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Lightening the Load:
Women's Labour and Appropriate Rural Technology
in Sub-Saharan Africa
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Working Paper vol.21 / 1994
African Studies Centre - Leiden

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Copies may be ordered from the African Studies Centre, 
P.O.Box 9555, 2300 RB Leiden, The Netherlands. 
Prices do not include postage.

ISBN 90-5448-022-X
Met lit. opg.
ISBN 90-5448-022-X
Trefw.: vrouwenarbeid ; landbouw ; Africa
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Lightening the Load:
Women's Labour and Appropriate Rural Technology
in Sub-Saharan Africa

Abstract

In the present period of heightened gender awareness, few contest the value of labour-saving
devices for women in developing countries. In Sub-Saharan Africa, rural women, whose
agricultural and household maintenance activities have long been recognized to be especially
arduous, are considered to be the main beneficiaries of such innovations. This paper questions the
assumptions of the rural technology debate, re-assessing if and how the technology is potentially
valuable to rural women in Sub-Saharan Africa. This entails examining what kinds of technologies
are being promoted, and for whom they are being introduced, with comparisons drawn from the
Green Revolution experience in South Asia.

The first section of this paper discusses historical and contemporary factors contributing to
the intensification of women's work day as well as the contraction of women's access to
community-held natural resources. An assessment of the different purposes and phases in the
development, spread and impact of rural technology on women producers follows. The concluding
sections consider the overall utility of rural technology initiatives in Sub-Saharan Africa,
emphasizing the challenges that women's severe lack of time and money pose for their appropriate
design and distribution.
1. Rural African Women's Work Regimes and Agrarian Evolution

There is abundant evidence that demands on women agricultural producers' labour time in Sub-Saharan Africa have been increasing over the past century. This section examines some of the major reasons.

**Female Labour and African Agricultural Systems**

Intensification in the use of agricultural land, labour and/or capital has been the primary feature of agrarian evolution world-wide. Sub-Saharan Africa is no exception. Boserup (1965) was the first to identify the false dichotomy between land and labour intensification. As fallow periods are shortened in the relatively land-extensive agricultural systems of Sub-Saharan Africa, land and labour intensification are part and parcel of the same process. Moreover, Boserup recognised that it is primarily female labour, rather than male labour, that is intensified in the context of Africa's shortened fallow systems.

Why has women's role in African hoe agriculture been so profound? Audrey Richards (1939) traced its origins back to the sexual division of labour in hunting and gathering societies, whereby women were primarily involved in daily plant gathering in contrast to men's more irregular hunting and warrior activities. The transition from hunting and gathering to agriculture some one and a half to two thousand years ago has been relatively recent compared with South and East Asia. It has been an evolutionary rather than a revolutionary process.

Up to the present, women are observed doing both gathering and agricultural activities in many African rural economies. By contrast, men's hunting and military activities were largely eliminated by colonial modernisation. Why has the gender divide not only remained but, as agriculture intensifies, the additional work has fallen disproportionately on women's shoulders? Boserup attributes it to men's ability to control female labour through marriage. "Many wives in polygamic tribes are domestic and agricultural slaves in disguise" (Boserup 1965:74).

It is methodologically difficult to compare working day estimates between societies or over time. Nonetheless such figures are relevant to the discussion of male and female labour inputs during the process of intensification. Already decades ago, it was apparent in labour expenditure studies that women's working day was both longer than that of men and subject to less seasonal fluctuation. Richards (1939) records Bemba women doing approximately 6 hours of work during the peak and slack agricultural seasons, as opposed to men's range of from 4 to 2.75 hours per day. Thus, sixty years ago, women's labour input exceeded men's by between 50 and 120 percent.
A survey of Bemba villages in the early 1980s showed women performing 30-40% more agricultural field work compared with men (Moore and Vaughan 1994:198-217). When domestic labour is considered along with agricultural labour it is notable that women's work load is considerably greater. Women performed almost 300% more work than men. The disparity narrows with market orientation. In households with the greatest commercial maize production, women's working day is 'only' 250% longer than men's.

These findings are not exceptional (Lewenhack 1992). Most evidence, including that of a major World Bank study in East and West Africa (Saito et al. 1992), shows that the balance of rural workloads is heavily weighted against women (Table 1).

**Table 1: Gender Division of Worktime**

<table>
<thead>
<tr>
<th>PLACE</th>
<th>Length of Working Day in Farm Season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>WOMEN</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MEN</strong></td>
</tr>
<tr>
<td>Zambia - Mpika, Mazambuka and Mumbwa Districts</td>
<td>(Due &amp; Mudenda 1983)</td>
</tr>
<tr>
<td>Agricultural Work</td>
<td>8.5 hrs/day</td>
</tr>
<tr>
<td>Household Work</td>
<td>5.0 hrs/day</td>
</tr>
<tr>
<td>'Working Day'</td>
<td>13.5 hrs/day</td>
</tr>
<tr>
<td>Cameroons</td>
<td>(McSweeney 1979)</td>
</tr>
<tr>
<td>Agricultural and Domestic Work</td>
<td>7.3 hrs/day</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>(McSweeney 1979)</td>
</tr>
<tr>
<td>Agricultural and Domestic Work</td>
<td>8.6 hrs/day</td>
</tr>
<tr>
<td>Tanzania - Bukoba District</td>
<td>(Kamuzora 1984)</td>
</tr>
<tr>
<td>On-Farm Work</td>
<td>4.37 hrs/day</td>
</tr>
<tr>
<td>Domestic Work Food, Water, Wood, Childcare</td>
<td>3.37 hrs/day</td>
</tr>
<tr>
<td>'Leisure'</td>
<td>3.41 hrs/day</td>
</tr>
<tr>
<td>Burkina Faso, Kenya, Nigeria, Zambia</td>
<td>World Bank Study (Saito et al. 1992)</td>
</tr>
<tr>
<td>Farm Work</td>
<td>8.3 hrs/day</td>
</tr>
<tr>
<td>Non-Farm Work</td>
<td>6.0 hrs/day</td>
</tr>
</tbody>
</table>
Rural Labour Siphoning and Male Outmigration

It is wrong to assume that the traditional gender division of agricultural labour is the main cause of labour inequalities in rural areas. There was, in fact, no one traditional division of labour. A multitude of physical environments, farming systems and tribal differences led to the bewildering array of gender patterns seen by 19th century European observers.

