there been concerted attempts to improve production. The resultant green revolution has affected rice and wheat, but other major subsistence crops such as yams and millet have yet to respond to research efforts. Market crops and small animal breeding have received little research attention, underscoring again the perceived dichotomy between the modern commercial sector and the

20. See for example Kathleen A. Staudt, "Class and Sex in the Politics of Women Farmers," Journal of Politics, May 1979; or Ann Stoler, op. cit.

21. Ingrid Palmer, Food and the New Agricultural Technology. Geneva: UN Research Institute for Social Development, 1972, p. 70.

traditional subsistence sector.²²

The impact of the new technologies both on subsistence and on cash crops varies both by major crop and by farming systems. Ester Boserup in her landmark book on Women's Role in Economic Development²³ relates women's status to the need for her labor in subsistence food crops or animals. Thus the technology of the plow contributed to a loss in status historically; similar impacts are recounted below when the introduction of the sickle in Indonesia or new crops in the Sudan lowers women's utility and hence their status.

Africa

The change in women's status as a result of modernization can be seen most clearly in Africa. In the traditional societies, women held fairly independent and equitable positions in both the nomadic and settled agricultural communities. Such societies were also characterized by little social stratification. Women did the bulk of farming work among the settled agriculturists. The major impact of technology, being focussed on non-subsistence crops, has been to draw off land and labor from the food crops. Women continue to grow and control food crops, but because this sector has not been monetized, they must seek money from other activities. The specifics of this impact vary from one society to another:

- men migrate to urban areas or to mines in search of income;
- women work cash crops in addition to subsistence crops;
- women's land is taken away for cash crops;
- new settlements ignore food needs and thus women's productive activities.

The culmination of these trends, discussed in more detail below, is to increase the work of poor women while lowering her status vis-a-vis men. Women from the growing elite classes have tended to move out of food production, although some have become extension workers or bureaucrats in development agencies.

Growing the subsistence crop has been increasingly left to African women as men migrate to cities. Statistics show that one-third of farm managers in Africa south of the Sahara are women, with even higher percentages recorded in some

22. Wortman, op. cit., chapter 7.

23. London: G. Allen and Unwin, 1970.

countries: 54 percent in Tanzania and 41 percent in Ghana. Algeria reported female participation in agriculture had more than doubled between 1966 and 1973.²⁴ Yet women's crops and women's work continue to be largely ignored by extension services.

Most cash crops in Africa are grown on small holdings. Thus, women are being asked not only to work their subsistence crop fields, but also to contribute their labor to cash crops. This added burden reinforces the inequity and inefficiency of the present practices according to Louise Fortman in her study of Tanzanian agriculture,

The inefficiency arises from the fact that women... have limited access to... information and land which would allow them to become more productive. This differential access is based... on accepted social norms and customs. Similarly, the heavy work load already imposed on women often prevents them from adopting improved technology that requires additional labour inputs. Thus the present village and household organization of labour limits the potential for increasing production.

[W]omen bear a disproportionately large share of the work (of export crop cultivation)... Because of traditional rules of land tenure relatively few women are able to undertake cash crop production in their own right. Those who work on their husbands' cash crops rarely receive a proportionate share of the proceeds.²⁵

Because women get few rewards from the production of cash crops, it is no surprise that whenever there are competing demands between food and cash crops, they work on the food crops.²⁶ In the Gambia, where women receive the proceeds from the sale of onions they grew, over 4,000 willingly work

24. UN document, *Effective mobilization...*, op. cit., p. 22.

25. "Women and Tanzanian Agricultural Development," Dar es Salaam, Economic Research Bureau, 1978, mimeo.

26. Jean A. S. Ritchie, "Impacts of Changing Food Production, Processing and Marketing Systems on the Role of Women, Impacts of the World Situation, Proceedings of the World Food Conference, 1976. Ames: Iowa State University Press, p. 133.

on this cash crop.²⁷ The success of this onion scheme was such that the men farmers was asked for assistance in planting this crop, and the government complied. The women, however, refused to work on their husbands' onion crop though they continued to grow traditional crops on their husbands' land. Apparently the men's onions withered.

Plantations are less common in Africa than in Asia, but women in both continents have provided cheap labor. This source of income is diminishing on the coffee and tea plantations in Uganda and Kenya. The introduction of insecticides and fungicides have reduced the need for weeding by as much as 85 percent.

Thus, technology has been used in a way that has had detrimental and paradoxical consequences for African rural women. While, on the one hand, the technological changes in the modern agricultural sector have deprived women of employment, the shortage of simple technological improvements in food-processing, energy and water supply, on the other hand, has left the rural women overburdened in their daily tasks.²⁸

Both national governments, eager for foreign exchange, agricultural experts, using the US as a model, have tended to view the use of land for subsistence crops as inefficient. According to one expert, writing in 1970, "...parts of upland Kenya could be devoted to vegetables, tea, dairying, and so on, but instead they are used by housewives for grains that take 9 to 11 months to mature."²⁹ Pressures to grow the more profitable export crops have reduced acreage allotted to food crops. Such changes have resulted in women losing their traditional rights to grow their crops on communal land. In Upper Volta, a foreign development scheme for swamp rice essentially turned the crop over to men through male extension agents working directly with men in the villages.³⁰ In the

27 Elliott R. Morse, et al., "Strategies for Small Farmer Development: An Empirical Study of Rural Development Projects." Prepared by Development Alternatives, Inc. for AID, May 1975, Vol. I, p. 190.

28. Ibid., p. 24.

29. Peter F. M. McLoughlin in his edited "African Food Production Systems." Baltimore: Johns Hopkins, 1970, p. 7.

30. Janice E. Baker,

Cameroons, women were forced off the cleared land near the village. Land near the village is nearly all taken up with coffee and cocoa plantations.

Food fields are anywhere from one to ten kilometers from the village with three to six kilometers most often cited. This distance implies a one-half to one and one-half hour walk to the food fields over rough forest paths, often with slippery stream and marsh crossings. The worst aspect of the trek comes during the return—a woman is often carrying the daily food supply of cassava, plantain, and corn, plus firewood, and often her baby as well. The weight is anywhere from 30 to 80 pounds. Injuries from falls or scrapes are common, and much spontaneous abortion and persistent backache is blamed on this aspect of women's work.³¹

New settlement schemes have had a particularly deleterious effect on women. In Nigeria the government provided five hectare plots for the growing of soybeans for sale. Corn could be grown for personal consumption, but amounts were limited by the seeds provided. No garden plots were provided, thus depriving women of land to grow food for the family which they had done, with the exception of corn, before joining the resettlement program. Income from the cash crops was given to the men; women received no wages for their labor. Further, those activities normally done by men, the clearing and ploughing, were mechanized, but not women's activities of planting, weeding, and harvesting.³²

The Mwea irrigated rice scheme in Kenya did allocate small garden plots to the women, but these were small because it was assumed that rice from the irrigated plots would be added to the diet. Women in fact did receive some rice in return for her labor on her husband's land, but since the men refused to eat rice, women had to sell it and buy traditional food at increasingly high prices. Women on the scheme did not have time, nor land, to raise enough food for their own consumption. Thus they worked longer hours than before but could not provide as much food for their families as they had. In addition, they often had to buy firewood for cooking since

31. Henn, Jeanne K., "Report on Women Farmers and their Relationship to the ZAPI de l'Est." Washington, D.C.: World Bank, Rural Development Division, March 1976, mimeo.

