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Technology, production linkages and women's employment in South Asia

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Introduction

In South Asia, where women's earnings constitute a significant proportion of poor households' total income, it is clear that anti-poverty strategies can be successful only if they effectively promote female employment and income. Studies of landless and nearly landless households in India (Mencher and Saradamoni, 1982) and Bangladesh (Salahuddin, 1986) have shown that the women's earnings amount to about half of household cash income and are crucial for the family's survival. The incidence of poverty is highest among female-headed households, which are estimated to make up about one-fifth of the total in India (Buvinic and Youssif, 1978).

South Asian women work long hours in both rural wage employment and household production, often longer hours than those worked by men.[1] But the fact that they assume a large and frequently disproportionate share of the household's workload and make a significant contribution to its income does not necessarily give them access to cash income or an equitable share of food and other consumption items, or enable them to take a greater part in family decision-making.[2]

Women account for between one-third and one-half of the agricultural labour force in South Asian countries.[3] There are also substantial numbers of women in the rural non-farm sector; it was recently estimated, for example, that women made up more than one-third of the rural industrial labour force in Bangladesh (Ahmad, 1986a, p. 61). Those engaged in agriculture are more likely than men to be unpaid family workers; to be casual labourers working seasonally rather than year-round; to be unemployed and looking for work; and to earn lower wages than men for the same work.[4] For those in wage employment the steady decline in the purchasing power of wages in recent years has meant a loss that obviously could not be made good by working more days a year.[5] Women, moreover, tend to be concentrated in jobs characterised by low productivity and low returns – the most undervalued and underpaid sectors of production. We shall argue here that a proper use of technology, with a corresponding reorganisation of work, can

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help to correct the situation: technology should serve to raise poor women's labour productivity (and thereby the return on their labour), expand their productive employment opportunities, lighten their workload and do away with a great deal of the drudgery it entails.

In exploring the prospects for bettering poor women's employment and incomes through the use of improved technologies, we shall analyse the effect of production linkages on women's aggregate (direct and indirect) employment and the direct employment implications of technological change at various stages of the sex-sequential labour and production processes. Although household work accounts for the bulk of women's daily calorie expenditure,[6] we shall not discuss technologies in relation to domestic energy needs since that subject is dealt with in Cecelski's article in this issue of the *Review*. Finally, we shall consider the choice of technology in women's activities as influenced by rural factor market imperfections (including the question of access) and explore the possibilities of enabling women's groups to use improved technologies for larger-scale production.

Crop production

The Green Revolution

Green Revolution technology is found in farmers' fields virtually everywhere in South Asia. Its impact depends largely on the institutional basis of female labour use in agriculture (i.e. wage employment or unpaid family help). Evidence from India (Agarwal, 1985) and Bangladesh (Ahmad, 1985) shows that such technology, resulting as it does in an increased demand for hired labour, has enhanced wage employment opportunities for women from landless households. Peasant families, on the other hand, make intensive use of female family workers who, unlike their counterparts in landless households, receive no payment at all; indeed, where commercial farming has been introduced, the fact that decisions regarding the negotiation of production credit from institutional sources and the marketing of increased output lie in the hands of male household heads has often reinforced men's patriarchal or entrepreneurial role to the detriment of women. Large landowners, on the other hand, whose womenfolk play more of a supervisory role, find it more profitable to mechanise farm operations – and in so doing they displace hired female labour.

In Nepal women's role in farm management has increased as a result of the Green Revolution (Pradhan, 1985, p. 279). In non-labour farm management matters women largely decide Green Revolution technology inputs, including the selection of the seeds (over 81 per cent of the decisions), the use of improved seeds (over 60 per cent) and the amount and kind of fertiliser to be used (nearly 40 per cent by women alone as opposed to 32.5 per cent by men alone). Men, on the other hand, make most decisions about labour allocation. This sex-based division of farm management respon-

sibilities gives males the power to decide the use of household labour, which they often use to their own advantage – systematically reserving for themselves the task of applying chemical fertilisers, for example, while assigning women the unpleasant work of preparing and applying organic manure.

Rice transplanting

Rice transplanting in most of South Asia is done by women,[7] who spend all day bent double, knee-deep in mud and exposed to such health hazards as intestinal and parasitic infections, split heels, leech bites, rheumatic joints, arthritis and gynaecological infections (Agarwal, 1985, p. 328).