Colonial policy served to reduce the fluidity of task allocation between the sexes and to standardize sexual divisions of labour. Colonial officials premised their economic policy on the assumption that male labour was essentially surplus to rural household subsistence requirements (Box 1). Male labour was siphoned to the mines of Southern Africa and the plantations of East and West Africa. Peasant cash cropping also became increasingly important as the colonial era unfolded. As a result, men became the cash earners and women became the subsistence provisioners of rural households. Men's physical absence from their rural homes served to make the sexual division of labour more rigid in terms of women's involvement in rural subsistence production and men's disassociation from it. Men who returned to their rural home areas could reject so-called 'female work', i.e. the household provisioning work. Taboos about men's involvement in cooking, cleaning and cultivation of certain crops still remain strong, well-exemplified in labour reserve territories such as Lesotho.

******************************************************************************

Box 1: African Women Agriculturalists from the Colonial Perspective
The colonial state saw the dichotomy between male and female work patterns from a fiscal perspective. Men were the taxpayers and women were men's tax dependents. Tax collection was expedited by dealing with male-headed households rather than female and male adult individuals (Bryceson 1995). At the same time, Indirect Rule, the mainstay of British political policy in Tanganyika and Nigeria, was based on stable, consistent chiefdoms which were understood by colonial officials only in terms of male descent. This insistence on male inheritance also coloured colonialists' understanding of traditional lands and strengthened ideas of male land tenure and resource rights.

******************************************************************************

During the post-colonial period, this divide has continued to operate, although the economic impetus has changed. The rural-urban migration stream has been biased towards men. Boys tend to receive more education and skills training than girls, giving them an advantage in the non-agricultural labour market. In some places, agricultural work is left almost entirely to women due to resource constraints or low returns in agriculture (e.g. Uluguru, Tanzania: van Donge 1992 and Kisii, Kenya: Raikes 1993). It is not an exaggeration to state that African farmers are, in most places, overwhelmingly female (Allison 1985). In Kenya, 61%
of rural women stated farming to be their main occupation, as opposed to only 24% of rural men. Figures for Nigeria were 88% and 58% (Saito et al. 1992)

The colonial period created a pattern of male cash and female subsistence spheres which shows an intransigent persistence throughout the post-colonial period, despite many conscious efforts by women’s development projects to subvert it (Bryceson 1995).

Agricultural Intensification and Women’s Work

During this century, commodity production in peasant economies has expanded alongside subsistence production. Additional production for the market either replaces some direct fulfillment of household needs, or requires additional labour inputs into market products. In Sub-Saharan Africa, the latter usually comes from labour intensification, or ‘extending the working day’ of peasant producers, especially women, rather than from investments in yield-increasing technologies and inputs (Beneria 1982, Whitehead 1981). ‘Extending the working day’ can mean: longer working hours, a longer working season, more work inputs from older women, children or nursing mothers, etc. It can also mean more intensive, higher quality, and more supervised, labour, as well as multi-tasking.

Under the influence of increasing population density and commoditization, agriculture is characterized by a steady reduction in the proportion of land under fallow, as well as an increase in the number of years any one plot of land is cultivated. This process has implications for male and female workloads. Land clearing, traditionally a male task in most areas, demands reduced effort in total, since land is less frequently subject to clearance. On the other hand, the longer period of cultivation causes increased weeding, a traditionally female activity.

In some areas, fallow periods have been reduced to critical levels requiring measures to enhance soil fertility. Traditionally, this involved crop mulches, often entailing a great deal of load carrying, primarily a female task. However, in the case of cash cropping, artificial fertilizers are now frequently used. Women are less involved with purchased fertilisers, and evidence suggests that transport devices under men’s control are used for their house-to-field carrying (Airey and Barwell 1991). Nonetheless, fertilisers encourage weed growth, leading to more weeding by women.

Plough agriculture, where not infeasible because of tsetse, represents a major step in the intensification of agricultural land and labour, but does not appear until demographic pressure has reached a critical level. It is usually argued that women’s labour declines with the introduction of ploughing as men take over cultivation, but the actual outcome is not so clear.
In Mazambuka, Zambia, for instance, Wright (1983) reported that ploughing and commercialisation reduced male labour inputs but did not relieve women nor children, of their arduous workload, and instead created new heavy tasks. Because animal ploughing is associated with increasing population pressure, the availability of extensive tracts of land for animal grazing is largely precluded. Stall feeding or zero-grazing usually involves transporting grass and crop residues considerable distances to the place of consumption. Women's 'traditional' role as load carriers leads to their co-option in this activity, a point often overlooked by conservation livestock farming projects. Women rarely control draught animal power, except sometimes for minor animals like donkeys, because of the inherited connections between livestock, status and patriarchal domination.

Gender Divide in the Household Economy: Subsistence and Cash Earning

Growing commoditization is a major contributor to the labour imbalance between men and women. Traditionally, men were not usually responsible for helping with women's tasks and this pattern persists. The reverse is not the case. Presently, women's participation in commodity markets, often on behalf of their husbands, has caused a one-way blurring of the gender delineation of tasks. Women get involved in many former male tasks with a cash-orientation, whereas men are not participating in former female tasks having a subsistence-orientation (Moore and Vaughan 1994). The rigidities of the gender division of labour thus tend to be one-sided. The balance of evidence suggests that it is political and institutional power rather than economic complementarity which forms the decisive influence on task allocation by gender.

The labour time transferred to working on husbands' cashcrop fields, or to small scale food processing or crafts to earn cash, means that less time and effort can be devoted to "domestic" activities, notably childcare and family nutrition. Both children's and women's health can suffer. The problem of declining nutrition is further compounded by the transfer of land resources into commodity production. Child nutrition and health parameters often decline with increasing wealth and market-orientation (Geisler et al. 1985, Swantz et al. 1975). On the other hand, in places where food output fluctuates widely or is generally meagre, commodity production can be a boost to household food security (Bryceson 1989).

This pattern of labour would not be so detrimental to women if male and female cash income was pooled at household level. Income pooling, however, is not the norm in most of rural Sub-Saharan Africa. Separate male and female purses exist and a division of responsibility for expenditure on household needs is also delineated. In Zambia, the decision to sell farm
produce was more often made by males only (32%) than by females only (12%), though joint
decisions were 47% (Due and Mudenda 1983). Male responsibility for expenditure on
household needs tends not to be in accordance with their earning power. Due and Mudenda
(1983) calculated that, on average women generated more income and contributed more (55%)
of household cash income. Men have a large portion of discretionary income, some of which
can be used for capital investment. Many studies find divergent expenditure patterns between
men and women in rural households, the striking difference being that women put a higher
priority on children's and household basic needs (Ahmad 1984, Jones 1986, Trenchard 1987).

