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The role of gender and resource access in women's technology interventions in Mali

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THE ROLE OF GENDER AND RESOURCE ACCESS IN WOMEN'S TECHNOLOGY INTERVENTIONS IN MALI

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ABSTRACT

THE ROLE OF GENDER AND RESOURCE ACCESS IN WOMEN'S TECHNOLOGY INTERVENTIONS IN MALI

by Paul Laris

Research has shown that women have access to fewer natural and economic resources than men in rural West African villages. Evidence suggests that this has restricted women's ability to use labor-saving technologies and has resulted in the failure of many women's projects.

This thesis explored the relationships between women's use of diesel-powered mills, time allocation patterns, and income generation strategies in four Maninka villages. The study examined these factors to understand how gender influenced women's ability to access resources including land, water, forest products, agricultural equipment, and credit.

This research confirmed that gender is a key factor in determining access to resources. The study found that women's limited access to both technology and credit, rather than male imposed limits on access to land, was the main restriction on their productive potential. The long-term effect of lower rainfall in the region has also negatively impacted women's ability to make use of traditionally available resources.

The study found that Maninka women used diesel mills primarily to process their own agricultural products rather than grains that are farmed and controlled by men. Women reallocated the time savings due to using the mills to fuelwood collection during the dry season. This effectively provided them additional time during the agricultural season. This researcher concluded that careful analysis of the roles and responsibilities of both men and women is needed to understand whether women will benefit from a new technology.

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CHAPTER 1

INTRODUCTION

West African women face the dual burden of productive and reproductive work. Development theory suggests that labor saving technologies can be introduced to women that will allow them to reduce the time they spend on domestic chores while increasing the time they allocate to productive endeavors.

A key assumption in this theory is that women can reallocate the time they save by using a technology to food production or income generation. Women's limited access to essential resources, however, may restrict their ability to reapply time savings to these productive activities. Furthermore, if women are not able to access the resources necessary to permit them to increase their income, they will not be able to earn the additional money necessary to pay to use the technology.

This research tested the assumption that women can reallocate the time they saved by using diesel powered mills to productive activities. It examined time reallocation as influenced by women's ability to access important resources such as land, water, forest products, agricultural equipment, credit, and markets.

Historically two factors have influenced women's access to and control over resources: male bias in the development process and the gender roles of a particular society.

Women's Work Burden

In most African societies women in rural areas fulfill multiple roles. They are farmers of food and cash crops, they spend time on income generating activities, they perform the bulk of the domestic chores, they nurture the children, and care for the elderly. A substantial part of a woman's day throughout much of rural West Africa is spent performing time consuming, repetitive tasks such as pulling water, collecting fuelwood, and processing grains and oils. Women rely on children, particularly daughters, to help with this work burden.

Women also have financial responsibilities separate from men. Many African households do not pool economic and food resources. Women must earn their own income and grow their own crops. Research shows that African women spend a greater portion of their income than men on child nutrition and clothing, on education, and on family health (Kabeer 1994). Despite their contributions, women in many African societies do not have equal access to land, credit, technology, employment, or political power when compared to men (Stamp 1990).

Gender Bias in Development

Throughout the past forty years development has been perceived as a panacea for the poverty afflicting people in developing countries. Conventional wisdom held that development would create a modern infrastructure capable of improving the well-being of everyone (Sachs 1992). The dominant development model assumed both men

and women would benefit from development:

> Women benefit from (development) even more than men...Woman gains freedom from drudgery, is emancipated from the seclusion of the household, and gains at last the chance to be a full human being, exercising her mind and her talents in the same way as men (Lewis 1955, 422).

Research shows that women in rural West Africa are responsible for performing both an economic and a reproductive role in society. In contrast, the modern development paradigm is based on the assumption that women have a single role in society--that of mother and housekeeper. This assumption, grounded in Western beliefs, created a bias that unintentionally favored the economic development of men over women. This bias is prevalent throughout the history of development work in Africa.