32. Dulansay, Maryanne L., "Women in Development: A Training Module." Washington, D.C.: Consultants in Development, 1977, mimeo, p. 5.

fuel was scarce in the resettlement area, and women's time was less. Thus while the total income of the families in the scheme has gone up, and visible wealth in the form of transistor radios and bicycles is in evidence, nutritional levels nonetheless have fallen.³³

The New Halfa Agricultural Scheme involved the settlement of the nomadic Shukriya. The independent production these women traditionally enjoyed came from their ownership of animals and their rights to milk from all the animals they cared for.

Since the Scheme concentrated on cash crops men's work acquired a new value: money. The only opportunity women have to make money on the Scheme, being deprived of their animals and not owning tenancies, is cotton picking. But since they can work on immediate family tenancies, the monetary value of that labor is very slim... Poor Shukriya women are the most likely to benefit from cotton-picking on other people's tenancies since being so poor exempts them from behaving according to the dominant social norms.³⁴

A recurring theme in all these studies of new technology for cash crops is that while cash income may have increased, nutritional levels tend to fall. The primary reason for this seemingly contradictory phenomenon is the fact that this income belongs to the man. Men use this money for improving homes, throwing "prestige" feasts, buying transistor radios. In the Cameroons men do use their income to pay school fees, unlike Kenya. Men often spend their money on liquor, gambling, or women, while their wives lack money to buy food they cannot raise.³⁵

A second major problem in ensuring that increased income is translated into improved nutrition is the marketing system. The fragmented nature of the present marketing

33. Palmer, Ingrid, "Rural Women and the Basic-Needs Approach to Development." International Labour Review, Vol. 110, No. 1, January-February 1977.

34. Murdock, Munaera Salem, "The Impact of Agricultural Development on a Pastoral Society: The Shukriya of the Eastern Sudan." Washington, D.C.: AID, April 1979, p. 54.

35. Wipper, Audrey, "African Women, Fashion, and Scapegoating." Canadian Journal of African Studies, Vol. 6, No. 2., 1972, pp. 329-349.

system in Africa means that traditional subsistence crops are not widely available.³⁶ Market crops cannot be shipped any great distance because of the spoilage problems and inefficient transport. Staples in many areas are sold only by one merchant; in the Cameroons the price of salt and sugar, sold only through the Zapi project store, rose with the availability of cash.³⁷ As areas urbanize, and markets include a greater variety of food, cash becomes even more important since in smaller markets it is still possible to barter. This fact, and the cost of getting to the central market, limited the ability of Shukriya women to obtain additional food.³⁸

Agricultural technology has clearly not worked in favor of African women. Subsistence crops and market crops have generally been ignored both by researchers and extension workers. Cash crops and farm machinery were considered appropriate only for men. Little concern has been directed at improving breeds of small animals. There are signs of change. The Integrated Farming Pilot Project in Botswana which was started in 1976 for male farmers to improve their dryland farming and livestock management techniques has recently expanded its program to include 100 women. Week-long courses will stress vegetable gardening and poultry keeping. Further, agricultural extension agents will organize special field days to demonstrate new techniques to women.³⁹ Scattered efforts have been made by Peace Corps volunteers to encourage the raising of bees, poultry, or rabbits, but there is little evidence that these new productive activities were incorporated into the local economy.

The Peace Corps efforts in introducing or improving fish culture in Africa have had a more lasting impact, particularly in Northwest Cameroons. Because this is a new activity in much of interior Africa, there is no cultural reason for introducing this potentially important income-producing activity only to men. However, only since 1978 have any of the "fish" volunteers been women. The current program in Zaire features the tilapia, which is vegetarian. Fingerlings are introduced into shallow ponds which have been built with a

36. Lele, op. cit., p. 180.

37. Henn, op. cit., p. 6.

38. Murdock, op. cit.

39. "Women in Development." The NFE Exchange, No. 13, 1978/3, Institute for International Studies in Education, Michigan State University.

plug so that water can be drained for easy harvesting. While men dig the ponds, women carry the agricultural and animal wastes on which the fish thrive. In six months there can be as high as a two hundred percent return! At present the fish is sold and eaten so quickly that preservation is not a problem. There needs to be immediate attention to marketing before problems arise. Given the divided use of money within an African family, improved nutrition will happen faster if the ponds and the fish marketing are developed within the woman's economic sphere.

The most successful African program for income-producing gardening and pigs is in Kenya. Its growth seemed almost spontaneous. While the government is now assisting in marketing, they played very little role earlier. It is instructive that the women expanded their gardens and small animals once they had time to do so. Every study of African women speaks about their overwork. How can women so close to survival dare to stop doing any one of the daily chores that keeps her family alive?

The mabati movement in Kenya gave women time. Tin roofs mean that rainwater can be saved and stored, releasing women from the daily chore of fetching water, a chore that takes two to ten hours per household.⁴⁰ The women used the traditional rotating credit societies to accumulate cash to buy the tin roofs.⁴¹ Each woman puts so much money in a communal pot; each woman wins the pot with the turn drawn by lot. With the time saved by available rainwater, and often with cash earned by selling some of the water, the women increased their production of vegetables, chickens, and pigs for sale in the urban markets.

This project would seem to corroborate the assumption that the major stumbling block for increased production of food among African women is their present time overload. Yet population pressures have meant that both water and fuel are harder to find, so that the time women spend in the traditional support for the family is increasing. Children can help the mother in these tasks. Thus concern for improved water and energy supplies not only would release women for more productive activity, but would also alter the present

40. "UNICEF/NGO Water Project", National Council of Women of Kenya, n.d.

41. Rotating credit societies are found throughout the world among men as well as women: for example, the arisan in Indonesia, susu in West Africa, gamava in Egypt, tanaboshi in Japan, etc.

incentives for large families.

Asia

The green revolution has tended to increase unemployment and contribute to the maldistribution of income in rural areas.⁴² More recently, studies have disaggregated the impact on women and on men. In India the overall impact has been a reduction of employment opportunities for women, a trend reported in the Census of 1951. A study in Punjab, India, noted that while displaced men were given an opportunity to take the training necessary to operate new machinery, women were left to work on the increasingly scarce unskilled jobs.⁴³ This "pauperisation caused by the disappearance of their traditional avenues of employment" has pushed many poor women into the cities.⁴⁴ Nutritional levels are so low among landless women that they lose twice as many children as women from landed households.⁴⁵ Children that survive are malnourished, with the worst cases observed among female children.⁴⁶

Such poverty has made plantation work attractive to many poor Indian families, both in India and in neighboring countries. On tea plantations in India and Sri Lanka, women make up over half the labor force; on Indian and Malaysian coffee estates, they make up 44 percent of the labor force, while their participation in rubber estates is only somewhat less. A major reason for this growing female labor force is the wage differentials between males and females: women are paid about 80 percent of male wages for the same work. As

42. A classic statement is found in Uma J. Lele and John W. Mellor, "Jobs, Poverty, and the 'Green Revolution'," International Affairs. Vol. 48, January 1972, pp. 20-32.

43. Billings, Martin H. and Arjan Singh, "Mechanization and the Wheat Revolution: Effects on Female Baour in the Punjab," Economic and Political Weekly. December 26, 1970.

44. Muzamdar, Vina and Kumud Sharma, "Women's Studies: New Perceptions and the Challenges," Economic and Political Weekly. January 20, 1970, p. 117.

45. Rosenberg, David A. and Jean G., Landless Peasants and Rural Poverty in Selected Asian Countries. Ithaca: Cornell University Rural Development Committee Monograph, 1978, p. 17.