A Sum Greater than Its Parts: Women's All-Encompassing Work Day

The content of women's working day arises from cultural norms which have evolved
gradually as well as from inescapable exigencies that occur sporadically. Women have to
conform and adapt to both and in so doing the sexual division of labour is continually reinforced
or reshaped. Despite the sexual division of labour's basis in social consensus and economic
necessity, it is usually interpreted as part of a natural order.

The main components of rural women's labour can be characterised as:
1) primary production including agriculture and raw material extraction;
2) value-added production including post-harvest operations and food processing;
3) domestic maintenance, i.e. cleaning and repair of the residence and its
   surrounds, preparation and distribution of consumption goods to family and
   household members;
4) childbearing, childcare and education; and
5) transport from agricultural fields and raw material sites to places of domestic
   consumption and for marketing.

Two features distinguish the African woman's working day from that of women in
modern, industrialised societies. First, the range of labour tasks, especially in primary
agriculture, is likely to incorporate a vertically-integrated production process. Women are
involved in facets of basic raw material production and extraction and the products' transport
and processing right up to the site of final consumption by their families. By contrast, women's
domestic labour in industrialized countries mainly consists of value-added work on purchased
goods, preparing them for final consumption within the home.

Second, and related to the first, rural African women do not work only 'inside the
home'. Women's work terrain extends beyond the confines of the household. The subsistence
economy is largely managed and controlled by women, and women have been active participants
in local market production and community resource utilization. A western model of state, market and household spheres distorts perception of this fact. In this paper, the term 'homestead' refers to the combination of household, village and field activities which are essentially women's domain. Resource allocative mechanisms in the homestead are influenced by the state and market, nonetheless, they retain autonomy from national state and market relations (Bryceson 1994a).

Having argued that women's labour day is not only arduous but growing in intensity, it is useful to consider the nature of physical exertion embodied in various components of the female working day.

* Women's agricultural work entails medium to heavy labour effort and medium to high levels of skills acquired in 'learning while doing'. Although these skills remain generally unrecorded and unrewarded, women are increasingly taking over previously male tasks, often considered 'too heavy for women'. Agricultural labour has seasonal peaks and is more often performed for subsistence rather than monetary gain.

* Value-added production is usually characterized by low to medium labour effort with lengthy, often drudgerous operations that must be performed year-round, primarily on the homestead.

* Homestead maintenance work is similar to value-added production with respect to drudgerous, low labour effort of a year-round nature. Heavier work is more likely to be performed by men.

* Childcare is different. Physical exertion tends to be low, but the work is highly differentiated and skilled, again unrecognised, and is carried out daily, round-the-clock, throughout the year.

* Women's transport activities represent year-round, unskilled, drudgerous work that cumulatively amounts to a high labour effort (Box 2). It entails head- and backloading of water, fuels, and field products as well as children. The absence of baby-carrying technology and women's high mobility on the homestead necessitates small children being bodily carried by their mothers (Bryceson and Howe 1993, Fielding and Pearson 1992, Sandhu and Sandler 1986).
Box 2: Carrying the Loads
The total distances and tonnages moved by rural African women is impressive. Loads of 25 kgs. are normal, up to 50 kgs and more for woodfuel are not uncommon. Women in subsistence-based East African rural households carried on average approximately 85 tonne-kms of goods per year compared with men's 11 tonne-kms. In a more cash-based Ghanaian community, figures were 47 tonne-kms per annum for women householders and 13 tonne-kms for men householders (Barwell, Howe and Zille 1987, McCall 1985).

Simply enumerating and describing the component activities of women's working day does not convey the logistical complexity of the work effort in terms of mobility, time and physical exertion. It should be borne in mind that at any one moment women are usually juggling three or four tasks at once (Obbo 1990). Generally, one of these tasks is childcare. The fertility rate is high in rural Africa, thus, women tend to be involved in minding one or more children throughout the day in addition to other work. Multi-tasking requires prioritization. Almost unconsciously, women are continuously deciding which of several concurrent activities requires the most attention.

Box 3: Multi-Tasking
When a woman is headloading a bucket of water, carrying her infant on her back and looking for small bits of firewood to give to the other child who is accompanying her, her priorities are likely to be: first, the safety of the baby on her back; second, minimizing water spillage; third, maximizing detection of firewood; and fourth, making certain that her young child follows her directions.

Efficient management of an open cooking fire demands a high degree of skill and multi-tasking, recognised by appropriate technology experts in the 'stove diamond' (Bussmann 1988).

Managing the time and speed of cooking involves controlling fire draught, preparing and selecting fuel piece sizes, feeding the fire, moving the pot, stirring, mixing the food itself, fuel saving, retaining embers, trying to minimise smoke as well as childcare and safety imperatives.

In addition to these complex management decisions, women's working days are filled with repetitious labour tasks. Perhaps the repetition makes complex multi-tasking possible since certain tasks can be carried out unthinkingly. However, as argued with respect to factory work, repetitive tasks, offering the worker little sense of accomplishment, can have a demoralizing effect on the psyche. Nonetheless, whatever work alienation women may feel, the fact that most of their work is necessary for their family's physical survival gives the work a compulsive nature. It is work with a sense of urgency but very little surprise.
**Women's Limited Access to Supplementary Labour**

Historically, women have tended to be controlled rather than the controllers of labour vis-a-vis men. Marriage contracts may have shifted superficially between bride service, bridewealth, and polygamy, but the fundamental lines of patriarchal control have not changed (Wright 1983). Men continue to command female labour as a supplement to male work activities, even though male access to other supplementary labour has diminished after the outlawing of slavery and chiefly labour tribute.

Unlike men, women have very little recourse to labour support from other people. In Kenyan smallholder agriculture, women provide 84% more of the family labour than do men, and hired labour accounts for only 17%. For Nigeria, the figure is 33% (Saito et al. 1992). Women could, however, traditionally rely on co-operative help amongst themselves as well as co-opting the labour of their children. But these traditional sources have drastically contracted. The lineage organization of rural society is weakening in some rural societies as African states’ development outreach is directed at nuclear households (Caplan 1984). Women tend now to have less time to help their female neighbours on a reciprocal basis due to intensification of their working day (Meagher and Mustapha 1994).