The ramification of this bias has been decades of development practices that have failed to meet the needs of women or to improve their well-being. Nowhere is this more clear than for women in Africa. In many parts of Africa, women are worse off now then they were at the onset of the development era forty years ago. Women's work burden in many countries has increased, and their health, nutritional, and educational status have declined (Sen and Grown 1987, World Resources 1994).[1]

The development model is founded on the western concept that makes two assumptions: (1) that men and women pool economic and other resources, and (2) that

[1]Sachs and Esteva (1992) consider the birth of the development era to be Truman's Inaugural Address in 1949 when he speaks of improving conditions in undeveloped areas.

men are the primary providers for the family. In the African context, this assumption has been proven false. Men and women may maintain completely separate cash boxes and distinct labor and economic responsibilities within the household (Whitehead 1992).

Through the process of development, the men in rural areas have received modern tools and seed varieties, education, and access to credit. These are all necessary elements for improving one's economic well-being. For example, among the Maninka in Mali only men have obtained loans to purchase plows and carts. Men and women work on separate fields and agricultural tools are not shared. A woman must pay her husband for the use of his plow in her fields.

Furthermore, land use changes and deforestation--consequences of population growth and increased farming--have made it more difficult and time consuming for women to collect fuelwood and other forest products of economic and social importance (Shiva 1988).

Efforts to Introduce Milling Technology

Throughout much of rural West Africa women are responsible for conducting 90 to 100% of the food processing (Stamp 1989, 47). These tasks are time and energy demanding, often performed using simple yet inefficient technology. For example, dehulling and grinding grains into flour is commonly done in the traditional manner by pounding the grain in a wooden mortar with a pestle. Peanuts and other oil nuts are

often ground by hand on a flat stone with a hard cylindrical piece of hardwood (See Appendix A for examples of hand tools).

In the Manden region of Mali, where this research took place, women surveyed cited diesel powered milling machines as the second most important technology for reducing their labor requirement and increasing their potential to earn income. Plows were women's first choice (Leury 1989, Diallo 1994).

Grain mills have been one of the most frequently introduced time and labor saving technologies for women in West Africa. Over five thousand engine driven mills have been distributed in Senegal alone, many in rural areas. Grain mills are a favored women's technological intervention implemented by donor organizations in the region (Freudenberger 1994).

Despite widespread efforts to disseminate grain milling technology, most women living in rural areas are still grinding grain by hand. Many grain mills are no longer operational, others are only providing service to a small portion of the population, while others still are operating at an economically unsustainable level--meaning that when a breakdown occurs there will not be sufficient savings in the coffer to make repairs (Freudenberger 1994, UNIFEM 1988, Carr 1985).

Studies have shown that the majority of mill projects fail in West Africa because women do not have sufficient income to pay user fees. In this context, researchers have concluded that women make a rational decision not to use mills based on the principle of "willingness to pay" (Freudenberger 1994). Other studies have

shown that women do not reallocate their time to income generation because their access to crucial natural and economic resources is limited. Furthermore, research has determined that gender influences access to resources in West Africa.

Goal of the Research

The primary goal of this thesis was to examine the factors that influenced a West African woman's choice to use or not to use milling technology. In particular, this paper explored a woman's economic ability to pay milling fees in relation to her access to environmental and economic resources.

Women in four rural Malian villages with diesel powered mills were observed over a three month period. Women were questioned regarding their workload, responsibilities, time allocation patterns, income generating activities, access to resources, and control over resources.

Employing the Harvard Analytical Framework, these data were analyzed to determine women's and men's roles among the Maninka, how gender affects women's access to key resources pertaining to income generation, how women earned money to access the mill, the factors that influenced a woman's decision to use the mill, how the mill allowed women to alter their time allocation, and the empowering effect the technology had on the women's community.

