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DECISION-MAKING IN AGRICULTURAL HOUSEHOLDS: A COMPARATIVE PERSPECTIVE[1]

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1. Introduction

Agricultural households make decisions in the context of their respective farming systems and cultural institutions. Resource endowments and constraints faced by these households affect current crop and input choices, as well as longer-term decisions regarding agricultural technology adoption, farm investment, wealth accumulation, and transfers to kin. Equally important are social and institutional considerations which determine which of the household members--men or women--are vested with the authority to make these decisions. From a policy perspective, a lack of understanding of these decision-making processes may mean that agricultural development projects may not benefit their intended beneficiaries.

This paper attempts to provide some perspective on agricultural decisionmaking in different countries in Africa, Asia, and Latin America, which are characterized by markedly different resource endowments, family structures and farming systems. In the first part, I discuss farming systems, family structures, and their implication on decision-making processes in agricultural households, emphasizing the women as decisionmakers. In the second part, I summarize evidence from studies on the adoption of agricultural innovations and examine the consequences of technological change on households.[3] While there

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[3]This is obviously a very limited subset of decisions made by agricultural households, since agricultural households allocate their time not only to agricultural production, but also to off-farm work and household production activities. Decisions regarding the number of children and investments in their

is a whole range of studies on technological adoption, this paper focuses on those which emphasize the effects of individual characteristics (especially gender) and cultural institutions in technological adoption.[4] Finally, the conclusion highlights some policy implications of the review.

2. Farming Systems and Family Structure

An overview of farming systems is a convenient point of departure for an analysis of agricultural household decisionmaking. At the risk of oversimplification, I classify farming systems into three types, following Boserup (1970) and Lele (1986): (1) intensively cultivated, labor-surplus systems with a unimodal farm size distribution, as in Asia; (2) extensive, land-surplus systems, as in Africa; and (3) dualistic systems with different factor intensities between large and small farms, as in Latin America.[5] These systems coexist with different family structure "types": the monogamous extended/nuclear family type in Asia, with agricultural decision-making primarily by men; and the polygamous societies of Africa, in which there is less congruence between women's interests and their husbands, and wives are often responsible for their own, and their respective children's, food security. Traditional peasant agriculture in Latin American has also been characterized as a "male" farming system. Although

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human capital (health, nutrition, schooling) are also important. For a more general view, see Singh, Squire and Strauss (1986). Behrman and Deolalikar (1991) provide evidence on the intrahousehold allocation of nutrients in India; using data from the United States, Brazil, and Ghana, Thomas (1991) finds that mother's education has a bigger impact on daughters' height, and father's education, on son's height.

[4]See Feder, Just and Zilberman (1985) for a review of the literature on the adoption of agricultural innovations.

[5]Resource endowments play an important role in the evolution of farming systems and family structures. Boserup (1970) has argued that female farming systems can predominate in societies with low population densities and an ample land/person ratio, such that families can produce their food with very small inputs of labor and no fertilization by leaving exhausted, low-yielding lands fallow. "It is precisely because such labor-extensive farming systems can be used in most of Africa that it is possible for African villagers to leave most of the farming work to women, while the men work very short hours in agriculture, in comparison to male farmers in densely populated regions of subsistence agriculture" (Boserup 1970:32). Boserup further argues that intensification leads to the use of the plow, and the decline of female relative to male labor. Whether intensification necessarily leads to a "defeminization of agriculture" is an empirical question, and the evidence is mixed.

the regional trend is for greater female migration to urban areas, women may take a more active role in farm decisionmaking if husbands are seasonal migrants or have off-farm employment. Industrialized crop production in the large farm sector also involves a sex-specific division of labor (Ashby 1985).