46. Levinson, F. J., Morinda: An Economic Analysis of Malnutrition Among Children in Rural India. Harvard-MIT International Nutrition Policy Series, 1974.

production costs rise there is greater incentive to utilize new labor-saving technologies and to increase the percentage of women being paid reduced wages in the labor force.⁴⁷

The differential impact of the green revolution on women of different classes has also been noted in Indonesia, where the intensive farming system has traditionally supported a more equitable society than the plough farming system of South Asia. The new high-yielding varieties of rice have triggered a change in the traditional harvesting patterns. Because of the high investment in the new varieties, particularly in fertilizer, landlords wanted an increased return from the crop. Further, population increase has multiplied the number of harvesters, who are traditionally women. Women use a small knife, the *ani-ani*, for cutting individual stalks of rice. Leaning from the waist, the women might leave as much as 10 percent of the rice in the fields--a practice which provides a sort of social security for the poorest in the village. The harvesters divide the rice stalks, not evenly, but rather by levels of obligation which may reflect class. Between 12 and 15 percent of the crop goes to the harvesters under this system. Thus traditional harvesting patterns mean that the available rice is only about three-fourths of the rice in the fields.⁴⁸

The new harvesting pattern involves a new technology: a hand sickle. Gangs of men are hired by a middle-man to complete the harvest; with the sickle, little rice is left in the field. Further, the men are paid by weight rather than by rice stalks. Total "cost" of the harvest is therefore only between 6 and 8 percent of the rice in the field. This change in harvest practices automatically showed an increase in rice production, has drastically reduced female labor, especially among the landless, and has effectively abolished the gleaned rice for the poorest.

Population pressures and technological change have also reduced work opportunities for the poor males, thus increasing the importance to family survival of female income from trade and handicrafts.

47. UN document, op. cit., pp. 25-26.

48. Rosenberg, op. cit., pp. 70-72; Ann Stoler, "Class Structure and Female Autonomy in Rural Java," Signs, Vol. 3, No. 1 (Autumn 1977), pp. 74-89; Gary E. Hansen, Rural Local Government and Agricultural Development in Java, Indonesia. Ithaca: Cornell University Rural Development Committee Monograph, November 1974, pp. 49ff.

It is men, in fact, who have a smaller set of viable alternatives to agricultural labor. Women are, in a sense, better equipped to deal with the situation of increasing landlessness and can manipulate a more familiar set of limited options...⁴⁹

The multiple strategies which poor rural families use for survival can be illustrated with two cases from the wet zone of Sri Lanka.

One household with 13 members had seven sources of income: (1) operation of 0.4 acres of paddy land by the adults, (2) casual labor and road construction by the head and eldest son, (3) labor in a rubber sheet factory by the second son, (4) toddy tapping and jaggery making by the head and his wife, (5) seasonal migration to the dry zone as agricultural labor by the wife, eldest son and daughter, (6) mat weaving by the wife and daughter, and (7) carpentry and masonry work by the head and eldest son. Another household with 11 members and six sources of income, mostly agricultural: (1) home garden by the family, (2) a one acre highland plot operated by the wife, (3) labor on road construction on weekdays and on the plot on weekends by the head, (4) seasonal migration to the dry zone as agricultural labor by the daughter and son, (5) casual labor in a rice mill in the dry zone by the eldest son, and (6) casual agricultural labor in the village by the head and his wife.⁵⁰

The economic contribution of women to family survival is evident in the study of two Philippine villages, one Muslim and one Christian, near Davos on Mindanao. The Muslim women grow, harvest, and sew nipa palm for house shingles, while the major occupation of the Christian women related to fishing.

All the women...worked for money at some point in their lives. All control the family budget, and all but one continue to contribute to the family income. Throughout the Philippines, and indeed all of Southeast Asia, women play an important entrepreneurial role. Traditionally, such activity was not considered particularly high status; perhaps for that reason it was left to women...It is clear that these women, even though they live in a village economy that is often referred to as subsistence

49. Stolar, op. cit., p. 88.

50. Rosenberg, "Incidence of Landlessness and Near-Landlessness," op. cit., p. 8.

could not live without money to buy food. Even their basic diet of vegetables and salted or dried fish must be purchased in the market.⁵¹

A major factor which encourages women to increase their economic activity in the monetized economy is the ability to keep control of their earnings. The success of the Korean Mother's Clubs is a case in point. Based on historic cooperation of women in supporting each other in providing expensive ritual festivals for marriage or death, the Mother's Clubs were set up to facilitate the distribution of birth control pills. Three-quarters of the Mother's Clubs organized Mother's Banks. Encouraged by financial resources of their own, women in many villages started projects to earn money with which to build schools, run stores, improve village services. While the groups have now branched out into a variety of income-producing activities, market production including gathering of nuts for sale was frequently the first income-producing activity.⁵² Women are also employed in public works projects, but at lower wages than men, a fact that reiterates Korean women's low, if improving, status.⁵³

Studies of women's roles in agriculture in the Muslim countries of North Africa and West Asia have been inhibited more than elsewhere by cultural norms that encourage underenumeration. In Thailand the labor force participation rates in the Southern province, where one-quarter of the population is Muslim, for females over 11 years old is 63.9 percent, as compared to a national average of 86 percent. This suggests

51. My section on the Philippines in Raining, Priscilla, *et al.*, Village Women: Their Changing Lives and Fertility. Washington, D.C.: AAAS, 1977, pp. 230 and 238.

52. Misch, Marion Ruth and Joseph B. Margolin, Rural Women's Groups as Potential Change Agents: A Study of Colombia, Korea, and the Philippines. Washington, D.C.: George Washington Univ. Program of Policy Studies in Science and Technology, May 1975, pp. 26-58; also Hyung Jong Park *et al.*, Mother's Clubs and Family Planning in Korea. Seoul National University School of Public Health, 1974.

53. Soon Young Song Yoon, "The Emergence of the Fourth World: Korean Women in Development," Korean Journal. February 1977, pp. 35-47.

few Muslim women are reported as actively employed.⁵⁴ Studies in Turkey confirm the invisibility of Muslim women in statistics even when they take complete charge of the farms in areas of intensive out-migration of males. Mechanization has contributed to greater social stratification, with resulting leisure available to wives of the larger landowners. Wage-working families continue to pick cotton, hazelnuts, tobacco, and strawberries.⁵⁵

Recent efforts to reach rural poor women in Bangladesh have been impeded by purdah restrictions. Nonetheless, women's cooperatives are successfully marketing fish, bananas, limes, ducks and chickens, and vegetables. Operating solely with capital saved by the women themselves, these cooperatives are seen as models for the rest of the country. Yet of the 13 cooperatives in the country, only two are totally Muslim. Muslim husbands still resist the idea of their wives leaving the compound for weekly meetings.⁵⁶

As men are drawn off to work in Saudi Arabia, Yemeni women are taking over much of the farming. As noted above, the poorest women in the New Halfa resettlement scheme benefitted from greater opportunity to pick cotton. Yet the recognition of women's economic activity is resisted the most in the conservative Muslim areas. Status is attached to seclusion except for the Westernized elite; with the recent revolution in Iran, even that is subject to change. Nonetheless, it is clear that poor women in all countries, including Islamic ones, must and do contribute to the survival of their families.⁵⁷

54. Oey Astra Maesook, "Working Women in Thailand." Paper prepared for the Conference on Women and Development, Wellesley, Massachusetts, 1976, mimeo.

55. Kandiyoti, Deniz, "Sex Roles and Social Change: A Comparative Appraisal of Turkey's Women," Signs. Vol. 3, No. 1 (Autumn 1977), pp. 60-62.

56. Dixon, Ruth B., Women's Cooperatives and Rural Development. Baltimore: Johns Hopkins, 1978.

57. For an insightful view of women's present and potential roles in this area see Roxann A. Van Dusen, "Integrating Women into National Economies: Programming Considerations with Special Reference to the Near East," AIP Policy Paper, July 1977, mimeo.