CHAPTER 2

REVIEW OF THE LITERATURE

The following review of the literature examines the factors influencing the current development strategy for implementing labor-saving technology projects for women. These include: the historical precedents for the Women in Development (WID) movement, gender roles and household economics in the African context, and the consequences of gender bias in the development model. These factors led to various practical applications in the field in Africa. This review concludes with a summary of the efforts to introduce and evaluate milling technology interventions in rural Africa and the presentation of a methodological framework for examining development projects.

Women in Development: A Brief History

Ester Boserup is generally credited with publishing the pioneer work on Women in Development (WID). Her analysis in a Woman's Role in Economic Development published in 1970 laid the ground work for subsequent analysis of WID (Kabeer 1994). Boserup's book was ground breaking for three reasons relevant to this discussion of African women. First, she documented women's productive role in agriculture. Africa in particular was referred to by Boserup as, "the region of female

farming par excellence" (Boserup 1970, 16). Boserup found that in nearly all of the studies conducted in sub-Saharan Africa, women performed over 50% of the agricultural labor and in some cases up to 70-80% of the labor. Second, she noted that men generally inherited the new agricultural technologies. And third, she found that men play a more active role in cash crop production, leaving food crop farming in the hands of women (Boserup 1970).

Boserup's book painted a picture of African agriculture as a system exhibiting a dualism based on gender where there existed a distinct division of labor by sex. Men did the heavy clearing of fields and women did much of the sowing, weeding and harvesting, and nearly all of the processing of food crops. Men gained access to new technology and intensive farming methods, which they then applied toward planting cash crops.

In this model there was a cash crop sector where men grew highly productive income generating export crops and a food crop sector where women used traditional methods to produce food for their families for consumption (Whitehead 1990, 1992). The consequences, Boserup found, were that in villages where men were using intensive techniques women did not necessarily benefit and in fact they may have suffered an increase in workload.

Boserup's book included a before and after comparison study of a village in the Central African Republic where modern technologies had been introduced, "The figures show that women were doing more work in the modernized village than in the

the old-fashioned one, while the men were doing less" (Boserup 1970, 23).

Boserup's work, as well as that of others, was influential in fostering efforts to document the role of women in different societies throughout the world. Anthropologists and rural sociologists went to the field to build on Boserup's work and test her findings. Time budget studies developed as a particularly useful tool for recording the relative amounts of time women spent on different activities. These studies use various methods to record each activity performed by a subject during the course of a work day (Gross 1984). By analyzing data from time budget studies researchers were able to categorize the multiple roles of African women. They divided women's tasks into productive and reproductive work.

Productive work involves generating income through agriculture or other activities. Reproductive work is concerned with meeting domestic and child care needs of the family (Kabeer 1994). Reproductive work includes tasks such as, nursing and caring for children, processing and cooking food, cleaning and washing laundry, and fetching water and fuel.

Aggregate time study data for Africa revealed that women perform 50% of the planting, 70% of the weeding, 60% of the harvesting, 80% of the transporting, and 80% of the storing of food crops. Women are also responsible for the majority of the domestic food related tasks including, 90% of the food processing, 90% of the carrying of water and fuel, and 95% of the feeding of the family (World Resources 1994, 46).

This new time study data on farming in Africa supported the findings first put forth by Boserup. Aggregate data provided evidence of women's productive role in agriculture in Africa and of their heavy load of domestic tasks. But the data collected from case studies also revealed that gender roles in agriculture systems varied extensively between different regions and ethnic groups. The time women spent on various agriculture and domestic chores also showed tremendous variation (Carr and Sandhu 1987).

One reason women spend different amounts of time on activities is due to environmental factors. For example, in areas where wood for fuel is scarce, women may spend up to eight hours per day collecting wood. In forested areas women spend only a few hours collecting wood (World Resources 1994). A similar situation holds true for water. The Sahelian droughts in the 1970s and 1980s were particularly hard on women. As fuelwood and water grew scarce, women's work load increased.