Furthermore, women’s command over children’s labour, both male and female, is also decreasing. Children are more likely to be attending school than was previously the case. Girls as well as boys are being educated now. Thus, daily tasks like water and firewood fetching with which girls assisted, can become more arduous for women. Kenyan children now supply only 5% of smallholder farm labour, and Nigerian children, only 11% (Saito et al. 1992).

**Labour and Natural Resource Scarcity experienced by Women in a Shrinking Homestead**

Demographic factors are conferring scarcity value on natural resources. Since independence, women’s traditional rights of ownership or access to ecological resources have eroded. Common property resources are being privatized by resource-rich entrepreneurs, and community-held lands are being arrogated by the state, for possible sale to private capital. In so doing, the essential tool kit for basic needs provisioning is being dismantled for vast numbers of rural households. This action is frequently justified by reference to a ‘tragedy of the commons’ scenario, i.e. the belief that commonly held land is subject to ecological mismanagement due to short-sighted, individualistic interests of its users. In Africa, community-held natural resources like land, water and woodfuel were traditionally not ‘open access’, but communal goods subject
to consensually agreed rights of access and usufruct. Within these controls, women enjoyed relatively unimpeded access to natural resources (Shepherd 1992, Warner 1991).

The encroachment of the market into both homestead labour and community-held land and natural resources, has given rise to what is best termed the 'shrinking homestead' (Bryceson 1995). In the short-term, the shrinking homestead intensifies women's labour and reduces their access to natural resources. However, the question of its effects in the long term must also be posed. If land and labour productivities increase in the sphere of commodity production, do women stand to gain? If women gained direct access to cash-earning and control of the income, the answer is undoubtedly "yes". However, there are many social and technological impediments blocking this. The prevailing sexual division of labour, responsibilities for household provisioning, and inherited attitudes are obstacles which cannot be removed by decree or circumvented without serious challenges to women's position in the rural community (Bryceson 1994b).

Technologically, women's severe lack of labour time due to the inordinate amount of time and energy that they expend in drudgery, but vital, household provisioning tasks, appears to make the introduction of labour-saving devices a clear priority. The following section therefore examines experiences with rural technology interventions in relation to rural women's needs.

2. Rural Technology Interventions and Initiatives

Over past decades, many developing countries have experienced domestic food supply constraints while being pressured to follow an agricultural export-led growth path. It is generally recognized that rural household, and especially women's, welfare is severely impaired by the low productivity of traditional agriculture in the face of commercial and demographic expansion. Donors and governments have assumed one way out of the impasse was the introduction of technological interventions at farm and village level to increase agricultural output and improve rural standards of living.

In this context, it is important to distinguish between two types of technology. The first consists of technologies introduced to improve the efficiency of production, i.e. to reduce inputs in terms of labour effort or time which is valued. In the long-run, this aimed at reducing the costs of production. The second type is directed at reducing drudgery as the primary objective. Secondary aims are an improvement in women's domestic status and freed time spent in more directly productive activities. It is essential to recognise the order of priorities to evaluate the technology's effectiveness as well as identify areas for improvement. There are usually mixed
motives in the introduction of labour-saving devices, while in practice it is not always possible to separate the various outcomes. The distinction between the two types of technology forms the basis of a chronology and a typology of labour-saving technology interventions.

The first phase represents technological interventions of the early years of planned rural development during the Green Revolution of the late 1960s to mid 1970s. Such interventions were directed at raising the productivity of the rural population in general. There were specific effects on women which were mostly unintended or unforeseen.

A second phase, developed from the mid-1970s through to the present, aimed directly at the welfare and domestic aspects of women's labour in the household and other sectors. The key issues centre on the effectiveness of these programmes in actually ameliorating drudgery, and on freeing women's time to pursue alternative activities.

The third, and most recent phase, emphasizes projects aimed at women's commodity market participation to promote women's autonomy. Underlying this approach is the conviction that rural women have a right to control what arises from their own productive efforts (VENA 1986, IWTC 1984, Pronk 1991). Regarding technology, this involves projects working directly with individuals and women's groups, usually with small-scale technologies for income-generating activities.

**First Phase: Farm Technologies for Productivity-Enhancement**

During the 1960s, productivity-enhancing technology was introduced to raise agricultural, notably cereals, output and streamline crop processing work. It was, and continues to be, technology destined primarily for areas of land scarcity and relatively abundant labour, i.e. areas where a rural wage labour market arising from extensive landlessness is already pronounced, where commodity and land markets are relatively advanced and where demographic and economic pressures militate for increasing agricultural output per unit of land.

The short-term impacts of productivity-enhancing technologies on women were usually non-existent, whereas the medium and long-term effects were frequently negative. In terms of direct beneficiaries, virtually all the technologies were aimed restrictively at the household level, and thus implicitly at the male head of household. The other resources necessary for access and utilisation were usually already under male control, including legal and cultural rights to land, water and other resources, the ability to organise hired labour, and the legal prerequisites for credit. Not surprisingly, the introduction of technologies in most cases exacerbated the situation (Harris and Watson 1987). Initial inequalities in resource access gave rise to inequalities in technology access, which in turn gave rise to further differential benefits from those resources.
Cumulative causation operated to the detriment of women, as well as exacerbating income differentiation amongst social groups.

Whitehead (1985) attributed the process to the 'contractual inferiority' of women relative to men. She argues that women's differential access is based not only on the more obvious components of land, inheritance, credit availability, and labour time, as noted in many studies, but also on differential social connections. Rural women do not have the same opportunities to make contact with development professionals, notably technologists, advisers, extension workers, animateurs, NGOs, bankers, etc.

Although this is true of all small farmers relative to the rich, it is all the more significant for Asian women farmers who live primarily within the private domain of the household rather than the more public arena of state and market relations (Ahmad 1984). Public space is generally synonymous with male space in much of rural Asia, and women's use of it is traditionally restricted either by non-entry, as in conservative Islamic societies, or by behavioural sanctions on the boundaries of 'female modesty' in South Asian public spaces. Public spaces include credit institutions and government offices where women may be ill at ease, as well as the business negotiations done in bars and hotels. Moreover, rural women tend to learn cultural and social skills for performance at household or farm level, and not those needed in offices and public meetings (Baud 1993).