Latin America

Women in the agricultural labor force in Latin America, while lower than that in Africa and Asia, is still an impressive 40 percent, according to the Economic Commission of Latin America.

This figure is low, according to Carmen Diana Deere. In her review of women doing agricultural work in Peru, Deere found that 86 percent of the women in peasant households participated in the agricultural work as compared to the 1976 Peasant Family Survey of 36 percent. Self perceptions are partly responsible; if a man resides at home, he is the farmer. "The majority of the women that considered themselves to be agriculturalists were female heads of households with no adult male present."⁵⁸

In Honduras, 13 percent of the rural households are permanently headed by women; the figure rises to 25-27 percent if seasonal migration is included. These women tend to be landless, and must seek wage employment on the cotton and coffee plantations.⁵⁹ In the Peruvian highlands, the transition from the hacienda system to minifundio has relieved women of many servile tasks formerly required by the landlord. But it is difficult for a family to live off the small plots of land. As men are forced to seek wage income off the farm, the responsibilities of the women increase, increasing her self-esteem and status.⁶⁰

As landlessness or near-landlessness increases, the poor farmers must increase their wage labor. In Peru and Honduras men migrate seasonally from the mountains to work on large farms. In Northeastern Brazil, the farmers assist with the sugar harvest on the large plantations.

58. "The Agricultural Division of Labor by Sex: Myths, Facts, and Contradictions in the Northern Peruvian Sierra," paper for the joint Latin American Studies Association and the African Studies Association, Houston, Texas, November 1977.

59. Gallup, Cynthia B., "Observations on the Role of Women in the Agricultural Sector in Honduras," USAID Honduras, January 1978, mimeo.

60. Deere, Carmen Diana, "Changing Social Relations of Production and Peasant Women's Work in the Peruvian Sierra," paper prepared for the Fourth World Congress for Rural Sociology, Poland, August 1976.

On the small farms, then, modernization has meant an increase in women's labor as the men frequently seek work elsewhere. In addition, manufactured goods in the market have undercut many local handicrafts previously made by women, making them more dependent on income from agricultural production. Women in Mexico who work on commercial crops are paid less than men. The rationale given is that women do not work, they merely help with the farming.⁶¹

Conclusion

Technologies for agricultural production have been concentrated on cash crops and on selected basic grains. Generally the impact of these technologies has been to increase production, concentrate landholdings, and encourage social stratification. In Asia and Latin America the wives of larger landholders have greatly reduced their involvement in the fields. While this release from hard work is to be commended, there is often an accompanying loss of status. In India, a switch from bride price to dowry has occurred in some areas where brides are no longer valued for their economic contributions.⁶² In Africa, however, well-off farm women tend to remain in the rural areas managing the farms and often hiring other women to help with the harvests, particularly of cash crops.⁶³

Poor women in all the developing countries have had to work harder as a result of these new productive technologies. Women heads of households or wives of men who migrate to wage jobs elsewhere undertake both the traditional male and female agricultural activities. Families with only a garden plot or splintered field must send all adult family members to work as wage laborers. As new technologies reduce the need for unskilled laborers, a few men are trained for the semi-skilled jobs. Men left in the unskilled labor pool are perhaps worse off than the women; women's wages are less and so are displacing men in plantation work. Women also have traditionally worked at a greater variety of unskilled jobs and so in many countries are able to survive through market selling or handicrafts. Elsewhere, women have joined the urban migration, working for low wages in industries, or as domestics,

61. Young, Kate, "Changing Ecibinic Roles of Women in Two Mexican Communities," paper prepared for the Fourth World Congress for Rural Sociology, Poland, August 1976.

62. Epstein, T. Scarlett, South India Yesterday, Today, Tomorrow. New York City: Holmes & Meirer, 1973.

63. Raining et al., op. cit., p. 89ff.

or becoming prostitutes.

The garden plot where the poor women can grow food to enhance her family's nutrition and then sell the surplus emerges as an important factor in survival. Clearly, greater attention to garden crops and to marketing of fresh vegetables and fruits should be a priority in any planning for rural development. Similarly attention to small animals and fish culture could add immeasurably to the welfare of the poor, if not to recorded GNP.

Processing and Preserving

The processing and preserving of home-grown and home-consumed food is not an economic activity which is counted in the GNP.⁶⁴ Women's contributions in this area are even more invisible than their work on farm production. Yet it is here that small technologies can have their greatest impact; they can: reduce post-harvest food loss, thus providing more food for consumption or sale; reduce drudgery and so give women the gift of time; form the basis of income-producing activities. The test of any technology introduced at this level must be its social utility. That is to say, the introduction of the technology should improve the quality of life of the people meant to benefit from its introduction. How the technology is introduced, who owns it, and who controls its use are fundamental questions that must be the basis for planning.

Many of the "new" technologies presently being tried around the world have in fact been tried many times before. That is why the major focus today is on process and adaptation. No longer can it be assumed that a piece of equipment or a method of production can be packaged and dropped in a village where, like a genie, it will transform the quality of life. Disaggregating the intended beneficiaries by sex, and also by socio-economic levels, is clearly a necessary step, but not alone sufficient.

64. The National Academy of Sciences sponsored an International Working Group meeting on Postharvest Food Losses in Developing Countries. One workshop focused on the importance of interventions in the subsistence or non-market sector. "It was observed...that in many places in the developing world there is an increasing trend toward market-oriented agricultural production, and interventions directed toward commercial agriculture are generally quite different from those required at the subsistence level." Staff Summary Report, p. 31.

Appropriate Technologies

Nor is it sufficient to argue only for small technology. While raising a series of crucial questions about the size and use of technologies, proponents of alternative or appropriate technologies have taken on a moral tone which has tended to polarize the debate. Much of the righteousness reflected in the AT argument results from the conviction that indiscriminate use of capital-intensive technology has needlessly increased unemployment while escalating energy needs which contribute to environmental degradation and pollution. Third world politicians tend to favor high technology and complain that AT is a method of foisting off second-hand technology onto the developing countries.

Basic to the debate is the attitude toward technology. AT essentially questions what has been a tenet of faith to much of the world: technology is development; any technology is better than no technology; the more advanced, large, and complicated the technology, the more it hastens progress. Of all the nationalist leaders only Gandhi and, in some phases, Mao have seriously questioned modern technology. Gandhi in particular made a virtue out of simple living: the hand spinning wheel became his symbol and his handspun dhoti and shawl his uniform. Despite this political heritage, the First Five Year Plan in India emphasized industrialization; indeed, only recently has India begun to emphasize village development and intermediate technology. China, in contrast, seems now to be reversing the self-sufficient commune ideology in favor of large-scale technology and interdependence. Perhaps these two giants represent the future: the need to mix rural small-scale development with national advanced technology.

Underlining the AT argument is the impact of technology on people. Disaggregating people required additional refinements precisely because women's work cannot be equated to men's work until household work is equitably shared. A major error of social reformers has been to see only one part of women's dual roles of economic activity and household-reproductive support activity. Where the support role has been neglected, as in Eastern Europe, low reproductive rates and family instability are the penalties. Where the economic roles are ignored, unsuccessful development schemes, growing welfare costs, social unrest, and family instability abound.⁶⁵

65. See my "Development and the Disintegration of the Family," op. cit.

The questions to be asked when introducing new technologies also apply to agricultural production. There are many useful tools for weeding, turning the earth, planting, harvesting. Solar-powered sprayers may soon compete with the Chinese non-chemical pest control systems. I have not spent much time on these technologies because I feel that more immediate benefits will accrue to women through improved technology in the processing, preservation, and preparing of food. Women do not dominate the production phases of agriculture, given the present land systems, and the increasing world demand for food, modern large-scale technologies will be hard to resist for major grain crops. The number of poor, men as well as women, will increase unless income-producing activities are set up in the rural areas. The purpose of this paper is to emphasize how technology can ensure that women may continue to play an economic role essential to their survival and that of their families.