Another environmental change negatively impacting women's workload was the continual clearing of new land for agricultural use or logging. This resulted in an increase in the time women spent on fuelwood collection because it required them to travel further into the bush to find adequate fuelwood. Women are particularly vulnerable to environmental degradation and change because women rely on their environment for fuelwood and other forest products for consumption or sale and they have little control over these resources.

Women have been portrayed as environmental resource managers who

understand the importance of sustainable forest use (Rosi 1994, Dankelman 1988). However, men often control the rights to land and can convert it to crop farming or the sell trees on it to logging companies. Shiva (1988) explained how this led women to organize in defense of their environment. The Chipko movement was the most well-known of these efforts by women to maintain some control over their environment. The Chipko women in India became famous for hugging their trees and refusing to allow loggers to cut them down on the grounds that doing so would cause environmental destruction (Shiva 1988).

Shiva argued that women's increased work burden and decreased relative wealth, nutritional, and health status was the result of developments' negative effects on the environment,

> The displacement of women from productive activity by the expansion of development was rooted largely in the manner in which development projects appropriated or destroyed the natural resource base for the production of sustenance and survival. It destroyed women's productivity both by removing land, water, and forests from their management and control, as well as through the ecological destruction of soil, water and vegetation systems so that nature's productivity and renewability were impaired (Shiva 1988, 3).

Shiva's arguments were extremely relevant to India and other areas where population density is high and land is scarce, such as the Kenyan Highlands. Her argument demonstrates a fundamental issue in the development process, that of conflicting land rights between traditional systems and modern ones. Women's limited access to and control over natural resources is one consequence of their lack of land rights.

The environment, however, was not the only reason for the variation in women's time study data. Different societies in the same ecological zones have distinct divisions of labor by gender. These gender roles are part of a complex system of relationships that involve a separation of economic and social responsibilities.

Gender Roles and Household Economics

> Boserup's findings were very significant in bringing the enormous role African women play in rural production to the forefront of public thinking on development. However, in their popular forms they have often been oversimplified, for example by suggesting that African women produce most of the continent's food, especially that produced for subsistence. It is more accurate to point out that women and men are involved in a complex gender division of labour in agriculture (Whitehead 1992, 47).

A thorough examination of gender roles in African society begins with the African household and its links to the division of labor in the agricultural production system of a particular society. African households bear little resemblance to the Western model. Although households in Africa are heterogeneous, in general African women have traditionally worked independently and they continue to do so. Men and women do not pool income nor the proceeds of the harvest into a common marital fund as in other parts of the world. In much of Africa, women are not expected to rely economically on their husbands or families (Whitehead 1992, 1985).

Women and men are involved in a system of complex gender divisions of labor in agriculture. In some areas men grow primarily cash crops and in others they are the principal food crop producers. Women's food crops are not only produced for

consumption, they are often sold as cash crops as well. In some areas women have even led the development of cash crops, particularly where men migrate to look for work (Whitehead 1992).

This gender based division of labor is part of a system of rights and obligations within the family. It implies an interdependence between family members in both productive and reproductive spheres, creating the need to exchange goods and services within the family. There is no a priori reason to assume that the exchange is harmonious or equal; researchers have noticed a striking separation of the domestic budgets of men and women (Whitehead 1992). This contrasts sharply with the standard western conception of the household where husband and wife pool their resources.

It is extremely difficult to construct a viable model to encompass the diversity of the West African farming systems although some attempts have been made to categorize different gender-labor systems. In much of Sahelian West Africa, families are organized around the extended family and the common head of the extended household. The male head of the extended family does not necessarily control all of the labor nor the resources of the family (von Braun 1989). Men often work two sets of fields, the family fields, which will provide the food and cash for the needs of the extended family, and their personal fields.

According to Whitehead (1992), women's productive role in the contemporary African family farm is one of dual work situations. They have access to the land and

other resources for independent farming--for which they have control of the proceeds and they must also work as unremunerated family labor on the fields of male household members.