In some parts of India women are hired in groups for the job. It is interesting to note that, according to a recent study, a collective spirit of solidarity is generated by certain technical (speed and timing of the work) and organisational (gangs of women workers) aspects of rice transplanting. Furthermore, given the sex-sequential nature of the labour and production process, women's manual work is a precondition for men's related labour input (with higher levels of capital intensity). Women are thus in a good position to strengthen their bargaining power and wield it to counter the exploitation to which they are subject at present (Mies, 1986). With the experience they have acquired they are also in a position to establish, with appropriate policy backing, formal and solidly based grass-roots organisations.[8]

Mechanical innovations

Under the prevailing sexual division of labour in crop production, the mechanical technologies at the disposal of men are based on the use of non-human sources of energy (hydraulic, animal, mechanical, chemical and electrical) while the efficiency of the tools that women use depends on the physical energy they expend (the universal tool, apart from baskets and winnowing fans, being the sickle, with which they cut grass, weed, reap grain, etc.). This manifest disparity in the use of technologies is reflected in the daily calorie expenditure of men and women. In India, for example, it has been found that, time for time, the calorie expenditure in women's tasks like transplanting and weeding is slightly higher than in the heavy but mechanised tasks of ploughing and irrigation that are reserved for men (Batliwala, 1982, p. 331).

Three mechanical rice transplanter prototypes (two motorised and one manual) have been tested in India, Pakistan and Sri Lanka. The manual one gave the most promising results. The yields were higher than those obtained with hand transplanting (e.g. in Pakistan 4,800 kilograms per hectare as against 4,000) and operating costs were lower than those of both the two engine-powered prototypes and lower than the labour cost of hand planting

in all three countries (ESCAP/RNAM, 1983a). Women will need to receive special training if they are to use this transplanter.[9]

Women perform between 75 and 85 per cent of the total weeding work in the rice fields of India and Sri Lanka. Although numerous improved manual weeders have been identified in both countries through technical tests (ESCAP/RNAM, 1983b), it does not appear that any of them has been adopted so far.

Post-harvest processing

Of the 460 million days of rural employment in crop processing in Bangladesh, over 80 per cent are generated by rice processing alone (Government of Bangladesh, 1985, p. 108). Women's work accounts for 86 per cent of this employment. The labour requirement for husking, which is entirely a woman's job, constitutes 52 per cent of the total post-harvest employment (J. U. Ahmed, 1982). Post-harvest income accounts for nearly 40 per cent of total women's earnings, and their earnings from rice husking by traditional "dhenki"[10] technology amount to 60 per cent of total post-harvest income (Salahuddin, 1986, p. 29) and constitute a major source of livelihood for women from landless or nearly landless households. The rapid growth of mechanised milling has led to the displacement of 3.5 to 5 million days of female labour per year (Government of Bangladesh, 1985, p. 108). There are now 11,000 rice mills in Bangladesh, most of them using electric or diesel-powered rice hullers, though some 50 use automatic or semi-automatic machines (Ahmad, 1985, p. 29). Jobs created by the new technology, though fewer than those created by traditional technology, are almost exclusively male. This is a glaring example of a technological change that favours men alone.

Capital/labour substitutions as a result of relative factor price distortions in conditions of surplus labour are well known by now. Such distortions lead to a fall in the price of capital below its equilibrium level (i.e. its marginal value product) while forcing the price of labour up above its equilibrium. The direct consequence is that entrepreneurs naturally tend to take advantage of the relatively cheap factor (capital) and to economise on the relatively expensive one (labour). These are simple economics that are everywhere applied regardless of the sexual composition of the labour force; even so, they often result in the displacement of female wage labour, as has happened, for example, in rice processing in South Asia.

In rural Bangladesh the government policy of extending electrification and credit to small-scale industries has produced a net return (value added minus labour costs) per unit of capital of 48 per cent a year for rice mills while the annual rate of interest on loans charged by financial institutions is less than 15 per cent (ILO, 1985, pp. 62-63).[11] At the same time, while the return on labour when mills are used is 139 to 163 per cent higher than the wage rate, it is only 22 to 34 per cent higher when the traditional dhenki

technology is used. That the burden of unemployment resulting from the introduction of the new technology falls overwhelmingly on women from landless households is clear from the fact that whereas the vast majority (73 per cent) of the mill owners previously hired female wage labour for rice processing (Begum, 1985, p. 238), they now hire only men for the jobs that remain. For other categories of women, however, the change has been beneficial. Those who belong to wealthier households no longer have to supervise hired women workers; and unpaid female family help in peasant households that can afford to send paddy to the mills for processing are relieved of this time-consuming and physically demanding task.