Questions to be asked before introducing technology:

1. Who benefits?
Women or men? Poor or rich? Community or nation?
2. What are the benefits?
Time? For whom? Less time?
Less human or animal energy expended? At whose expense?
3. Who pays?
For the technology? For the use of the technology?
4. Who controls?
Group or individual? Through costs or licencing, or group effort?
Human scale or mysterious other?
5. Who maintains?
Availability of parts? Skills to repair?
Costs to repair or replace?
6. Who introduces?
Government? Coercion, incentives?
Agencies?
Motive for accepting?

Unless such questions are asked of any technological innovation, the chances are high that technology meant to benefit the poor, especially women, will not benefit them all. The women of Upper Volta produced a report outlining their perspective on development which emphasizes the masculine

drift of technology.

Traditionally women are in control of processing and manufacturing many products which they use in their homes. The surplus they trade or sell. As modern products are introduced, the market for home-made items diminishes. In many cases, industrialization changes the item from woman's domain to that of the man's. When the dolo (traditional millet beer) parlor becomes a bar, when pottery pieces become imported plastic or metal hardware, when traditional cotton thread is replaced by factory manufactured thread, women lose control of both production and distribution of these products. If women wish to buy modern products, this new demand for money comes at the very time their source of money from traditional products is declining.

...Women frequently mention that processing millet flour is the worst part of being a woman. It takes 4 to 6 hours to prepare food for a hot meal and most of this is the pounding of millet. When technical help is devised, the process usually becomes the domain of men. This means that something that used to be laborious and time-consuming but which cost nothing and sometimes was a source of income for women, is taken over by machines run by men. Women now have to pay for the service.⁶⁶

Too often the reluctance of women to utilize a new technology is interpreted as hidebound conservatism or as ignorance. On the contrary, argues Maryanne Dulansey, a longtime activist in this field.

Women are the most practical people in the world. They have to be, especially the women we are talking about here. There is evidence of a myth that women enjoy their role as cultivators, as carriers of water and wood, as harvesters, preservers, preparers and servers of food. The "traditional woman" who spends long hours each day in the arduous work needed to nourish her family is well thought of. Yet if truth be told, women are human; they do not appreciate the hard work and long hours any more than men, even though social value attached to performance of these tasks is important to women. Indeed, women take the first opportunity to move into other occupations, usually small commerce, so as to escape to some

66. Social and Economic Development in Upper Volta: Woman's Perspective, Agency for International Development, Regional Economic Development Services Office, West Africa, April 1978.

degree these tasks. If they are able to earn money, they hire other women to hand pound or grind their staple food if mechanized milling is not available. They pay others to carry water and wood, to prepare meals, to care for children. Therefore, women are prime candidates for technology which helps them cut down on the work involved in the whole process of getting food to the family, or so it would seem.

What is the problem, then, with the technologies which are available, which, have been introduced in developing countries? Women have not perceived the technology to work for them, to deliver what they need and want. What good is a solar cooker to the woman who spends her time in the field from sunup to sundown?...If improved storage has the effect of taking the staple out of the control of the woman responsible for delivering it to her family, can she be expected to embrace the improved technology?⁶⁷

Technologies are the basis of development, and development means change. Change is disruptive, there is a price. Clearly women often find the price too high. When they can resist, they do. When governments assign technology a high priority, they must include this social-economic cost in any final accounting. Otherwise, the technology may not accomplish the job it was meant to do; or the side-effects of the change may engender problems as large or larger than the original problem the technology was meant to solve.

Technologies for Food Processing

Technologies which can assist women in carrying out their food-related post-harvest activities fall within two general categories: mechanical technologies which reduce the expenditure of human or animal energy, primarily in the processing of food; and improved methods of preserving and storing food. I shall discuss the policy issues related to the choices of technologies and review present technologies under each category, giving particular attention to the impact of the choices on income-producing activities of women.

Mills

Grinding mills for corn, wheat, and millet, as well as rice hullers, are now widespread throughout the developing world. Small presses for palm oil, cocoanut milk, or sugar cane are widely distributed. Grinders and beaters for making

67. Dulansy, op. cit., pp. 3-4.

peanuts into oil are also becoming common. Simple, low-cost hand-operated machines can relieve much of the drudgery from these activities while not displacing too many laborers. Preferably, these machines are sold on long-term credit to women's organizations. As early as the 1950s corn grinders were introduced into what is now West Cameroon through the patronage of a respected elderly village woman. Once the technique of drying the corn before grinding was understood, the grinders were quickly adopted through corn mill societies which were formed to pay back the cost of the grinder within a year.⁶⁸ These societies became the trigger for other development efforts.

With the increased leisure that the women now had they turned to other community based projects. They dug roads to their villages so that lorries could come in to take out their produce, they piped water into storage tanks so that the abundant small streams of the rainy season could still provide them with water in the dry, and they built meeting houses in central villages in which they could hold classes throughout the year regardless of the weather. They learned how to look after their children and how to cook and make soap...to read and write and to do simple arithmetic....They fenced in their farms...set up cooperative shops....Above all they learned how to improve their farming techniques....When independence came in 1961 the movement had spread as far as the coast...and the membership exceeded 30,000 women so that it was able to make its voice heard in the community on most matters affecting women.⁶⁹

Yet when the same organizer, Elizabeth O'Kelly, tried to introduce rice hullers in Sarawak, the technology proved inadequate; the hullers were not strong enough to withstand the constant usage by all the women in a longhouse. Yet the intervention from outside was enough to encourage the formation of women's Institutes which focussed their activity on piping water and improving farming. Fourteen years later these Institutes run seminars, organize flood relief, and even run their own radio station. This type of responsive intervention is being tried in many parts of Africa today; the process may be more important than any specific technology as

68. For a delightful account of the problems surrounding the introduction of the first mills, see Elizabeth O'Kelly, Aid and Self-Help. London: Chas. Knight, 1973.

69. O'Kelly, Elizabeth, "The Use of Intermediate Technology to Help Women of the Third World." London: ITTC, mimeo, pp. 9-10.

long as the technology is simple and inexpensive enough for the women's organizations to buy and run it.

Marilyn Carr, in her excellent book on Appropriate Technology for African Women, argues that most hand-operated crop processing machines used in Africa have proved more economically efficient than more sophisticated imported machines. A study in Kenya compared four types of corn-grinding; a Nigerian study compared four types of palm-oil presses. "Another study in Nigeria compared two techniques for processing gari from cassava. This found that a locally-generated 'intermediate' technique was far superior to a fully-mechanized foreign machine. Among other things, unit costs of production are about 20 percent lower with the 'intermediate technique'."⁷⁰

In Upper Volta a government program is assisting women's groups to acquire hand grinders. Yet even remote areas have commercial mills powered by diesel oil. During the last round of oil price increases one mill owner near the village of Tangaye raised his grinding fee by 25 percent to compensate for a price rise in oil of 33 percent. "As a result he lost so many customers that he was forced to open the mill twice a week, on market days, rather than every day as he had done in the past....Expenditures for fuel comprise 50-60 percent of the monthly cost of running the mill."⁷¹ Currently the government of Upper Volta, utilizing funds from US Agency for International Development, is installing a solar unit in that village to power a grinding mill and to pump water. This photovoltaic system is highly experimental since the present costs of battery storage make the unit very expensive. For the time being, then, hand grinders may still be the most economically efficient method of grinding local grains. But for how long?