Whitehead's description is also a generalization. In some cultures women may be required only to work part time on the family fields, in the morning or on certain days of the week for example, leaving time for them to farm their own fields (van Braun 1989). In other cases women may also work on their husband's fields. Finally, there are cases where women have no responsibility to work on men's fields at all except during the harvest when men and women work together; even then they are compensated for their labor. A woman's labor may be compensated in cash or kind depending on the custom. Furthermore, men may also help women in their individual fields (von Braun 1989).

According to Kabeer (1994), men and women generally tend to cooperate to produce the families' subsistence needs and to use their residual time to pursue their own-account activities. "The picture that emerges from the literature is of varying degrees of autonomy for women, based on gender specific assignment of resources and responsibilities" (Kabeer 1994, 117).

Furthermore, these patterns of resource and responsibility sharing are not static nor are they a constant across ethnic groups. There may even be significant variation in the specific organization of families within a single village as was found to be the case among the Bambara in Mali (Creevey 1978).

In sub-Saharan Africa, separate accounting units are more likely to be a feature of West African households where women are most likely to be provided with independent farming land. Furthermore, the more pronounced the separation of accounting units, the sharper the division of labor.

An example from this researcher's field experience in Mali illustrates the diversity of gender roles and responsibilities in Malian farming systems and the relationship between them. The Maninka and Bambara are ethnically similar groups occupying adjacent areas in similar ecological zones. Bambara women work part of the day on the family fields while Maninka women work primarily on their own fields. When a Maninka man requests help from women to weed his field women are paid in cash for their labor. Women normally perform this labor in groups. Traditionally, payment was made in salt and meat. The man who requested the women's labor also organized a party at the end of the harvest providing the food for the festival.

Maninka women are solely responsible for providing a portion of each of the daily meals. They alone must purchase salt, spices, and fish, and either grow or purchase the peanuts and vegetables that go into the sauce. Perhaps because Bambara women labor in men's fields, Bambara men often provide their wives with salt, fish and other condiments on a weekly basis (Creevey 1986). Maninka women claim their husbands would never provide this help.

The gender division of labor can be expressed in terms of a continuum. On one end, women provide unremunerated labor on men's cash crop fields and then work

their own food crop fields without help from men. In the middle of the continuum are the Bambara and Maninka examples where women have varying degrees of autonomy and responsibility. At the other end of the spectrum is the case of the Bejaa people in Guinea-Bissau. In Bejaa society men and women maintain separate granaries and do not eat together. There is no unit that can be easily identified and defined as a "household". Men and women farm separate fields and crops performing all agricultural tasks. There is a single field where they both farm together and that harvest is divided between men and women (Funk 1988).

The variations in African households, gender roles, and farming systems make it extremely difficult to develop models for development projects and policies that will allow for these differences. The following section examines the efforts of WID advocates to bring to light the plight of African women who have suffered the consequences of a maladroit development agenda.

Gender Bias in Development

Gustavo Esteva (1992) has written an essay entitled, "Development." In his essay he traces the meaning of the word through several centuries until the point where it received its modern significance. He credits President Truman with initializing the modern development era during his inaugural speech in 1949,

> We must embark [President Truman said] on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas. The old imperialism--

> exploitation for foreign profit--has no place in our plans. What we envisage is a program of development based on the concepts of democratic fair dealing (Esteva 1992, 6).

According to Esteva "development" always implies a "favorable change, a step from the simpler to the complex, from inferior to superior, from worse to better" (Esteva 1992, 10). The definition also implies growth, evolution, and maturation.

In its modern sense development has been associated with strategies to alleviate poverty, to fulfill human needs, to develop human potential, and to transform rural subsistence farming communities into modern ones. Development has also been reduced in some circles of thought to a euphemism for economic growth.