In neighbouring India the scale of job losses for poor women due to a similar technological change is just as great. Here too the new milling technology has been adopted for economic reasons (lower cost of processing) and has resulted in an estimated loss of 125 million days of work per year, or an income of about US$55 million, for women from poor households. The men have taken over the mill jobs, as is clear from an annual gain of roughly US$5 million in male wages in rice milling (Srivastava, 1985, p. 407).

Poor households have suffered other economic losses as a result of this new technology. Where the rice is pounded by hand, the husks can be used as fuel for parboiling rice or sold to potters for firing and the bran can be used to feed animals, poultry and fish. Poor households are now deprived of these by-products because of the mills, which are spreading rapidly and are clearly here to stay. There are two main policy options for dealing with the plight of these households, especially their female members:

(a) provision of collateral-free loans to poor women displaced by the technology to enable them to purchase and operate rural rice mills in groups: this has been done with remarkably successful results in Bangladesh by the Grameen Bank, a semi-governmental institution.[12] In 1984 the loan recovery rate was 99 per cent and the income of the borrowers had risen by 26 per cent in two years (Ahmad, 1986a, p. 35). In 1984 alone 70 women's collective enterprises secured loans for rice hullers (Grameen Bank, 1985, p. 32). This success story could no doubt be replicated in other parts of South Asia;

(b) the development and introduction of intermediate technologies that raise women's productivity and reduce labour displacement: in Bangladesh such an intermediate technology prototype (an improved dhenki) in fact is now available. A comparative assessment gives the following results (see table 1): (i) the lowest unit milling cost is for the improved dhenki; (ii) there is no labour displacement following the introduction of the intermediate technology to replace the traditional one, while labour productivity is 11 times higher than with the traditional method; and (iii) capital costs for the automatic, rural and improved dhenki mills are 833 times, 36 times and 2.3 times higher respectively than for the traditional dhenki, with productivity increases of 14, 23 (at current

Table 1. Alternative technologies in rice husking, Bangladesh, 1984

Technology	Capital cost (takas) [1]	Rated hourly production (tonnes)	Employment (No. of persons)	Capital intensity (capital cost per worker) (takas)	Milling cost (per tonne)	Labour productivity (value added per hour) (takas)	
						At rated capacity	At 40% (current) capacity utilisation
Automatic mill	8 000 000	2.030	30	266 666	163	180	72
Rural mill	70 000	0.750	6	11 666	171	291	116
Improved dhenki	1 800	0.060	2.5	720	58	54	–
Dhenki	800	0.006	2.5	320	585	5	–

[1] In May 1984 there were 26 takas to the US dollar.
Source: Ahmad and Islam, 1984.

capacity utilisation) and 11 times, respectively. In India an intermediate mini rice mill developed by the Central Food Technological Research Institute (CFTRI) is also capable of processing small quantities of paddy with the same efficiency and quality standards as large mills (table 2). This composite mill can carry out cleaning, shelling, polishing and separation operations.

Credit to cover fixed capital costs would have to be provided in both cases. Training for women workers would also be needed both to ensure an adequate level of labour productivity and to prevent the mill jobs becoming exclusively male jobs.

There are other simple and inexpensive technologies available for the winnowing and drying work done by women. In winnowing, women separate the pieces of straw from the threshed grain with a sieve (chaluni) and the lighter particles with a fan (and the aid of the prevailing wind). The Bangladesh Agricultural Research Institute has developed a winnower, though its performance results are not yet known. And a Japanese-designed hand-operated machine is being manufactured by a factory in Comilla, Bangladesh (Infield, 1982).

The sun drying of grain before storage or husking, which is another job done by women, is important for maximum yield, for preservation during storage and for prevention of breakage during husking. The Bangladesh Rural Development Board has introduced black polythene sheets for faster sun drying and easier handling of the grain. Their use can be extended to dry pulses and spices. The fact that such sheets have been purchased by 5,150 women testifies to the demand for them, although no performance evaluation is yet available (Abdullah, 1985, p. 218).

Other activities

Besides its impact on their work in post-harvest processing, technological change can directly affect a number of other activities performed by women, two of which are discussed below.