In Indonesia the intermediate alternative for rice hulling is a small, relatively low-cost, Japanese-made, machine-powered rubber hull roller. In the four years from 1970 to 1974 the number of these small rice mills exploded until they dominate the market, and can process up to three-quarters of the total rice crop on Java. The original figures were assembled by Peter Timmer "with the intention of demonstrating in simple, clear-cut terms...that the large scale bulk termi-

70. Marilyn Carr, advisor to the Intermediate Technology Group of London and to UNICEF, wrote the book for the African Training and Research Center for Women of the Economic Commission of Africa in 1978.

71. Hemmings, op. cit., p. 4.

nals were inappropriate in the Indonesian countryside. The battle to be fought in the planning agency was not hand-pounding versus small rice mills but large bulk facilities versus large and small rice mills. I was nearly laughed out of court for defending the small rice mills."⁷²

This rapid switch to rubber rollers cost over one million jobs on Java alone and 7.7 million throughout Indonesia.⁷³ Estimating that 125 million woman-days were lost by the introduction of the new technology, William Collier concludes that "the total loss in laborers' earnings...seems to be of the order of \$50 million annually in Java....This represents a substantial diminution of income for large numbers of households of landless laborers and small farmers. Three million tons of rice (if hand-pounded) would provide wages for one million women every day for four months each year."⁷⁴

Whether the rice rollers should have been introduced is irrelevant for Indonesia, but is an issue today in Bangladesh. Hand-pounding continues in Indonesia for most domestic consumption, about 40 percent of the crop. It is economically sensible only when opportunity costs are virtually zero, which is the case of women in the home. Costs for commercial milling are very low because of the over-capacity of the new mills. This results in lower consumer prices per kilogram of rice of perhaps three times the value of lost jobs.⁷⁵

These figures clarify the debate. Small rice mills using rubber rollers add to national income nine times the value of the lost jobs. But who benefit? Clearly the distributional impact of this change has been in favor of the larger farmers and the owners of the rice mills. The losers are the poor, but it is the women who lost the jobs. The Indonesian government does have public works programs to provide income to their poorest citizens. But where 125 million women-days

72. Timmer, C. Peter, "Choice of Technique in Rice Milling on Java," Indonesian Economic Studies, Vol. IX, No. 2 (July 1973) reprinted by the Agricultural Development Council, September 1974, p. 20.

73. Cain, Melinda, "Agricultural Technology and Labor Displacement in Indonesia With Specific Implications for Women," prepared for the AAAS Workshop on Women and Development for UNCSTD, May 1979.

74. Collier, et al., A Comment (on Timmer's article), reprinted by the Agricultural Development Council, September 1974.

75. Collier, Timmer, op. cit.

of wage labor were lost on Java in 1972, the county public works program provided only 43.5 million man-days of employment.⁷⁶ Recent reports note that for the first time in Java women in large numbers are now vying for this strenuous job. The impact of rice hullers has clearly been an increase in rural poverty.

Governments should be able to anticipate such impacts, altering tax, subsidy, or pricing policies in such a way that the poor consumers benefit from lower prices and greater volume of grain. But only a job can replace a job; without income, lower prices are irrelevant. Because statistics fail to reflect the actual employment of the poor, especially poor women, economic costs of new technologies in the area of food milling are ignored. The first step is a more accurate accounting of real work in rural areas.

The nutritional dimensions of new grinders must also be considered. Incomplete milling through hand-pounding leaves sufficient bran in the rice to provide needed vitamin B. Husks are fed to chickens, later consumed. What will prevent deficiency if hand-pounding is further reduced? Can new techniques for handling husks prevent their turning rancid and so provide an alternative food, a new breakfast cereal for the poor?

In Bangladesh, government policy could presumably slow the introduction of small rice mills, allowing time to develop alternative economic activities for displaced labor. A hand rubber roller is being considered a halfway measure which may reduce the economic advantage of the power mills. This intervention should be carefully monitored. No one can really argue that the hand pounding is of itself good. But the heavy work must be balanced against no work when evaluating the impact of any new technology.

Preserving

Postharvest food losses are enormous. Most observers agree that a 10 percent increase in the available world food supply could be more easily achieved through a reduction of losses than through increased production. Some of these increases may be illusory, as with the increased yield of rice by the use of sickles: the "lost" rice had provided free food

76. Collier, op. cit.

77. No one, that is, but Mirabhen, a disciple of Gandhi, in her cattle ashram in Uttar Pradesh, India, who argued that physical labor sweetened the grain. Interview with M. Walker.

as a sort of social security for the poorest in the village. On the other hand, the improved efficiency of mills over pounding has been demonstrated.

Improved storage for grains has been a goal of many development agencies including the Peace Corps. Weevils and rodents destroy half the corn stored in rural Cameroon homes⁷⁸; small changes can reduce that loss in half. Rodent baffles, inverted funnels on support poles of the cribs, can be fashioned from old kerosene tins or molded in clay. Metal storage tanks work well in dry areas but cause mildew problems in more humid areas. VITA, under contract to Peace Corps, has issued a training manual on storage techniques.⁷⁹

Waxing cassava has reduced losses in Latin America and is being tried on plantains in West Africa. Solar dryers are being touted as a substitute for the habit, widespread in South Asia, of spreading grain on the black tarmac: one car can wreak havoc.⁸⁰ Yet buying a piece of heavy black plastic to line a box is out of reach for many poor. Selling such dryers at subsidized prices would seem an important project. In Tanzania an improved solar dryer was demonstrated at a recent workshop; women were taught to make the mud container and the form for the plastic core.⁸¹

Many traditional methods of smoking or drying fruit, vegetables, fish, and even meat are being studied for improvement and wider dissemination. In Thailand fish pickled by one method frequently produces illness; another traditional method is safe. In Ghana one group traditionally smoked fish until cheap electricity from the Volta Dam gave an advantage to freezing fish; the knowledge is rapidly vanishing.

Canning has not been widely taught, perhaps because of the concern over botulism poisoning. Ester Ocloo, owner and manager of a commercial cannery, said she once came to the United States on her own to learn home canning techniques at a university in order to teach women in Ghana to do their own

78. Henn, op. cit., p. 5.

79. Lindblad, Carl and L. Druben, Small Farm Grain Storage, 1976.

80. "Postharvest Food Losses in Developing Countries," Staff Summary Report, National Academy of Science, 1978, p. 13ff.

81. Workshop on Food Preservation and Storage, report published by the Government of Tanzania, distributed by the UN.

canning. In 1977 the UNICEF in Dacca brought out an instructor's manual on Food Preservation in Bangladesh as part of a project to encourage income-generating activities among women. The emphasis is on canning: chutney is featured in addition to fruits and vegetables. Canning lends itself much more to community enterprise than to individual effort. Finding markets must be a part of the planning, for the glass container itself prices the product out of the reach of the poor.

In Honduras, Save the Children Foundation assisted a remote mountain village to set up a cooperative mango cannery. It has survived many setbacks. The institutional consumers actually bought less than anticipated; the remoteness of the village added greatly to transportation costs; and the resource poor area has made diversification difficult. Attempts to encourage local consumption through a deposit system on the glass jars has worked only in the immediate neighborhood due to the rugged terrain. But local women take advantage of bottle return; they buy the puree and dilute it with water for sale at soccer matches. Attempts are now being made to market the mango puree as dried "fruit leather", a familiar product in Asia--the Bangladesh book calls it "mango dried sheet"--but not well-known in Latin America. Experiments using plastic sheets to wrap the leather produced a product more chemical than natural. In addition, the cooperative hopes to utilize a system of vacuum-packed plastic bags as soon as it is perfected by a similar cooperative in Costa Rica. Meanwhile, the coop members are planting mango trees; they have also contracted with a neighboring village to pickle their excess onion crop.⁸²

Despite the difficulties of setting up this women's cooperative in such a poor and remote village, the coop is functioning. The husbands migrate out at least half the year, but they did help with the building of the cannery, and maintain the equipment. Perhaps if the foreign technician had been female, the women might have been taught this skill. The women, working a six-day week during the mango season, earn \$1.50 per day or \$42 per month. Men in the region earn between \$150 and \$300 a year, so that the cannery earnings are an important addition to family income.