Asian farming systems have been characterized by Boserup (1970) as a "male" farming system. In these systems, where plow agriculture is the norm, men perform the major agricultural task of land preparation, with women providing auxiliary labor in hand operations. Such farming systems are typically found in regions of high population density such as Asia, where more intensive agriculture is needed to satisfy subsistence requirements, in contrast to the female farming system prevalent in Africa. Boserup also argues that the plow is used in regions with private land ownership and a higher proportion of hired relative to family labor.

Boserup's associations are suggestive but do not provide a clear explanation for the gender division of labor in Asian agriculture. Climatic factors, such as the monsoon season in Asia, may be responsible for huge seasonal fluctuations in labor requirements which are typically met by hired labor. Some (e.g. Oshima, 19--) have argued that the monsoons have played a great role in determining the organization and intensity of production and the rise of irrigation systems, particularly for paddy rice cultivation. Cultural institutions evolved out of these agricultural organizations--cooperation and team work was necessary to take advantage of the growing season for crops, and to coordinate the distribution of water from community irrigation facilities.

It is possible that the pooling of family labor as well as the gender division of labor by task within families may have evolved for similar reasons. For example, it is commonly observed that men perform land preparation tasks (plowing, harrowing), using a combination of family, exchange, and hired labor. Women tend to be involved in seasonal work for which work effort can be easily monitored, eg.e.transplanting and harvesting. Work with monitoring difficulty (water control, chemical spraying) is usually left to male family members. What could be the reasons behind such gender-specific task assignments?

If women's primary responsibility is customarily perceived to be child care and domestic work, such activities would be a constraint to her participation in rice production activities which require regular effort and supervision. That is, her time for rice production activities could be rationed. However, during times of peak demand for labor, higher market wages would exceed women's reservation wage in home production and they would then participate in the rice e labor market. Unless substitutes can be found for domestic labor, women would tend to be involved in production activities which would not take them very farm from the home, e.g. gardening and livestock raising. Land inheritance rules which favor men reinforce the primary role of male labor in Asian rice farming systems (Quisumbing 1991). However, women's involvement in post-production processing and marketing (Paris 1988) also gives them opportunities to undertake independent entrepreneurial activities, particularly for women whose families' (or husbands') tenure status permit them to appropriate the gains from yield increases.

Women's control over cash income from marketing agricultural produce gives her some degree of influence in agricultural decisionmaking. As incomes from agricultural production increase, female hired labor (from landless families) has replaced female family labor, and wealthier (landed) women have moved on to nonagricultural occupations--a phenomenon observed in Indonesia and the Philippines.

The relationship between agricultural decisionmaking and social class is determined by cultural considerations, however. In India, there seems to be an inverse correlation between a woman's status in the community and her status within her household (World Bank 1991). Evidence suggests that wage employment may actually improve a woman's bargaining position within her family. Female agricultural wage workers may have more say in determining intrahousehold resource allocation than women who perform domestic work or unpaid family labor in more prosperous households. Agricultural laborer households have a less pronounced gender hierarchy and less concern with concepts of female purity and ideals of female seclusion. Patrilineal ideology also becomes less central if

there is no land or other property to pass on in the male line (Bardhan 1986:2207; in World Bank 1991).

In Latin American agriculture, there is substantial variation between cultural ideals (such as "machismo") and actual fulfillment of role obligations across cultures and within social classes in a particular culture. Although cultural ideals categorize house work as "women's work" and field work as "men's work", in practice, one can observe men and women working together in the fields, not necessarily demarcated into exclusive sex-specific tasks. This flexibility is related to cultural factors (strength of Hispanic versus Indian traditions); social class (whether income comes from land or wages); and the degree of market integration of the peasant economy (Ashby 1985).[6] There seems to be an inverse relationship between women's participation in agricultural production and decisionmaking and wealth. Deere and Leon de Leal's (1982) survey of peasant households in the Cajamarca, Peru found that female decisionmaking in agriculture is inversely related to landholding size. In near-landless and smallholder farms, women were the principal decision makers in choice of crop and inputs; only in the wealthier strata of farms was women's participation in such decisions limited.