Vegetable oil extraction and weaving

Technological dualism is found in oil extraction (animal-powered processes versus engine-powered oil mills) and weaving (handloom versus powerloom) in Bangladesh (table 3). The fixed capital per worker in the modern oil-seed crushing and weaving technologies is 7.5 and 16 times higher than that in the traditional technologies. The labour productivity gains, on the other hand, are only five times higher for weaving. As in the case of rice mills, there is a great incentive to introduce oil mills because of the relatively high net return per unit of capital, estimated at 72 per cent (ILO, 1985, pp. 62-63). However, their introduction results in considerable labour displacement and traditional small entrepreneurs tend to disappear.

Table 2. Alternative technologies in rice husking, India, 1980s

Technology	Average yield (as % of paddy)	Milling capacity (kg/hour)	Losses due to broken rice	Quality of by-product	Operators needed per unit	Remarks
Hand-pounding	–	4-5	High[1]	Bran mixed with husk	1-2	Arduous work and low productivity
Mechanical milling (electric or diesel-powered)	–					
Huller	60	200-400	High	Bran mixed with husk	1-2	Low efficiency: impure bran
Centrifugal sheller	68	200-1 000	Low	Pure bran	2	Good for high-moisture paddy
Disc sheller and cone polisher						
Parboiled rice	70		Low			Good for parboiled and fair for raw rice
Raw rice	68	400-500	Medium	Pure bran	5-7	
Rubber roller sheller and cone polisher	70	500	Low	Pure bran	5-7	Good for both par-boiled and raw rice
CFTRI composite mini rice mill	68-70	300-500	Low	Pure bran	4-7	Very good small unit at rural level

[1] These are not really comparable with losses in the case of mechanical technologies because of the uses made of the by-products when the rice is pounded by hand.
Source: Srivastava, 1985.

Table 3. Alternative technologies in oil-seed crushing and weaving, Bangladesh, 1980 (in takas)

Technology	Capital/labour ratio: fixed assets per worker	Output/capital ratio: value added per taka of fixed assets	Output/labour ratio: value added per worker
Oil-seed crushing			
Ghani[1] processing	2 882	2.22	3.74[2]
Oil mill	21 716	5.00	36.57[2]
Weaving			
Handloom	1 583	2.81	4 448[3]
Power loom	26 061	0.87	22 673[3]

[1] Traditional animal-powered crushing. [2] Value added per labour hour. [3] Annual value added.
Source: Ahmad, 1986a, p. 22, and 1986b, p. 46.

The impact on employment is both sexual and quantitative. Female jobs are taken over by men, but the total number of jobs is smaller. While over 30 per cent of the workers in "ghani" processing were women, no women at all are employed by the oil mills (Ahmad, 1986b, p. 46).

In Bangladesh women's participation in handloom production is currently confined to reeling but could be expanded to include weaving as well. That women are active in the weaving industry is shown by the fact that in 1984 nearly as many landless women (929) as men (1,074) contracted Grameen Bank loans for weaving (Grameen Bank, 1985, pp. 23-24).

Technological dualism is also found in weaving in Pakistan (Ahmad, 1986b) where old machinery is generally used in the handloom sector and power looms constitute the improved technology. Together the two technologies employ some 320,000 people and there are strong domestic upstream linkages (raw materials and machinery) in both. In Sri Lanka, too, owing to the low productivity of the handlooms and the need to improve the competitiveness of the rural textile sector, it is considered that the relatively advanced technology of power looms is appropriate for the decentralised weaving industry (Ahmad, 1986b). The strategies adopted in both countries should increase employment opportunities for women, especially those now working as unpaid family help.

Production linkages

Technological changes in men's activities indirectly affect women's employment and incomes through the operation of the production linkages and sex-sequential nature of the labour process. This can be illustrated by what has happened in three important industries in South Asia (fishing, dairy and coir) that employ both men and women. At the same time we will look at

the direct effects on women's employment and incomes of technological changes in segments of the labour and production processes in which only women are engaged.

The fishing industry

In the State of Kerala in India, where men were traditionally responsible for catching fish while preservation, distribution and marketing were women's jobs, a fisheries development project was set up in the 1950s for the purpose of mechanising fishing and introducing the use of ice and improved freezing techniques for fish preservation and the use of insulated vans for transport. Little account was taken of the traditional sexual division of labour in the project's design (Gulati, 1984a).