For shorter-term preservation, solar coolers and refrigerators are being developed. Improved handling of both fresh and dried perishables are expected to reduce losses. Chemical fumigants and insecticides are particularly useful in reducing losses among cereals and tubers. Experiments in bio-

82. Conroy, Kim, "The San Juan Bosco Canning Cooperative: The Case Study of a Small Rural Industry." 1979, mimeo.

logical control of pests through the introduction of predators continue. Resistent species are being developed. Details of the state of the art for reduction of food losses may be found in the 1978 report by the National Academy of Sciences report, Postharvest Food Losses in Developing Countries.

The careful scientific language of the report masks the dominant role which women play in postharvest activities. One paragraph in the staff report alone recognized the human element behind technological change: the discussion group "took note of the fact that the subsistent fisherman and fish merchant are generally second class citizens, often living in crushing poverty, with no hope for the future. This fact and the role of women in the society conditions what, how and by whom technology should be offered, how it should be delivered, and what incentives are necessary to convince the people to adopt the remedies."⁸³

Such oblique language is not sufficient to counteract the biases among developers and planners that technology is for men. Community-based technologies which reduce food losses and so provide surpluses for sale can and should provide alternative incomes for women displaced in the agricultural production activities.

Preparation of Food

Selling of cooked foods is an income-producing activity of great importance to the poor woman, though it is seldom recorded in national accounts. Outstanding among the sparse literature on this subject is Emmy Simmons' study of "The Small-Scale Rural Food-Processing Industry in Northern Nigeria."⁸⁴ Even among the secluded women living near the Muslim city of Zaria, "It is rare...to find a rural woman who has never set up production in some food-processing enterprise." These women produce a variety of traditional lunch and snack foods from grain, cowpeas, peanuts, and cassava. Most of the women work alone at home in seclusion, sending their daughters or other young relatives out to sell to neighbors or in the market. Their work is sporadic, more an extension of home activities than a commitment to enterprise. Nonetheless Simmons found that all the products, with one exception, turned a profit of between 6 and 40 percent.

Two major problems threaten the future of this important

83. Staff report, op. cit., p. 24.

84. Food Research Institute Studies, Vol. XIV, No. 2, 1975.

income-producing activity: (1) the single owner-operator pattern of the industry, and (2) government policy. Working out of their homes, the women mingle family feeding with commercial cooking, confusing the profits. Also such small scale production leads to uneconomic buying of supplies and inefficient distribution of the products. Much of the profit or loss relates to the size of portions versus the price: frequent price fluctuations of ingredients means that the seller must understand the market. Many women have a canny sense of pricing, but others quickly go out of business. A cooperative organization would seem a logical alternative which would improve investment return, make credit easier, and allow intermediate modernization of the industry. Yet Simmons remarks on the apparent unwillingness of the women to work together. Whether this reluctance to organize stems from cultural or religious practices such as seclusion or easy divorce, or whether no appropriate model or collective action has been tried, is unknown.

Currently the single owner-operator pattern remains competitive with products made by larger industrial establishments, both those in the area offering similar traditional products and those located on the coast which produce European style breads and candy. Government policies favor larger industry through subsidies and taxes. It seems clear that if the women do not join together to become more competitive, their share of the market will inevitably shrink. Simmons summarizes the impact of this decreasing production on the women themselves and on the rural village economy:

[W]omen's ability to meet social and economic obligations on their own with earnings from their profitable commercial enterprises will be decreased; the village economy will become less self-sufficient as far as producing and consuming local productions; and the value added and income generated by the agricultural sector will migrate more directly to the urban sector. Nutrition may be adversely affected....The deprivation of a substantial means for earning income will have the effect of downgrading women's independent and family roles.⁸⁵

Selling of lunch food and snacks is a traditional part of the economic activity of the West African coastal market women. As the Ivory Coast becomes more urban and workers commute further to their jobs, both breakfast and lunch are often purchased from vendors. While western style lunch shops and fast food chains are appearing, their prices are

85. Ibid., p. 160.

too high for the average worker. Government has begun subsidizing commercial caterers to provide modern pre-packaged meals at offices or on work sites.

Consistent with its pell-mell rush to copy the west, the government of the Ivory Coast celebrates only the modern. Barbara Lewis, in her insightful study of the over-crowded world of petty traders in that country, notes the lack of government support for the organizational efforts of the market women to set up wholesale purchasing and group savings schemes. Indeed, governmental policy, as demonstrated by courses for women offered through Social Centers run by the Ministry of Work and Social Affairs, appears "designed to re-focus women's attention away from moneymaking toward homemaking, rather than providing social or technical skills to upgrade gainful productive activities."⁸⁶

In Abidjan the workforce, drawn from all over West Africa, needs cheap familiar food. Experienced and organized market women are being squeezed out of their traditional activities at the same time that more and more women flood into the informal sector. An imaginative program concerned with supplying indigenous food to workers during the day would benefit both the workers and the women in that capital immensely. The biases against women's work are coupled here with slavish imitation of the west, to the detriment of the majority of Ivoreans.

The reluctance of modernizing governments to accept the continued existence of a more traditional sector has been overcome in many Latin American countries. "Local" markets have been funded by AID along with modern supermarkets. This insight has only occasionally been extended to include local industry. A recent review of Mexico's rural industry program noted the complete lack of attention to women's employment. Of the 60 industries studied, only nine related to food-processing; but no mention was made of women's traditional or present role in these industries.⁸⁷

This report reiterated the danger of assistance agencies setting up non-competitive industries through grant programs: once the subsidy runs out, the industry fails. The literature

86. Lewis, "Petty Trade and Other Employment Options for the Uneducated Urban West African Women," paper prepared for the AAAS Workshop on Women and Development, March 1979; p. 9.

87. Conroy, Kimberly, "Mexico Rural Development Project PIDER: Analysis of Rural Industry Program," The World Bank, Rural Development Division, April 1979.

on women's projects is full of such failures. It is imperative that women's projects be fully competitive and economically viable. Small crafts projects to help women earn "pin money" are not only passe, they are almost destined to fail. Such failures reinforce the biases against women's real economic activity. Even well-conceived schemes may fail if they are not totally integrated into the country's national plan. Will the increased production of millet beer by women's organizations in Upper Volta be undercut by the new Heineken beer factory? Both projects have heavy government subsidies.

In India, a number of very successful women's cooperatives provide possible models for rural industry. In Women's Cooperatives and Rural Development: A Policy Proposal, Ruth Dixon discusses both the dairy industry and a dispersed factory system which produces a soft wheat flatbread for later crisp frying at home.⁸⁸

There are several lessons to be learned from these several studies:

- the importance of an organizational base for women's economic endeavors, and
- governmental recognition of and support for the economic parameters of the projects.

There is a tendency to overload women's projects with welfare concerns: health, education, family planning. These often take precedence, and sink the enterprise. As self-sufficiency is preferable to dependency, so economic activities should be given priority over welfare programs. Recognizing the economic role of women is the starting point.