As Green Revolution technology expanded, a clear pattern of change by gender-defined task allocation became evident (Whitehead 1981 and 1985). This restructuring was related to two distinct aspects: the sequence of the mechanisation of tasks and the economic domain of labour, i.e. whether the tasks were rewarded within the sphere of the household or the market. In the first aspect, the common pattern was for 'traditional' male tasks to be mechanised before traditional female tasks, especially when the male and female tasks were found in the same sphere, be it the household or market. In the Green Revolution, the male tasks of clearance, land preparation, and planting were mechanised by animal or tractor-drawn equipment, whilst female tasks of weeding and harvesting, and transport to and from fields were not (Agarwal 1985). Mechanised land preparation normally removed a bottleneck to expanding the land area farmed, but this meant considerably more female weeding and harvesting by hand, not unlike many situations pertaining in comparatively land-rich Africa. The second aspect of the restructuring was related to whether any of the tasks were carried out as wage labour. If this was the case, whether or not the labour was female, the tasks tended to be mechanised for cost-efficiency reasons. This was contingent on relative wage rates and equipment costs, but usually the performance and profit advantages of mechanisation were far superior to continued reliance on wage labour.
Box 4: Capitalists’ Labour-Savings versus Wage Earners’ Loss of Income
Traditionally, rice-milling in Java, Sri Lanka and Bangladesh involved hand pounding of rice, a drudgerous, labour-intensive female task paid at very low wage rates. Under the influence of the Green Revolution, these milling activities were almost totally replaced within a relatively short period of time by mechanised milling. In the process, men rather than women were employed, relegating women to unpaid domestic work (Timmer et al. 1975, Scott and Carr 1985). Thus, a drudgerous task was removed, but at great cost in female employment and income. Similar outcomes have been noted with palm oil mills in Nigeria (Carr 1984), and improved fish-smokers in Senegal (Lewenhack 1992).

Green Revolution technical innovations were mostly taken up by households with above average resource endowments. In South and Southeast Asia, these households already had moved away from reliance on the household labour of their womenfolk who had gone into seclusion. Such households were depending on hired landless women’s labour. These women lost their employment and means of livelihood as a result of the technical innovations. Thus, the detrimental impacts of ‘labour saving’ were most deeply felt by women from households which did not adopt the technology. In Bangladesh for instance, prior to the technical innovations, poorer households husked rice with a pestle and mortar using unpaid family labour and richer households hired the custom huskers. In this context, mechanisation of crop harvesting and post-harvest processing tasks displaced the poor hired women, whilst having a negligible effect on the women of richer households (Whitehead 1985, Agarwal 1985).

Do these Asian developments have implications for African rural women in more land-abundant, labour-scarce agricultural systems? With crude population growth rates of over 3% in several countries, e.g. 3.6% per annum in Kenya and 3.3% in Zimbabwe, rural pressures are mounting rapidly (World Bank 1994). Many highland localities with above-average rainfall and soil conditions have reached critically high rural population densities. Landlessness and rural labour markets have surfaced in these areas and are expected to intensify, especially since urban migrants’ employment prospects have declined in the economic crises. In an era of market liberalization, many African governments have toyed with ideas of giving de jure status to a rural land market that often already exists in an embryonic form. The recent outbreak of violence in densely populated Ruanda has dramatized Africa’s rural land pressure problem.

Throughout Sub-Saharan Africa, women already have limited ownership, inheritance and tenure rights to land compared with men, and usually restricted usufruct rights. Women’s traditional use rights to land, fuel, fodder, tree products, etc. have been eroding during colonial and post-colonial times (Pala Okeyo 1980, Rocheleau 1987, Fortmann and Bruce 1988). Once
rural private land and labour markets are in full operation, combined with increases in larger-scale farmers' technology investments, they could unleash similar tendencies to those of South Asia with detrimental labour and welfare implications for women.

**Second Phase: Domestic Technologies for Drudgery Reduction**

In the 1970s, it was asserted that generally much less effort had gone into technology for non-market production, precisely because "technology is to reduce the costs of production [and] domestic production has no value" (Palmer 1977). But after that many agencies and local institutions took drudgery-alleviation to be an end in itself (Staudt 1985, Curtis 1986).

Domestic technologies were aimed at women, and specifically at their unpaid domestic tasks with the intention of alleviating drudgery. Thus, they included crop and food processing technologies like grain mills, and water-lifting and distribution devices, especially hand pumps. It is notable that burdens of fuel collection were not considered until much later in the 1980s, and then normally through production of more fuel supplies and very rarely through improved technology for collection and transportation of firewood.

Three sets of criticisms have been directed against the anti-drudgery domestic technology programmes. Firstly, there are implementation problems regarding the choice of technologies and the mechanisms for their dissemination to women. Sometimes, there is a failure to get the technology accepted at all. Secondly, there is a question of the technology's ultimate welfare effect: do women benefit in the long term, or is their 'saved time' simply redirected into equally arduous domestic tasks, or, co-opted by their menfolk for more cash cropping and other male-controlled activities? A third related issue is: what do these technologies contribute to women's decision-making power in the community?

The first problem is already wide-ranging and deeply entrenched, though it often boils down to the question of who decides on the selection of the labour-saving devices and on whether women can pay for them. This has often been successfully tackled in projects using participatory research and the concept of 'indigenous technical knowledge'. There is evidence of the existence of huge pools of knowledge and skill (Brookshna et al. 1980, McCall 1994, Wachira 1987, Bradley 1991). However, to exploit this information resource requires a viable local forum for elicitation, assessment, exchange and overcoming a 'psychological dependency' of women and the poor, which is a barrier to their contribution (Oakley 1991, McCall 1988, Mosse 1993). In these cases, women's local knowledge could effectively improve both technology design and project implementation. Examples of women's indigenous knowledge of technologies or of production systems include those of cassava production in Zaire, tree-

Women may find the technologies highly desirable, but have no cash source or credit to purchase them. Labour-saving domestic tools usually have no cash-earning value, and because of the domestic nature of the technology, women's male relations may see no need for them. Even if they do, the clear division of household expenditure between men and women may preclude men from considering their purchase for womenfolk. Similarly, governments and donor agencies may give them a low priority for subsidised dissemination compared to more urgent and more productive needs, such as health services, clean water, and education. The new technology might indirectly earn cash, but with a considerable time lag and uncertainty before any monetary returns from the investment. Operationalising this critique requires debate over appropriate mechanisms for disseminating and financing such technologies.