The main technological changes that have occurred in the fishing industry as a result of the project are that *(a)* whereas no boats were mechanised before, the number of mechanised boats that fishermen own has steadily increased over the years while the number of traditional craft has decreased (table 4); *(b)* the use of ice for preservation has taken firm root and expanded uniformly: it is even used by women vendors who carry the fish on their heads; and *(c)* there has been a significant growth in the infrastructure for ice production and freezing and cold storage (table 5).

The new technology resulted in a huge increase in the volume of the fish catch and a marked improvement in its composition owing to a larger share of prawns, which boosted export earnings.

Although the design of the fisheries development project was sexually neutral, an evaluation of the results has shown positive socio-economic gains to women through the operation of production linkages (table 6).

Women's work opportunities in both wage employment and self-employment have been stimulated upstream in net making and coir processing, and downstream in prawn processing, marketing and trade. Similar increases in employment and incomes were produced by the great increase in the number of ice and freezing plants (table 5). Prior to the technological change, females in paid employment came predominantly from socially disadvantaged households, such as widowed, divorced or old women and unmarried girls from single-parent families. Now married women and unmarried girls from two-parent households account for the large majority of working women (Gulati, 1984a, pp. 61-62).

However, the socio-economic gains made by women are threatened by developments that directly affect their new sources of income. For one thing, the introduction of factory-made nylon nets (which facilitate a bigger catch) has begun to undermine net making as a source of earnings for women (Gulati, 1984b, p. 2094). For another, the introduction of the auction system of marketing has forced women to compete with large traders, so that they can no longer count on a livelihood from fish marketing ("Women, technology, and forms of production", 1984, p. 2023). From a policy

Table 4. Backward linkages in fishing: Changes in mechanised boats and traditional craft, Kerala, 1953-80

Year	Mechanised boats	Traditional boats	
		Thanguvallom (large plank-built craft)	Kochuvallom (small plank-built craft)
1953	–	197	280
1959	63	123	260
1963	87	93	135
1976	144	35	48
1980	419	40	147

Source: Gulati, 1984a, p. 8.

Table 5. Forward linkages in fishing: Growth in ice plants and fish-freezing plants, Kerala, 1953-76

Year	Ice plants			Freezing plants		
	No.	Production (tonnes)	Storage (tonnes)	No.	Freezing capacity (tonnes)	Frozen storage capacity (tonnes)
1953	–	–	–	–	–	–
1963	1	25	200	1	9	125
1968	...	83	385	...	37	400
1976	29	377	325	15	88	1 625

Source: Gulati, 1984a, p. 13

standpoint, there is thus a need *(a)* to protect the jobs of women engaged in net making and *(b)* to provide women traders with the means of resisting the financial muscle of speculative wholesale bidders at the fish auction market, say through the provision of risk capital free of collateral requirements along the lines of the credit provided by the Grameen Bank in Bangladesh.

The dairy industry[13]

Two alternative technologies for milk preservation are found in the Pakistan Punjab. The usual method of preserving milk during transport is to put ice in the cans of milk. This not only dilutes the milk but, when the ice is made from impure water, also contaminates it. At the other extreme a sophisticated and costly sterilisation process involving steam injection and

Table 6. Women's employment generated through production linkages to boat and gear technology in fishing, Kerala, 1978 (% of working women from fishing households)

Type of linkage and activity	Village		
	Sakthi-kulangara	Neenda-kara	Puthen-thura
Backward linkages			
Net maker	4.0	6.5	68.9
Processor of coir for nets, ropes, other fishing tackle	2.0	0.5	2.1
Forward linkages			
Wage-earning prawn processor	26.3	23.0	24.0
Prawn dealer	44.5	35.9	0.5
Prawn dealer at home	2.0	8.8	0.1
Fish trader	–	–	0.5
Shell collector	–	4.6	–
Fish headload vendor	17.2	7.8	0.6
Other	4.0	12.9	3.3
Total	**100.0**	**100.0**	**100.0**

Source: Gulati, 1984a, p. 39.

packaging in tetrahedral containers has been introduced in the Okara, Khanewal and Rahim Yar Khan districts. In between the two is the method being used at the Shah Jewna Livestock Farm in the Jhang district where a steriliser plant operates with domestically made equipment and materials which are simple to use and maintain – a steriliser, gas cylinders, burners and bottles – and is thus able to achieve an internal rate of return of over 30 per cent.