Attempts to transplant agricultural technologies from Asia to Africa have met with failure not only because the technologies were inappropriate to African agroclimatic conditions, but, more importantly, family structures are vastly different in African societies (Dey 1985). Unlike the unified "family farm" in Asia, in most of sub-Saharan Africa, households hold several granaries or purses, controlled by men or women depending on different but complementary responsibilities to the household (Dey 1985:423).[7] Various authors (e.g.

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[6]However, although men and women may participate in the same field operations, there are certain tasks reserved for men, usually those involving animal traction and farm machinery.

[7]It must be noted that the concept of a unified Asian family with a single decisionmaker or common preferences has been challenged by empirical evidence. In Thailand, Schultz (1991) finds that men's and women's unearned income have different effects on men's and women's labor force participation decisions and women's fertility behavior. In the Philippines, father's and mother's individual endowments differentially affect bestowals of land and educational investments

Whitehead 1984) have emphasized the "non-corporate character of the spouses' interest and the potential separation of their life courses." These features include "the flexibility of residence arrangements, with the absence of conjugality as a necessary basis for the domestic group; the existence of polygyny, giving varying degrees of concentration of wives amongst men of different ages and socioeconomic or political status; the likelihood and rates of divorce; and the asymmetrical relation of marriage to the kinship status of children (the 'lineality' of the kinship system)" (Whitehead 1984: 35, in Kumar 1987).

In most African societies, women have a traditional obligation to produce subsistence food crops for home consumption, and to perform household maintenance activities such as fetching fuel and water. Traditionally, men have cultivated cash crops, the sale of which provides cash to meet (non-subsistence) obligations to wives and children--although the gender division between food crops and cash crops is changing.[8] Men are obligated to provide the land and to be responsible for housing, taxes, ceremonial and religious obligations, and at least part of the school fees. In most patrilineal societies, men are responsible for surplus accumulation, usually in the form of cattle. This is linked to longer-term security, which may often be achieved through the exchange of cattle for additional wives (with concomitant increments in household labor supply) and through sale of cattle in times of crop failure (Kumar 1987:140). In many societies, both men and women also have the right to cultivate a personal field on their own from which they meet certain obligations to the household and their personal expenses. Evidence suggests that women substantially control their own plots, and, in addition, influence their husbands' plots, often becoming fully responsible for farming decisions and agricultural labor on plots of husbands who

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in sons and daughters (Quisumbing 1991).

[8]In recent years, women have also marketed surplus food crops, engaged in cash cropping, and taken jobs as hired laborers.

are away for most of the year (Safilios-Rothschild 1986)[9]. In countries or among ethnic groups which have a long standing sexual division of labor between crops, men and women generally have the right to own, inherit or use land suitable for their specific crops. In other countries, land rights belong primarily to the compound unit and are controlled by the compound head, and women have access to land for both household and personal crops (Dey 1985). In recent years, however, formalization of land rights through registration and titling may have eroded women's traditional rights to land, with implications on women's access to formal credit to purchase cash inputs.

These classifications highlight the important relationship between the agricultural resource base, social and cultural institutions, and the role women play in these farming systems. While it is tempting to speak about Asian, African, and Latin American "modes" of agriculture, one must recognize that within each mode lies substantial diversity. Furthermore, farming systems and family structures are continuously evolving. Some of these changes are due to increased population densities and agricultural intensification. Others are due to the interaction between overall development patterns, macro policy, existing asset and income distributions, and factor prices.[10]

3. Agricultural Technology: Adoption and Consequences

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[9]On the husband's plot, women tend to have less decision-making authority, but still substantial influence. A woman is less likely to have influence of the absent husband's plot if it is planted to a traditional "men's crop," e.g. coffee. In the Muranga district of Kenya, women apparently have less influence over husbands' plots when husbands are away. But these absent husbands concentrate on coffee production while the nearby husbands concentrate more on food crops which women traditionally control (Safilios 1986).