The Basics of Water and Energy

Rural survival, much less rural industry, depends upon the availability of water and fuel. The time spent scavenging for fuel or fetching water consumes large amounts of the day for rural women, children, and men. Reducing this expenditure of time must be a priority for rural development. Solutions must be appropriate to the need. Too many wells have caused desertification in the Sahel; too much water has caused severe sanitation problems in India. Elaborate schemes for modern water supplies lie on the planners' shelves in many developing countries.

Clean water for all by 1980 is a slogan often repeated. But where are the development plans to accomplish this? Is

38. Johns Hopkins Press, 1973.

part of the problem the lack of monetary value assigned to domestic water supply? If water is seen only as welfare, then hardheaded planners, anxious to show an increase in GNP, do not encourage such projects. If clean water were tied to rural industry as irrigation water has been linked to agriculture, perhaps more funds would be allotted to this need.

Similarly, energy for use in the household and for rural agriculture and handicrafts has gone largely uncounted in national energy statistics. This is due to the custom of measuring only "modern" or "commercial" energy: oil, coal, natural gas, hydroelectricity, and nuclear fuels. Yet such an energy-accounting procedure ignores what in many cases amounts to more than one-half the total energy used in many developing countries, exclusive of animal and human power.

-- Rural areas, where a majority of population in the developing countries still live, are seldom served by electrical power grids. Diesel motors power pumps for irrigation, provide energy for small industries, and run small lighting systems for wealthy enclaves. But most rural people as well as the urban poor cannot afford commercial energy in any form even where kerosene is subsidized.

Some two billion people continue to rely on non-commercial energy resources to cook, smoke food, heat water and space, or provide light and safety. These resources are primarily firewood, twigs and brush, agriculture residues, and animal dung. Resources for the Future has just completed a study on "Household Energy for Use and Supply by the Urban and Rural Poor in Developing Countries" which underscores the lack of data on these non-commercial fuels. They conclude on the basis of available data that the lowest energy consumption is among rural areas of South Asia; due to heavy deforestation, animal dung provides as much as 50 percent of the total rural energy consumed. As the amount of dung burned increases, food production will fall unless artificial—and energy intensive—fertilizers are substituted.⁸⁹

It would seem that many countries are following India's path toward deforestation. Experts estimate that Senegal will be bare of trees in 30 years, Ethiopia in 10, Burundi in seven.⁹⁰ Ninety percent of wood consumed annually in devel-

89. Dunkerly, Joy, et al., A Report to the World Bank, Chapter III, October 1973.

90. French, D., "The Firewood Problem in Africa," Report on the Africa Bureau Firewood Conference, Washington, D.C., USAID, August 1973, mimeo.

oping countries is used as fuel.⁹¹ Reasons for this alarming increase in the use of forest reserves are largely related to the population increase both directly in increased cutting and indirectly as more land is cleared for agricultural crops to feed the growing populations. Improved health measures have opened up river valleys in Africa and the Terai in Nepal to settlers, also reducing forests and exacerbating erosion.

As available resources drop, the time consumed in gathering fuel increases. In India it has been stated that one person in a family of five must spend full-time gathering dung, firewood, and refuse.⁹² Even higher estimates apply to Tanzania.⁹³ Such time requirements encourage larger family size, for children help the family more than they cost.

When one examines the use to which this energy is put, it appears that some 40 to 50 percent of the total energy consumed in rural areas is used in cooking alone.⁹⁴ In the case of India, for example, this leads to the conclusion that approximately one-fourth of the country's total energy budget is used in rural areas just for cooking, while rural Bangladesh uses about 40 percent of that country's total national energy budget just to cook food.⁹⁵

The urban poor must also eat, yet their energy consumption is estimated as lower than that of the rural poor.⁹⁶ As much as one-third of the family's budget may go for fuel in

91. World Bank, Forestry Sector Policy Paper. Washington, D.C. February 1978.

92. Mahajani, A., Energy Policy for the Rural Third World. London: International Institute for Environment and Development, 1976.

93. USAID, Environmental and Natural Resource Management in Developing Countries, A Report to Congress, Washington, D.C., February 1979, Vol. I, p. 13.

94. Pimentel, D., et al., "Energy Needs, Uses and Resources in the Food Systems of Developing Countries," Report of a workshop held at the College of Agriculture and Life Sciences, Ithaca: Cornell University, December 1977.

95. Revelle, R., "Requirements for Energy in the Rural Areas of Developing Countries." In Brown, Norma L., ed., Renewable Energy Resources and Rural Applications in the Developing World. Boulder: Westview Press, 1978.

96. Dunkerly, op. cit., p. 28.

the Sahelian countries. One study states that "to obtain the same amount of usable energy which can be purchased in the U.S. for about \$1.30, a charcoal burning family in Addis Ababa may have to spend about \$9.00."⁹⁷

As the worldwide energy crisis has engendered a new look at renewable energy resources, some interest is being directed toward improving both the supply of fuel and the efficiency of its use. Mud and sand "Lorena" stoves have cut firewood use in half in Guatemala.⁹⁸ But experiments in Mali suggest that the traditional three stones and open fire is still the most efficient cooking method for local food. Pressed rice husks are being marketed; improved methods of making charcoal are being developed; brojas is being produced in many village plants.

Reforestation projects are being upgraded and new plant and tree varieties tried. Biomass plantations will be tried in the Philippines; this fuel will go for large electrical installations as well as for local needs. Small hydro plants may reduce the erosion in Nepal caused by overcutting of trees for firewood. Solar water heating can reduce other fuel usage by a third in Gambia. Solar dryers, solar water pumps and purifiers, and solar sprayers are all in various stages of production. Uses for windpower are being expanded as styles and capabilities are the subject of experiments.

Technology turns to the energy crisis. Will development once again have an adverse impact on poor women? Improved access to fuel supplies will certainly lessen the drudgery of daily living if the women can afford the new fuel or the new stove. Economics is not the only determining factor in the adoption of new technology. Taste, ease of preparation, even the sociability of the kitchen, must be taken into account. Yet shortage of fuel has already changed diets in Guatemala, where many families can no longer afford fuel for the long cooking of beans. Such variables can only be learned at the project site. This was recognized by the participants at the AAAS Workshop on Women and Development sponsored by the U.S. Department of State to develop recommendations for the U.N. Conference on Science and Technology for Development meeting in Vienna in August 1978. The Workshop recommended that the United Nations sponsor worldwide pilot projects, one in each major region of the developing world, focussing on household energy. And because household is clearly a women's issue,

97. USAID, op. cit., p. 12.

98. Evans, Ianto, Lorena Owner-Built Stoves. A Volunteers in Asia Publication, January 1979.

women's views and women's groups must be involved at every phase of study and implementation.

A similar recommendation was put forward by the working group on Energy for Rural Requirements, part of a UNIDO International Forum on Appropriate Industrial Technology which met in New Delhi in November 1978.

[I]t is the women of the developing world who are most concerned with the problems of energy supply and use, because it is they who do the cooking and, in most countries, gather the fuel. Furthermore, it is usually the women who draw and carry the water for domestic use. Thus, although action programmes undertaken to meet the energy problems of rural areas must involve people at the village level during planning and implementation, their impact on women must be taken into account and indeed, should not be planned or implemented without the significant involvement of women at both the planning level and the village level.⁹⁹

Conclusion

Women's traditional economic contribution to the survival of their families is being eroded by technology. Often that technology can free women from back-breaking and time-consuming labor. But without income, the woman cannot afford the new technology. Without time, the woman cannot try her hand at new economic activities, much less improve the health of herself and her family or attend literacy classes. The vicious circle must be broken. Technology is part of the problem and part of the solution.

99. UNIDO, Draft Report, Chapter XI, pp. 71-72.