This intermediate technology has strengthened the backward production linkage with villages around the plant. The increase in the marketing and production of milk benefits the women responsible for animal feeding, tending and milking in peasant landowning, tenant and landless families (Hussain and Aziz, 1981, pp. 68-69). Backward linkages to the domestic capital goods industry bring benefits to the male population as well. Given the longer shelf life of bottled milk, its marketing poses fewer problems and helps to generate employment in the service sector.

Although it is the women who do most of the work of producing the milk and ghee, both of which fetch a good profit, it is the man of the family who pockets the earnings. The Women's Milk Collection Association of Shah Jewna was therefore set up to give women an opportunity to earn an income of their own.

In India a government-sponsored dairy scheme has been introduced in the State of Andhra Pradesh for the collection of milk from a large network

of milk centres in villages, chilling in milk plants located in small towns and marketing in urban areas. However, the backward linkages have meant an increased workload for women from marginal peasant and agricultural labourer households while the cash earnings generated by the women's activity are kept by the males. Credit facilities for purchasing animals were extended to the men despite the fact that animal husbandry is the responsibility of women (Mies, 1986, pp. 80-82). Similarly, advice on improved veterinary practices went to the males of Gujarat even where women were responsible for the care of the animals (ESCAP, 1981, p. 20).

The coir industry[14]

In the coconut/coir industry of Sri Lanka women have traditionally been engaged in processing rope. Coir production is also a sex-sequential labour process. Dehusking, transporting the husks by car and the making and cleaning of husk pits are exclusively male jobs. The work of filling husk pits is shared by males and females. Emptying the pits, hammering soaked husks, drying and cleaning fibre, spinning rope by hand and transport on foot are exclusively female jobs. However, the task of spinning rope of a superior quality by hand is done by men, who also take part in machine spinning (when this is done sitting down but not standing up).

Hence the dirtiest and hardest jobs fall to the women. To remove the husks from the pits they have to stand for several hours in chest-deep water in the stench of the fermentation process. The women (usually the poorest in the village) also have to remove the stones and logs covering the pits and hammer the soaked husk with a small wooden club until the fibre is loosened (20 to 30 blows for a well-soaked husk). Wooden "fibre-cleaning" machines can be rented from traders but most women cannot afford them without organisational and financial assistance.

Factor market imperfections

The existence of considerable factor market imperfections in the rural areas of most developing countries is fairly well documented by now, especially the fact that access to factors of production is much easier for some groups than for others (I. Ahmed, 1985). Even in the absence of technological change, unequal access affects the allocation of resources, the methods of production and the distribution of rural incomes. When technological change is introduced and there is a greater need for credit, modern means of production, knowledge of new technology, extension services, participation in rural organisations, etc., the access of disadvantaged groups to these factors becomes a crucial issue.

Consequences for women

Analyses of rural factor market imperfections have almost always focused on class-based inequalities. However, it has been convincingly demonstrated that inequalities may be based on sex as well: rural women are in many cases systematically denied access to land rights (and hence, as in Nepal, to collateral for loans), tenancy rights, training, farm inputs, extension services and the modern means of production.

Sex-based discrimination is most patent in cases where male extension agents regard women as worthy of advice only on matters of home economics. Such discrimination is due not only to ignorance of women's roles but also to the fact that the household is treated as the unit of production, with all services being channelled through the male head. Whatever the reason, it is a fact that women engaged in crop farming and animal husbandry are often ignored by extension agencies, despite the fact that, even if they do not enjoy the same advantages, they may be as efficient and progressive as their male counterparts (in Nepal, as we have seen, women make decisions about crop technology). This efficiency may be due to more intensive use of female family labour or to more progressive farm management. Just as high labour intensity on small farms is one manifestation of the existence of rural factor market imperfections, so rural women's predominance in labour-intensive sectors is another.

Access to credit

As noted earlier, loans for the purchase of animals were granted to men in Andhra Pradesh despite animal husbandry being the responsibility of women. Although the major decisions about modern farm inputs are made by women in Nepal, their access to institutional sources of credit is severely limited. While the Nepalese poor of both sexes are still at the mercy of the village money-lenders, more women than men experience problems in dealing with credit institutions: when a sample of men and women were asked why they had not applied for a loan, more than twice as many women as men replied that they did "not know how to apply" or that they had "no contacts with the lending institutions", and significantly more had difficulty in filling out the forms (Pradhan, 1985, p. 281). Furthermore, land ownership in Nepal is patrilineal by law so that women are denied the opportunity to use land as collateral for loans (ESCAP, 1981, p. 67).