[10]For example, the growing prevalence of female headed households is due to very different reasons in Africa, Asia, and Latin America. In Africa and parts of Asia, the migration of men to cities leaves women in charge of farming. In Latin America, the absorption of male labor into plantations has led women to migrate to cities, such that female headship is an urban phenomenon. It has been argued that dualistic, bimodal patterns of development (in Africa and Latin America) are conducive to individual migration, while broad based rural growth, as in the successful East Asian economies, induces family rather than individual migration (Lele 1991). Female headship has received a lot of attention in the literature, and a thorough analysis must include factors which bring about female headship. Research must go beyond the distinction between de facto and de jure female-headed households, to examine the reasons why households are headed by women in the first place, and whether or not this necessarily means that the households are more vulnerable, after controlling for other characteristics.

At the farm level, farmers adopt technological innovations because farm decisionmakers perceive long run income gains to adoption. On the aggregate, the diffusion of a particular technology will depend partly on its suitability to a country's resource endowments--whether it is intensive in the resource a country has in abundance (Hayami and Ruttan 1985)--and its appropriateness to prevailing social and cultural institutions.[11] This section reexamines the evidence on the adoption of agricultural innovations in the light of the above discussion on family structure and farming systems. Cultural considerations may pose constraints to the adoption of particular technologies; education and extension may increase willingness to adopt.[12] At the same time, the introduction of new technologies may change the existing distribution of power within households and societies, changing the decisionmaking process within agricultural households. Thus, I also briefly review the evidence on the welfare consequences of technological change in different countries. I argue that differences in relative scarcities of labor across countries have been critical in determining the direction of welfare change after the introduction of new technologies.

3.1 Determinants of Adoption

One issue which often emerges in studies of agricultural decisionmaking is whether or not female decisionmakers are more or less likely to adopt new technologies. It is possible that female decisionmakers are less likely to adopt crops traditionally grown by men. For example, female heads of households are less likely to adopt coffee in Kenya and livestock in Tanzania, although they are equally likely to have cattle in Kenya and to grow coffee or cocoa in Cote d'Ivoire (Appleton et al. 1991). Female farmers in Zambia are less likely to use oxen in cultivation, ox-plowing being a traditional male activity. However, evidence from Kenya suggests that female farmers (most of whom grow maize) are equally likely to use technological messages, and are even more likely to adopt

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[11]Of course, the introduction of a new technology may also bring about institutional change.

[12]This draws from a review of gender determinants of the adoption of agricultural innovations (Quisumbing 1992).

complex technological messages such as top dressing, chemical use, and stalk borer control (World Bank 1992a). Another study from Kenya (PHRWD 1992a) indicates that female farmers are more likely to adopt improved seed and use agrochemicals. In Nigeria (PHRWD 1992b), while male farmers are more likely to use insecticide, male and female farmers are equally likely to use fertilizer.

Despite the mixed evidence on technological adoption by gender, most of the studies find that more educated farmers, male or female, are more likely to adopt new technologies. More educated females, in particular, are also more likely to adopt coffee in Kenya. Increasing the educational level of female farmers by giving them universal primary education has higher marginal effects on the probabilities of adoption than increasing the educational level of male farmers (Burger and Gunning, 1992, personal communication). This is in large part because it stimulates early adoption by female farmers, whom other women are more likely to imitate. Other simulations suggest that female decisionmakers are unresponsive to increased earlier adoption by male farmers. This is consistent with other findings that previous awareness and adoption of the technology, particularly by farmers of the same sex, also increased the probability of adoption. The significance of gender-specific copying effects highlight the need not only for female extension agents to work with female farmers (the presence of a female extension worker at a sub-location has an independent positive effect on yield in Kenya, and female extension workers working with female farmers increase yields by 20 to 35 percent (World Bank 1992), but also for contact farmers to be women, if women farmers are more likely to copy innovations from other women. The importance of cooperatives and extension in many of these studies emphasizes the need for provision of support infrastructure to rural areas.