Although not obvious from these excerpts, Esteva's essay was written as a critique of the modern development paradigm. Others who have criticized development in the 1990s have prefaced their books with reasons why they avoid defining the word development. Here is a single example,

> [Development] is not an easy concept to define. Highly ideologically loaded, it means different things to different people. Some see it in terms of purposive and planned project; others prefer to talk of a process of social transformation. Some define it as enhancing individual choice; others see it as equalizing opportunities; still others focus on the interrelationship between ends and means (Kabeer 1994, X).

The end goal of the development process has generally been considered to be the improvement of the well-being of people. This usually implies an improvement in one's economic standing.

Implicit in the theory and practice of the conventional paradigm for economic

development are assumptions about gender roles in society. These assumptions are based on two elements of a traditional western model: (1) the father, mother, and children share a common interest and work towards a common goal and (2) men are the principle farmers and bread winners and women's role is primarily domestic (Jacobson 1992).

These assumptions ultimately led to a development policy that introduced new technology, seed varieties, and cash crops to men in belief that by improving men's economic well-being women and children would also benefit; however, in light of the findings from field studies given above, the original development model was flawed.

According to Kabeer, neo-classical economists have generally treated the household as a "black box" in economic theory, its internal processes were excluded from economic explanation. Economists base their model of the household on the principle of joint welfare maximization, which assumes that all household resources are pooled and that a "benevolent dictator who heads the household" will ensure that welfare resources are optimally allocated between household members (Kabeer 1992, 100).

Empirical research has contradicted the applicability of this principle in Africa. In particular, the gender of the person owning wealth or earning income appears to have a systematic effect on the patterns of resource allocation in the household. Examples from Kenya and the Ivory Coast reveal that an increase in earnings for the male head of household does not translate into significant changes in the welfare of

women and children. Male income is strongly associated with personal forms of consumption such as alcohol, cigarettes, radios, and bicycles, while female expenditures are related to food, goods for children, and for collective household consumption. Authors of the study in the Ivory Coast concluded that these are strong reasons for raising women's incomes (Kabeer 1994).

Sen (1990) has derived a new economic model of the household that operates on the principle of cooperative conflict. The model seems well fit for application to the West African household. In Sen's model the prosperity of the total household is dependent upon the sum of various activities, including income earning, purchasing or producing food crops and other goods, producing edible meals out of raw food and so on. According to Sen,

> The members of the household face two different types of problems simultaneously, one involving cooperation (adding to total availabilities) and the other conflict (dividing the total availabilities among the members of the household) (Sen 1990, 129).

Cooperative conflict is observable in the West African context in terms of how various members of the extended household distribute their time between activities for increasing personal wealth and activities for the family. For example, as noted above, all members of the Bambara extended family must dedicate a portion of each farming day to working the family fields, the remainder of the day may be spent working on personal fields. Male members in the Maninka society cooperatively work together on the family field until the Muslim prayer call at two o'clock and then separate to work

their individual fields.

The main axes of Mandinka[2] domestic life conform closely with the concept of cooperative conflict: "Badingya--cooperation, obligation, and harmony--and fadingya--ambition, selfishness, and conflict" (Carney and Watts 1990, von Braun 1989). It is worth noting that "fadingya" is a masculine term whereas "badingya" is feminine.

Feminists and advocates for the WID approach point to the fact that in the household, women must perform dual types of work--productive and reproductive--which imposes an unfair time burden upon women. Furthermore, because the development model does not acknowledge the principle of cooperative conflict, and assumes that men are the principle providers for the family, development policy has essentially improved men's well-being at the expense of women.

In her paper "The Adverse Impact of Development on Women" Tinker (1976) drew criticism to the stereotypical roles economic theorists attributed to women and men. She noted that a major consequence of these stereotypes was the invisibility of women's productive role in the development planning process. Consequently, "development has tended to put obstacles in women's way that frequently prevent them from maintaining what little economic independence they do have" (Tinker 1976, 24).