It would, however, be only logical to give priority to loans for women: data from Bangladesh show that 80 per cent of the value of loans granted to women is invested in processing, manufacturing, livestock and fisheries (table 7). In contrast, men channel the bulk (61 per cent) of their loans into marketing and trade. Clearly, the male borrowers increase traders' margins, without substantially helping the producer, and contribute to inflation (since their borrowing for service sector activities is not accompanied by an increase in the volume of production).

Table 7. Grameen Bank loans to the landless population by sex and activity, Bangladesh, from establishment of the Bank in 1976 to 31 December 1984 (% of total)

Activity	Landless males		Landless females	
	No. of loans (total 137,476)	Value of loans (total 280,544,825 takas)	No. of loans (total 137,242)	Value of loans (total 218,734,175 takas)
Processing and manufacturing	16	14	36	35
Agriculture and forestry	3	2	1	1
Livestock and fisheries	15	16	38	44
Services, trading, peddling and shopkeeping	50	61	14	16
Collective enterprises	16	7	11	4
Total	**100**	**100**	**100**	**100**

Source: Grameen Bank, 1985, p. 22.

Social organisation of production

The use of improved technologies, because of the larger scale of operations involved, implies a move from individual entrepreneurship to collective investment and operation. Such a move has been successfully accomplished in Bangladesh. Four women's groups (with between 30 and 40 members each) used Grameen Bank loans to invest in rice mills during 1982-83 (Abdullah, 1985, p. 216). In 1984 alone 70 groups of landless women contracted Grameen Bank loans for the collective operation of rice hullers and 18 for the collective operation of oil mills (Grameen Bank, 1985, p. 32). Other groups of women formed in 1984 took out loans for cultivating high-yield varieties of rice (208 groups), for fish farming (83 groups), for livestock raising (88 groups) and for poultry farming (20 groups).

Where loose co-operative forms of work organisation have developed spontaneously, as in milk collection in Pakistan or rice transplanting in India, the formation of more formal grass-roots organisations would enable the women to wield greater bargaining power. From the scattered instances examined here it would seem that women tend to be mobilised more effectively for joint economic ventures, particularly those involving improved technologies, when they belong to a similar class (landless households) or have a similar occupational background (agricultural labourers, milk producers, weavers, etc.). The focus on shared class interests tends to encourage self-reliance and to motivate the group members to exert collective pressure on the wealthier members of the community in order to obtain a larger share of material and social resources, while women from similar occupations can be more easily organised into co-operative work groups that bridge

traditional socio-economic and political cleavages – cleavages that men find it harder to overcome.

Summing up

This brief review of the social impact of technological change in South Asia has shown that on the whole the changes brought about by "modernisation" have so far done little to free women from their traditional domestic and non-market roles and labour-intensive activities.

The economic forces that put hired male labour out of a job operate in the same way and with the same intensity for women, as we have seen in the case of rice processing, oil extraction and handloom weaving. However, when the scale of production is increased or women's traditional activities are mechanised (with consequent commercialisation of their output), the men tend to take over mainly because they possess or can acquire the necessary skills, training, knowledge and fixed and working capital, while the women are excluded from the new opportunities, often because of institutionalised sexual biases. That the biases are unfounded is demonstrated by instances where women have successfully operated rice and oil mills.

Owing to the socio-economic factors that determine the status of female labour, different categories of women in South Asia are affected in different ways by a given technological change. For example, in India and Bangladesh hired female labour benefited from increased wage employment opportunities brought about by the introduction of Green Revolution technology, while women in peasant farm households had to shoulder a much heavier workload without any corresponding gain in return. On the other hand, the unemployment produced by technological changes in the rice processing, oil extraction and weaving industries hit hired female labour the hardest. This points to the urgent need for policy-makers to consider how technology may best be used to benefit women in the rural labour market.

In deciding the activities where new technologies should be introduced as a matter of priority, policy-makers should not overlook the most demeaning (and often unpaid) tasks performed by women – such as rice transplanting and emptying husk pits and hammering soaked husks in the coir industry – which frequently entail high risks to their health. Moreover, as we have seen from the several examples cited above, the range of improved and intermediate technologies available for the work done by South Asian women is much wider than is ordinarily believed.