The second set of problems emerged as the use of labour-saving devices has spread. There has been speculation about how women would, or could, use their new 'freed time', but there is little field evidence except in connection with water schemes. It is very difficult to isolate the effects of a particular labour-saving technology from general development effects, and to categorise clearly how labour is allocated. The impression is that the saved time is used in more cash cropping which falls under male control, or in market activities to provide income for the household. Cash-earning for the woman herself or more 'leisure time' has been apparent less often. In fact, women's cash-earning activities may not be very 'productive' in themselves, e.g. additional beer brewing and distilling are common outcomes which can result in an overall decreased work input on the part of men who, as women beer brewers' clientele, become heavily involved in drinking as a pastime (Bryceson and Kirimba 1980, Hannan-Andersson 1982).

The question of how women use any 'freed time' raises the important methodological issue of how domestic labour time can be valued. There is much literature on the need to measure domestic labour and the necessity of including 'women's undervalued labour' in labour statistics and planning. However, there is as yet little consensus on how this time is valued by women themselves or by their community, or how it should be valued by planners (Beneria 1982, Lewenhack 1992, White 1984). There are various economic methods of valuing time such as using minimum wage rates or shadow values based on labour opportunities, but it is important also to see how women actually spend their time. Women themselves may place a higher value on the arduousness of the work than on the time expended as exemplified in the case of grinding mills, where women usually face a three way trade-off between time expended, monetary cost and work effort (Box 5).
Box 5: Grinding Choices
Women can grind the grain at home with traditional technology, such as a pestle and mortar or a grinding stone. This is both time-consuming and very hard work (ILO 1984). Alternatively, they can travel to the nearest functioning grain-mill. Powered milling is much faster and requires no labour except walking to and from the mill. There is then a trade-off against the cost, and there are quality and taste differences. The normal finding is that women are willing to pay for this service, and they are willing also to walk long distances to reach a mill, even when this means spending more time than if they ground at home. In northern Zambia, women travelled by bus at a cost equivalent to the price of a bag of maize meal, rather than grind millet or cassava flour at home (Geisler et al. 1985). According to a Tanzanian study, women were willing to walk 10 km or more to a mill and pay for the service in order to avoid arduous grinding at home (McCall 1984).

On the other hand, there is little evidence demonstrating the willingness to pay for improved rural water provisions, or for more readily accessible or sustainable woodfuels. There should be implications for appropriate technology in the differences behind grain-milling and water. Is it due to the preferred taste for milled grain, which ironically is considered to be inferior by nutritionists? Why is there not the same preference for clean water? Is it because collecting water and fuel and walking to a grain mill are exclusively female activities with social companionship benefits? Or is it because governments have taken the initiative in providing water as an essential service, and people now feel it is the government's responsibility? Is it because grinding and pounding, like oil-pressing, are exceptionally arduous and drudgerous? The palm oil production process in Cote d'Ivoire usually involves both men and women. A palm oil project successfully disseminated an efficient press to women's groups. Women adopted the technology primarily because it reduced their work load and secondarily because of product quality and price (Boni 1993).

The appropriate scale of the introduced technologies also needs consideration. Very few drudgery-reducing technology projects are targeted specifically at the basic household unit. Usually the designers and planners opt for economies of scale along with reducing the drudgery, e.g. village grain mills or water pumps, or community woodlots. Explicitly, this is to reduce the investment costs and sometimes to create opportunities for more commercial production. Implicitly, it is often connected with ideologies of communal production or efforts to extend political control over the rural population.

The International Technology Development Group (ITDG), the International Labour Office (ILO) and others have argued that some of these labour activities would be better served by small-scale, simpler, household-oriented technologies (Carr 1984, ILO 1984, Scott and Carr
1985). For instance, hand-operated maize shellers and mills in Tanzania and Cameroun were widely adopted despite a minimum of promotion (McCall 1984). Small-scale technologies may offer the trade-off between reductions in drudgery, on one hand, versus a lower initial cost, easier operations and cheaper maintenance by the users themselves. They should have the further effect of strengthening women's self-confidence and capability with technical machinery, because the devices would be domestically controlled and not part of a bigger commercial enterprise. In the Cote d'Ivoire oil press case, technical control was the third-ranked reason women gave for the new technology's acceptability.

The final criticism of anti-drudgery technologies is that there is a tendency to treat rural women as 'welfare objects' rather than decision-making actors. In other words, there is a danger that women's own capabilities, i.e. their skills, technical know-how, entrepreneurship, organisation, and politics, will be downgraded and excluded in the compassionate rush to ameliorate some of the worst drudgery conditions under which women work (Stamp 1990, Pronk 1990). Likewise, there is concern regarding the distribution of benefits from 'appropriate' technologies, if they have to be targeted to 'welfare recepients'. These issues raise complicated issues of technology and other policies with respect to African women and power relationships in the community.

Where drudgery-alleviating technologies have been sensitively introduced, they can have positive welfare and health effects on women, unlike the first type of technologies. The key factor is the local participation of rural users and consumers in technology projects rather than just skilled cadres or the village political leadership. Participation has to be at all stages of the technology introduction, from needs assessment and resource availability, through design and testing, to distribution and maintenance and evaluations (e.g. Boni 1993, Carr 1993, Muntemba 1985)

**Third Phase: Market-oriented Technology for the Advancement of Female Autonomy**

The third type of technology intervention has been aimed specifically at women's income-earning capabilities. Although some of the devices may be the same as in the first or even second 'phase', the intention of the programmes promoting them is different, that is, to achieve a *controllable income* for women from their own *controllable labour inputs*. Thus they may implicitly incorporate socio-cultural components to improve women's marketable skills, increase their confidence, and bring them more into the 'public space', with the added intention of promoting solidarity and raising consciousness. It is presumed that the creation of economic opportunities will give rise to more female autonomy in terms of women controlling
their incomes and expenditures themselves which will enhance not only their economic, but also their political, socio-cultural and physical control over their lives (VENA 1986, Pronk 1991, Wallace and March 1991). Whether or not the income so earned is spent as before, i.e. on children, basic foods, domestic subsistence, is not significant. Clearly defining the objectives of these projects is important. A technology for women which increases production and material well-being is not necessarily a success under such autonomy objectives, unless the production is under women's direction.

However, most research evidence to date shows that the introduction of rural technology generally runs counter to the objectives of female autonomy. According to Dhamija (1984): "the only rule appears to be that when a new technology is introduced, which means upgraded skills and higher returns, it is men who take over". As the technology becomes more productive and finds a market, it is integrated in the cash economy for inputs, outputs and operations, and there is the stronger likelihood that men will acquire its ownership and control.