Tinker and others have argued that the development process widened the

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[2]Mandinka, Maninka, and Bambara are all related ethnic groups occupying a large portion of West Africa. These people share much in common culturally including a similar language.

economic, educational, and technological gap between men and women. Development became a form of discrimination superimposing Western values on other cultures. Despite women's traditional role, the development policies treated women as dependents and homemakers. In the practical sense this resulted in the planning and implementing of projects that trained women in domestic skills, completely ignoring their economic role.

According to Tinker the erosion of women's role in subsistence economies had begun under colonial rule with the introduction of cash crops and private land ownership that favored men. Additionally, much of the agricultural technology and improvements were introduced to increase cash crop production. According to Tinker, development continued the process of marginalizing women,

> The ways in which development agencies have introduced new technologies likewise have tended to contribute to the undermining of women's traditional roles. Small implements such as presses, grinders, or cutters generally have been introduced to men, even when the work for which they are a substitute traditionally has been done by women (Tinker 1976, 27).

Tinker, in her 1976 article, briefly touched on three issues that are relevant to the next section of this discussion. They have continued to be focuses of the WID effort: (1) technology can aid women in their domestic and productive tasks; (2) the acquisition of technology requires access to cash and credit--a resource women do not have; (3) women's lack of education is detrimental to efforts trying to introduce technology to them.

Technology and Women in Development

Some conclusions can be drawn from the above discussion on gender roles, household economics, and development by considering the following key points. First, women in some West African societies produce both food and cash crops. Second, African women often control their own income, and have distinct family responsibilities. Third, research has shown that a greater portion of a women's earnings than men's will reach children in the form of food, clothing, and medicine. Fourth, access to resources, particularly land, water, and credit is critical to women for improving their own well-being. Fifth, gender roles can influence a woman's access to resources, the amount of time she can allocate to income generating activities, her ability to shift tasks to control her own time, and her ability to control and invest her own income.

From here it can be concluded that improving women's agricultural productivity through the introduction of technology, improved seed varieties, and agricultural extension services--provisions that have long been provided to men--can increase both family food intake and women's income. It is logical to further conclude that improving women's agricultural potential could have a positive effect on children's well-being, a factor negatively correlated with infant mortality rates. Finally, because women have dual roles and must perform numerous time and energy consuming tasks during the agricultural season, a reduction in women's domestic work load could translate into an increase in food production, income generation, and family welfare.

Women in Africa faced with the triple responsibilities of farm work, domestic chores, and income generation--tasks that can add up to a sixteen-hour day--see the lack of time as a major constraint to improve family welfare (Carr 1987). Efforts to introduce income generating activities to women in Africa have frequently failed because women do not have time to partake in these activities. The activities themselves also frequently do not provide a high enough rate of return on women's time to make it worth their while (Jiggins 1989).

The twin goals of increasing women's economic income and reducing their domestic labor resulted in the development of the integrated project model. Carr (1978) describes the theoretical basis for the model,

> The introduction of labor-saving equipment will also give women more time to spend on improving their homes and participating in self-help activities. The combination of labor-saving devices and a diversion of time into profitable income-generating activities will also give the women more money to spend on these activities--and extra money to spend on more labor-saving devices and equipment to help with expansion of small-scale businesses. This process will be self-generating and the end result can only be that of a vast improvement in the living conditions in rural areas (Carr 1978, 8).

Carr also reiterated the position of Tinker and others in her approach stating that a change of emphasis was needed in the area of women's income generating projects. Training should not focus on "supposedly female areas of sewing and cooking" (Carr 1978, 9). Women also needed training in the use of technologies for construction, pottery making, and farming, areas where women have traditionally been engaged.

The development and dissemination of time and energy saving technologies became a major focus of the WID effort and continued for several decades. However, it soon became apparent that despite the efforts of a variety of development organizations, women in rural areas were not able to gain access to the improved technologies that were available; a variety of obstacles stood in their way (Carr 1978, Stamp 1990).