Most of the studies reviewed also suggest that farmers with larger areas cultivated and higher values of farm tools are more likely to adopt new technology. To the extent that women farmers may have less access to land and own fewer tools, they may be less likely to adopt new technologies.

Differences of male and female farmers in technological adoption are not

apparent in farming systems where men and women do not manage separate plots. In two studies of the differential adoption of high-yielding varieties in India and the Philippines, the suitability of land for high yielding varieties, the proportion of irrigated land, and male and female wages were significant determinants of the area planted to HYVs (Mukhopadhyay 1991; Behrman and Lanzona 1989). A number of differences exist emerge in the two studies. In the West Bengal study, male and female schooling were not significant determinants of technological adoption, whereas adoption of modern varieties, tractor use, and use of direct seeding were positively related to male and female schooling in the Philippines. This may be because schooling exerts a more powerful impact on adoption in areas with more rapid technological change.[13] In the West Bengal study, the size of land owned and the value of assets were also unimportant, while in the Philippines, land size and irrigation were important determinants of the percentage area using modern technology. Other evidence from the Philippines suggests that the increase in the tenants' share after the 1972 land reform increased the incentive for leaseholders to adopt HYVs, particularly in irrigated areas where the yield increases were high (Otsuka 1988).

In the West Bengal study, higher female wages and lower male wages are positively related to the adoption of HYV technology. Since the new technology uses a higher proportion of male to female labor, an increase in male wages would increase cost and decrease the proportion of land under modern varieties. Conversely, an increase in women's wages would decrease the area under traditional varieties and encourage MV adoption. In the Philippines, higher rice prices and lower input costs (fertilizer price, male and female wages) increase the percentage of area planted to modern varieties. The negative impact of <u>both</u> male and female wages is probably due to increased demand for both male and female labor compared to traditional varieties, since MVs require more weeding

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[13]Only 33 percent of the rice area in the West Bengal study was planted to modern varieties, compared to an average of 83 percent in the Philippine sample. Education is more important in dynamic agricultural environments because of higher returns to farm managers' entrepreneurial ability in adjusting to new disequilibria associated with agricultural innovations (Welch 1970; Schultz 1964).

(a traditionally female task) due to increased fertilizer use, and the increased yields require more harvest and post-harvest labor, much of which is increasingly provided by hired labor (Barker and Herdt 1985).

In the Western Highlands of Guatemala, von Braun, Hotchkiss and Immink (1989) find that the probability of export crop production is positively related to farm size (an additional hectare of farm land increases the likelihood of growing export vegetables by 26 percent), and negatively affected by the proportion of women in the household's labor force, off-farm income, and traditional attitudes of the household head towards growing maize for food. Age and education of the household head do not significantly affect the likelihood of growing export crops. Controlling for the total labor force of the household, the share of women's labor in the total significantly reduces the probability of growing export vegetables. This could be because adoption of the new crop is primarily a male decision.

3.2 Consequences of Technological Change

It is difficult to generalize about the consequences of technological change, since different technologies, many with distinct components (e.g. seeds, fertilizers, tractors), have been introduced under a wide variety of conditions. For comparability, I will summarize some of the studies which have examined the effects of the introduction of irrigated rice in Africa and Asia (Dey 1985; Unnevehr and Stanford 1985), and other studies of the consequences of technical change, particularly those related to the introduction of cash crops (Kumar 1987; Siandwazi and Kumar 1989; Bouis and Kennedy 1989; von Braun, Hotchkiss and Immink 1989).