'Taking-over' is not limited to new technologies, but occurs with any traditional women's activities absorbed into the market economy, and spans a wide range of activities, i.e. collecting medicines and herbs, making crafts and pottery, and the most important of women's income-earners in Africa, beer-brewing. Nkhoma-Wamunza (1992) found that women's brewing co-operatives in southwest Tanzania, whilst increasing their scale and profits, were continually under pressure from sabotage or 'hijacking' by local men and state officials. Similar examples of male expropriation of female economic activities are found, even in women's co-operative projects, e.g. in Tanzania and Zambia (Mbilinyi et al. 1987, Geisler et al. 1985)

Wherever there is pre-existing male control over some step in the production chain, men can manoeuvre to manipulate the whole chain, including those steps performed by women (Box 6). An ILO (1984) review of technology projects notes: "male handling of any of the processing operations and/or their free supply of the raw materials for the processing activity was a contributory factor, in some degree, to the rural woman's lack of control over the income from her processing activity". 
Box 6: Internal Mechanics of Male and Female Partnerships
In Sierra Leone, men and women prepared palm oil together and men supplied the fruits; whereas with rice processing, women did all the operations, but men supplied some of the rice. Despite the variation in the pattern of interaction for the two commodities, in both cases, very few women controlled the incomes for their work. However a Ghanaian fish trade case study offers a revealing contrast. Women controlled the whole fish processing sequence, paying their husbands for fish, and keeping control over the income (ILO 1984, Muntemba 1985, Baud 1993).

Male seizure of control over female income is often given backing by the state, a carry-over of the widespread, deeply rooted rural patriarchy which was intensified by colonial ideologies and policies. A historical example comes from the disappearance of palm wine making on the Kenyan coast. At the beginning of the century, palm wine production was taken up by women only to be squeezed out by colonial officialdom (Waaijenberg 1993). Credit provisioning is a well-documented and more recent example of institutional perversity towards women (Carr 1993). In Kenya, 14% of male smallholders receive credit, which is a rather small proportion, but the percentage dips down to 3% for female farmers (Saito et al. 1992).

Agricultural and technical extension services also contribute to the bias. Women are not recognized as being decision-makers worthy of extension advice. In Zambia, only 5% of 'contact farmers' are women. Women are hampered by lower levels of literacy and often by the extension language, e.g. English or Swahili, instead of local vernaculars. Their lower average levels of education penalize them. Culturally, they are expected to avoid or defer to men in public causing additional barriers between women farmers and male extension officers (Chilivumbo and Kanyangwa 1985, Staudt 1985). In Kenya, Saito et al. (1992) found that the extension services met rural women, but not female heads of households.

Male monopolization of rural technology and income control can be traced to the conflict of dual roles women face as domestic provisioners and childcarers, and as income earners in commodity markets. Most economically active rural women in Africa have children of an age needing care, on top of their domestic activities of cooking and household maintenance. The resulting role conflict is ideological, but, more importantly, it is physical. Logistically, it is difficult for women to fulfill their role as household provisioner and mother while earning an income using rural technology. Indeed, it can be argued that emphasis on income-earning projects can be negative for women, in that it might deny or trivialize their essential functions in food production (Stamp 1990).
The logistical problems relate to the question of the location and the timing of technology usage. Location in the home is advantageous but this almost invariably dictates that the process must be small-scale. Larger-scale production in a central location creates problems of childcare and home management. An ILO study rarely found any formal childcare arrangements made by technology projects. When women worked together they often made informal arrangements amongst themselves (ILO 1984).

Timing problems are even more intractable. Income-generating production processes are bound to reduce the time for domestic and subsistence requirements, including cooking, water and fuel collection, home garden work, etc. In the face of virtually non-existent basic service markets in most of rural Africa, women cannot forego these subsistence activities without jeopardizing their households' basic survival.

Additionally, there are many cultural restrictions on women's 'motor patterns', body positions, or clothing which are considered decent and proper by men and women alike (ILO 1984, Sandhu and Sandler 1986). For example, sitting on pedal-driven threshers, shellers or dynamos, not to speak of women's 'public display' on bicycles, is not sanctioned in many communities. Given African women's extremely active participation in hoe agricultural work and the consequent body movements required, it is likely that they face fewer cultural restrictions than in other rural cultures where women's labour input is less significant. In any case, these kinds of restrictions change over time. Thus they should not be considered 'brickwall obstacles', as has been the case with 'appropriate' stove projects which are overly concerned with women's socially correct cooking positions. Rather, when practicality or equity calls for it, technology projects should incorporate public education components which challenge cultural attitudes barring women's access to already available or new technology (Bryceson and Howe 1993).

The status of women's physical strength is also often used as justification against their more equal involvement in economic activities. Even proponents of appropriate technology for women slip into this reasoning, such as arguments that donkeys are more appropriate than oxen for women to work with. The reality is quite different, as clearly shown by African women's participation in heavy labour like road-building (Lexow and Skjonsberg 1989) or women's headloading activities previously cited in this article.

Given so many contributory factors, the realization of the goal of female autonomy in income-earning projects can only be achieved through social, educational, institutional and political changes. The technology itself is not neutral either before or after its introduction into a community. Similarly, the implementing agency and its projects cannot be gender-neutral. Where a technology project is inserted directly in the local environment, the consequent increase
of male control and exploitation should be anticipated, and the agency must be prepared to pursue positive gender discrimination.

In practice, this requires supporting women's access to resources and their capabilities to control an income-enhancing technology. This could entail providing special training, market access or credit, and complementary domestic technologies or childcare facilities (Carr 1993, ILO 1984). It might necessitate entering deeper, structural interventions, including adjustments in local political power, economic decision-making, legal changes in inheritance and land rights, and addressing the whole gamut of patriarchal attitudes, including restrictions over fertility control.

These demanding support conditions, whose scale and depth extend beyond technology introduction and enter the heart of rural societies and women's place in them, have meant that far-reaching technology interventions are generally financially and logistically prohibitive. In any case, such scale of interventions could degenerate into women's dependence on outside activists or amateurs. Experience with women's credit programmes in Zambia point to some of the contradictions which can arise with over-determination of donor-promoted autonomy (Chilivumbo and Kanyangwa 1985).

Despite the ambitious objectives and philosophy of market-oriented technologies for female autonomy, the reality is that technology interventions of this type have been rare in Africa. The few that exist have been small and isolated, often implemented on a small-scale by committed NGOs, with very little communication between projects of this sort (Carr 1984). Each one impacts on only a few women, covering only a narrow range of activities, usually food processing or crafts.