Because of the sex-sequential nature of the labour process characterising the fishing, dairy and coir industries in the region, a special effort is required to strengthen the backward and forward production linkages if women's employment and incomes are to be preserved and increased. The ancillary production processes in which women participate need, no less than these three industries themselves, to be protected against competition by large-scale modern sector manufacturing and imports.

The rural factor market imperfections that have been used to explain class-based inequalities, choice of techniques and resource allocation in rural areas also account for sex-based inequalities, especially women's concentration in labour-intensive sectors marked by low productivity and low returns. Biases in the agrarian structure and in extension services are largely responsible for the institutionalisation of discrimination against women.

In Nepal the sexual division of farm management responsibilities leaves women with the job of making critical technological decisions while men retain the power of allocating household labour resources. As a rule, women throughout South Asia are systematically denied access to credit, land titles and extension services in virtually every sector, even where they do most of the work. Since skills are a major determinant of labour productivity, women need to be given training that will enable them to operate and manage the improved technologies on a bigger scale of production. Facilities should be extended to them for improving the supply of raw materials and the marketing of their products. And special protection needs to be provided to those who are home-based, unorganised and isolated producers and hence more vulnerable to exploitation by the male trading and merchant classes.

Priority should be given to the provision of collateral-free loans for women, who have already demonstrated that they can utilise credit productively, particularly groups of women who make collective investments in rice or oil mills, improved reeling techniques, and so forth. While this would ease the constraints of vital working and fixed capital requirements, provision of risk capital – as in the fish auction market – is also essential if women's livelihood is to be protected. In a few isolated instances the formation of groups has enabled women to strengthen their bargaining power, both inside the household (control over income) and outside it (protecting and increasing income-earning opportunities), and such group formation needs to be encouraged and supported. Every opportunity should be seized to build formal organisational structures for women on the basis of informal and spontaneous co-operative forms of production, as in the case of rice transplanting in India.

Notes

[1] Data on Bangladesh are found in Ahmad, 1985, p. 23, on India in Agarwal, 1985, p. 325, on Pakistan in Khan and Bilquees, 1976, p. 261, and on Nepal in Nag et al., 1977, pp. 128-129.

[2] For instance, in three states of India (Agarwal, 1985) wages paid to women were taken over and controlled by the household men. Similarly, in the villages of Pakistan Punjab women's income earned from producing milk and ghee (clarified butter) were always pocketed by the man of the family (Hussain and Aziz, 1981).

[3] For data on Nepal, Pakistan and Sri Lanka see Rothschild, 1983.

[4] For example, the daily wage rate for male farm labourers in Sri Lanka is 25 per cent higher than the female rate (ESCAP/RNAM, 1983a), while in India too women are paid less than men for the same agricultural work (Agarwal, 1985). In Bangladesh hourly wages paid to women in rural industries were found to be only 42 per cent of those paid to men (Ahmad, 1985, p. 28).

[5] In Bangladesh real wages in agriculture have declined by one-third since the 1960s (Ahmad, 1986a, p. 58). Similarly, in India there has been a widespread decline in daily real wages (Agarwal, 1985, p. 330).

[6] For instance, gathering firewood, fetching water and cooking together account for 64 per cent of women's daily calorie expenditure on domestic work in India (Batliwala, 1982, p. 331).

[7] The only major exception being Bangladesh. Females account for 64 per cent of all labour engaged in rice transplanting in Nepal, 91 to 100 per cent in Sri Lanka and 70 to 80 per cent in India (see Unnevehr and Stanford, 1985). For data on a Pakistan Punjab village see Khan et al., 1985.

[8] In contrast, the women lace producers of Narsapur, as isolated home workers, have become vulnerable to exploitation by employers, local traders and exporters and, being regarded as "housewives" engaged in domestic production (Mies, 1982), are difficult to organise formally into women's associations.

[9] The illustrated manual for the transplanter is obviously addressed solely to male readers despite the fact that transplanting is done almost entirely by women.

[10] The dhenki is a foot-operated wooden husker.

[11] The effect of the fall in the price of capital is reinforced by low tariffs on imports (Government of Bangladesh, 1985, p. 109).

[12] For a discussion of this and similar credit schemes see P. Egger: "Banking for the rural poor: Lessons from some innovative savings and credit schemes", in *International Labour Review*, July-Aug. 1986, pp. 447-462.

[13] This section draws heavily on Hussain and Aziz, 1981.

[14] This section is based on Risseeuw, 1980.

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