Patterns of labor use have changed dramatically in most Asian countries which have widely adopted high-yielding rice varieties (Unnevehr and Stanford 1985). Modern varieties have been shown to be either neutral or labor-using. While the demand for labor in land preparation may have been reduced by the adoption of tractors, increased output due to multiple cropping has increased the demand for labor in harvesting and post-harvest processing. Increased labor demand has mostly been in women's tasks: intensification of crop establishment

(seedbed preparation and transplanting); crop care (weeding), harvesting, and processing. Moreover, the increased demand for labor has been met by hired female laborers from landless households, as women in landed households move out of agricultural labor into more lucrative nonagricultural occupations.

To a great extent, the benefits from HYV adoption have been captured by those with secure land rights (David and Otsuka 1990). In addition to the shift of women in landed households out of agriculture, in the Philippines, Behrman and Lanzona (1989) have found that children of share tenants spend less time in school compared to children of landless workers, leaseholders, and land owners.[14] For landless workers who depend on wage employment, the potential for HYV adoption to increase employment and real wages is limited, however. It is unlikely that the spread of HYV technology will generate the upward pressure on real wages similar to the earlier East Asian experience. Population pressure on limited land, and slow absorption of surplus labor into nonagricultural enterprises, have tended to depress real wages. Since adoption of HYVs is location-specific--areas with assured water supply and irrigation systems are likely to devote large areas to HYVs--migration of landless workers to favorable adoption environments may equalize wages in rice farming (David, Cordova and Otsuka 1990). The premature adoption of labor-saving technologies (e.g. mechanization and adoption of direct seeding) may also reduce overall labor requirements.

Many agricultural development projects have also tried to introduce irrigated rice technologies in rice farming areas in Africa. However, the record seems to be less favorable than that in Asia, partly because of unsuitability of agronomic and agroclimatic conditions,[15] and partly because the development

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[14]In the Philippines, farm households typically choose between bestowals of land and education to their children. In landless households which cannot make land transfers, education is the only way of transferring wealth to children. Share tenants have not been able to capture the income gains from HYV adoption and the fixing of leasehold rent in 1972 based on yields from traditional rice varieties.

[15]In the Casamance region of Senegal, for example, the introduction of a capital-intensive double cropping scheme involved the draining of a mangrove swamp, which increased soil salinity so that rice cultivation was no longer

programs have repeatedly failed to take into account differences in social structure and the roles played by women in African rice cultivation (Dey 1985). In addition, many of the new technologies increased demand for labor in situations where traditional tasks were being performed with very low-level, time-intensive, technologies. Where the introduction of the programs had detrimental effects on economic security of women, the success of the programs themselves were jeopardized.

Two classic cases are the introduction of irrigated rice in the Gambia (von Braun and Webb 1989) and Cameroon (Jones 1985). In the former, despite attempts to preserve women's customary role in rice farming, the introduction of centralized pump irrigation transformed rice into a male-controlled crop. As yields per unit of land increased from 1.3 to 5.9 tons, the share of women's rice fields in the total dropped from 91% to 10%. This represents a shift from rice being a woman's individual crop to a communal crop under the authority of the male compound head. The higher yielding technologies with higher variable costs became the responsibility of men. As women's control of rice production declined, they reduced their labor input in rice and increased it in the cultivation of upland crops. In the SEMRY irrigated rice project in Northern Cameroon, even when women were assigned rice plots, the proceeds were controlled by men. The higher labor requirement for rice reduced time in sorghum production. Following the harvest, rice was retained for home consumption, and from sales of the surplus, men gave their wives a lump sum in cash to compensate them for their labor. Jones (1985) points out that women were willing to work more days in their husbands' rice fields only if they were compensated more, suggesting that a bargaining process was taking place. She found that widows--who could allocate their time without pressure from a husband--had more efficient allocation of labor than married women.

Kumar (1987:142) reviews five case studies of attempts to introduce new technologies in other African countries, where direct access to all of the improvements was effectively made available only to men. She suggests that "in

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possible (Dey 1985).

each case there is either loss of women's crop production role to men or there is improvement in crops grown by men and not previously grown by women, which potentially require additional women's labor input." However, such a pessimistic view may not be warranted in all cases. In one case, when cocoa was introduced in Western Nigeria, it became a men's crop and women's traditional obligation to provide labor was extended to cocoa, subject to bargaining and remuneration. However, much greater reliance was placed on male hired labor. Eventually, women decreased their time in food production, but increased it in food processing, cloth making and trade. While self-subsistence in food declined, food security did not.