3. Technological Breakthroughs versus Social Barriers

Both the debate on rural technology interventions in agrarian societies, and the actual technology being introduced, have increasingly taken on board women's needs. There has been progress from gender-blind productivity-enhancing technology, to gender-aware domestic technology, and finally, to positive discrimination in favour of women embedded in the philosophy of market-oriented technologies.

While rural technology programmes have displayed an increasing sensitivity to social barriers involved in technology adoption, there has nonetheless been a failure to grasp the implications of the simple paradox embodied in applying appropriate technology to solve women's labour burdens. The paradox is that women's need for rural technology is
fundamentally due to the intensification of women's working day relative to that of men, yet notwithstanding, men's technology uptake supersedes women's uptake in rural Africa (Bryceson and Howe 1993, ILO 1984, Carr 1993).

It is necessary to understand the mechanisms by which this process continually reproduces itself. It is not enough to cite the subliminal effect of male domination in African rural societies and in African governments. External agency efforts are also at fault, as has been argued by Rogers (1980), Stamp (1990) and Mbilinyi (1984), and admitted by the agencies themselves (Pronk 1991).

The 'autonomist' argument behind market-oriented rural technology perhaps best represents the current consensus on how to promote women's technology usage. Essentially, it advocates that entrenched patriarchal domination can be combated directly by women's assertion of decision-making power in the household through involvement in technology-assisted market activities. It is believed that cash will raise women's status in the household and thus give women more leverage in decision-making.

There is no firm evidence that cash control confers more power on women in the household (McCormack et al. 1986, Jones 1986). Men have held various forms of control over women in rural Africa. Most are sanctioned culturally by the community, often strengthened by the introduction of market relations. Therefore, one must question the 'autonomist' approach which concentrates on the market. Is this valid in societies where the market, as an allocative mechanism, is relatively undeveloped? In any case, men's headstart in labour and commodity market participation gives them a pronounced advantage over women. Technology with market potential will be attractive to men as well as to women. Because men do not experience the same degree of labour and capital scarcity as women, they will always be in a stronger position to respond to market-oriented development strategies.

Furthermore, female target groups tend to be women of childbearing age whose labour time availability is already severely constrained. Their source of subsidiary labour, i.e. domestic tasks performed by children, is increasingly foregone under universal primary schooling policies. When rural technology initiatives fail to sufficiently distinguish 'need' from market purchasing power, it is inevitable that male purchasing power outcompetes women's felt need for rural technology. A strategy to help the economically weak compete against the strong is unlikely to succeed if both the game and the turf where the game is played is that of the strong.

While the fundamental cause of women's predicament in the market is male domination, the immediate constraint is lack of time, not lack of cash. In Sub-Saharan Africa, rural women's
workplace is the homestead, so that is where rural technology initiatives will score the most immediate success. Domestic labour-saving technology projects have already been attempted, but their geographical coverage has been very limited. More significantly, they have offered a very partial coverage of the range of female work tasks and ways of addressing multi-tasking in the female working day.

Rural women require a wider array of technology to address real labour and resource scarcities. This necessitates a great deal more research and development by multi-disciplinary teams holding a comprehensive understanding of the logistics of women's work day. Labour-saving devices in households and in farming must be grounded in an awareness gained through detailed observation and analysis of women's work on the homestead long enough to allow for seasonality. A sufficient number of representative case studies throughout Sub-Saharan Africa is needed to explore local variations in physical, climatic, social and human resources and in their history. Variability should be celebrated. Appropriate technology places a high premium on adaptability to local conditions. Interventions should not be directed at continental solutions.

If and when technologies are developed, their introduction and extension also require novel approaches. Focusing on female-headed and female-managed rural households as the most responsive group has received too little attention, given their obvious potential. Carr (1993) suggests not only adding technology training to farm extension aimed at women, but also a typically 'feminine' nutrition/health component to extension aimed at men. Some in Africa have argued for disseminating new technologies and their associated attitudes via 'role models', e.g. the daughters of rural mothers who have successfully moved to the city and modern careers in say, banking or teaching. It is hypothesized that these urban sophisticates have a disproportionate influence on their female relatives during their periodic returns home.

Bryceson (1994a) stresses the advantages of spreading innovations via rural unmarried teenage girls who, without children and husbands to provision, have more time to participate in training. The multiplier effects of their involvement could be great since they eventually become mothers and household provisioners themselves. If training programmes were combined with income-generating projects to enable teenage girls to accumulate capital, they are likely to form different economic life expectations compared to the working lives of their mothers. Ultimately this could result in more balanced labour/capital ratios between the sexes, giving women the possibility of competing more equally with men in the marketplace. But this is a long-term strategy with a time horizon of decades. This approach would have to rest on a strong technology education component, which questioned the existing gender division of labour and explored social measures to rationalize male/female labour imbalances.
In summary, labour and resource scarcities that women face derive from material and social conditions. They are both real and artificial. They are real in that the existing workload consumes so much of women's time and can be alleviated by labour-saving devices, and artificial in that they are caused by male control of labour and monopolization of resources which can be ameliorated by social, economic and political measures. The solution lies in sensitively combined technological and social interventions from the perspective of women's identity of themselves and the realities of their workday.

4. Conclusion: In Search of Labour Convenience with Minimal Capital Investment

Historically, the development of technology has always defied people's expectations about limitations to human capability. In rural Sub-Saharan Africa, technological development is required to reduce labour, conserve natural resources and be available at limited financial cost to its female users. Such 'miracle technology' is a tall order, but worth the effort in terms of enhanced material welfare for African rural women and those they care for.

A number of factors have combined to intensify the female working day in rural Sub-Saharan Africa. As a result, women face conditions of severe labour and capital scarcity relative to men in their own society. Any rural technology initiatives must be pursued with this in mind. Appropriate technology design suited to women's needs, and viable programmes for its successful introduction, remain a huge technological and social challenge.

At present the complexities of African women's working day are still largely uncharted territory. Until women are consulted, until there is understanding - not just more statistics - on their labour time, physical effort and multi-tasking, and until technologists and social scientists design a wide range of no-to-low cost, labour-saving devices and techniques, the elimination of African rural women's drudgery will remain a dream. Only after these steps are taken can domestic technology be transformed from the realm of miracles to the mundane of everyday life.
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