In another case, women's independent incomes dropped when families migrated to a resettlement area devoted to improved cotton and sorghum in Burkina Faso. In the resettlement area, women did not have traditional rights to land, and their food crops were not included in the program rotation. Husbands did give their wives informal authority to cultivate part of the bush fields. After five years, however, families had paid off initial debts, family size had increased with the in-migration of additional family members, cash income was seven times higher, and grain yields were two to three times higher than in the home villages. Much of the increase in yields was used to guarantee consumption and to hire labor. The increase in hired labor enabled women to decrease their labor inputs in common fields, expand their private grain fields, and become more involved in trading and livestock activities.

These two cases highlight the importance of relieving labor constraints either through the adoption of labor-saving technology in tasks which women traditionally perform (e.g. food processing, fetching fuel and water) or through the ability to hire labor. In both cases, the ability to hire labor enabled women to diversify into more profitable nonagricultural enterprises. Much of the African WID (e.g. Gladwin 1991) literature argues that the introduction of new technology only increases women's labor inputs, taking time away from her other responsibilities such as child care. However, this view does not recognize the women's tasks are time-intensive because of lack of tools and complementary

inputs. Women can increase the efficiency of their time use if appropriate labor-saving technology is introduced.

In fact, increased demand for female labor becomes a problem only in "labor-scarce" settingu where low levels of complementary inputs reduce the productivity of female labor, or where it is difficult to hire labor to meet seasonal labor bottlenecks. For example, whether or not a shift from a subsistence to a commercial crop has detrimental effects on welfare depends on relative labor scarcities. The nutritional effects of a shift to export crop production may depend on relative resource endowments. Bouis and Kennedy (1989) examine the effects of sugarcane adoption in the Philippines and Kenya. In the former labor surplus case, sugarcane used less women's labor than corn, a traditional subsistence crop. Women from sugar-growing households, which had higher incomes, were able to increase calorie intakes and reduce activity levels, and achieve better nutrition. In contrast, in the labor-constrained environment of Kenya, improved caloric intake was used by women to increase the energy intensity of their activities rather than improve nutritional status. The introduction of export vegetables in the Western Highland of Guatemala (discussed above) increased labor inputs of women and children, but also substantially increased returns per unit of family labor to twice that of maize and 60 percent over traditional vegetables. While increments in income were spent relatively less on food, children from export-crop growing households had substantially improved nutritional status.

It is may therefore be inappropriate to argue that a technology which increases the demand for women's labor will necessarily have detrimental welfare effects without examining relative resource scarcity, possible increases in income due to shifts in production (e.g. out of agriculture into processing and trade) or participation in labor markets, the availability of child care substitutes (possible in labor-surplus economies) and the labor (or time) intensity of current technology in home production.

4. Concluding Remarks

The above discussion highlights the need to consider the specific farming

system and cultural context in the introduction of agricultural technologies. Policymakers need to assess the appropriateness of technological packages to agroclimatic conditions, relative resource scarcities, and social and cultural institutions. In particular, they must pay attention to individual decision-making roles in farm households.

To the extent that women often lose traditional land rights as these are formalized, efforts must be taken to guarantee these rights or to provide them to beneficiaries of land reform or resettlement programs without gender bias. Extension programs must also address women in their role as agricultural producers, not only as homemakers. Innovative extension programs involving female extension workers, women's groups, and female contact farmers can increase the likelihood of women adopting profitable technologies. Finally, the role of education cannot be overemphasized. Information and education are important to decisionmaking, and policies must enable individuals in farm households to make appropriate decisions about their livelihood.

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