Two general categories of reasons given for the failure of early technology dissemination efforts were: (1) technologies were not designed appropriately for women, and (2) access was limited, primarily by high costs. The appropriate technology movement linked the two issues claiming that a technology was not appropriate for women if they could not afford it. A plethora of technology development organizations emerged during the 1970s and early 1980s whose mission was to design and disseminate technology appropriate for women. E.F. Schumacher's Intermediate Technology Development Group is the most well known of these organizations.

The result of the efforts of these technology development organizations was the development, testing, and dissemination of a wide variety of technologies for women. By the early 1980s according to Carr, there had emerged a large and increasing range of technologies available for use in almost every chore in which rural women were involved (Carr 1981). Many of these technologies had been designed within the guidelines of appropriate technology; they purported to increase productivity without

requiring large financial outlays, imported materials, or highly skilled labor for operating, maintaining, and repairing equipment.

But the appropriateness of many of the new technologies was called into question. Technology, often designed by male engineers, failed to consider issues such as a women's work schedule, cultural taboos, women's strength, the availability of natural resources, and women's social work patterns.

As a result, certain technologies introduced to women were doomed to failure. For example: solar cookers failed because women often cook in the early morning or late evening, pedal-powered grinders were unsuccessful where women are prohibited to straddle a cycle, methane gas cookers required heavy water inputs and were rejected by women where water was scarce, and oil presses required excessive upper-body strength--as a result women found the traditional method easier (UNIFEM 1987, Carr 1981).

Technologies perceived to address urgent needs by development agents were not necessarily thought of as high priority needs by rural women. Soak pits, latrines, and well covers are examples of technologies that could potentially provide important health benefits to women; but sanitation was not perceived by village women as a problem (Carr 1981).

Access to technology is a more complex problem. Women are denied access both in terms of credit, and information. Information about technology often cannot reach women because women do not have contact with extension workers, they are

often illiterate, they rarely own radios, and they travel out of the village less frequently than men. Women's lack of access to credit is also partly due to the bias of most extension services that fail to provide the same credit opportunity to women as men.

One consequence of the access problem is that men have used their ability to acquire credit to purchase machines such as grain mills. Women must then pay male proprietors to use the mills. In Mali the wives of men who own plows are forced to pay to use a plow and then only after the man has finished plowing his fields. WID advocates argued that credit could be made available to women's groups and cooperatives that would allow them to purchase and control their own technologies (Jiggins 1989, Carr 1985).

A final, but particularly relevant issue for this discussion, is the fact that some technologies require a particular level of organization for specialized tasks that may not exist in the community (Stamp 1989).

Women and Technology in Africa

The effort to introduce technology to women in Africa has involved technologies for both farm and non-farm work but has concentrated particularly on labor saving technologies for domestic chores. Time studies have shown that women work long days and that much of this time is spent on several domestic or so-called drudgery tasks, including pulling and hauling water, collecting fuelwood, cooking, and processing grains and oils (Carr 1987).

Technology has gradually been designed to be appropriate for women. Groups such as Intermediate Technology Development Group, UNIFEM, Appropriate Technology International, and the International Research Development Center have incorporated women into the design and needs assessment stages when beginning work on developing a new technology for women. As a result technologies have been developed and disseminated to women to aid them in a variety of labor intensive tasks. Many of these technologies have proven over time to be successful. Examples of the types of technologies include water lifting and storage devices, improved stoves to reduce fuelwood consumption, carts for transporting wood, tools for tilling, seeding, and harvesting, and tools for processing food.

The issue of credit for women remains a problem. The Grameen Bank in Bangladesh provides an example of a successful credit program for women entrepreneurs (Tinker 1990). But many women still do not have access to credit.

A common feature of many loan programs for women is the requirement that the women be organized into a group. The group surety itself becomes the collateral for a loan (Tinker 1990). Some organizations allow women to take individual loans and others allow only group project loans.

The consequence of this approach is that credit is gradually becoming available to women in villages who are able to organize into groups. The draw to gain access to a labor saving technology has been strong enough to pull some village women together to form organizations or cooperatives to qualify for a loan. The process may

require women to transform their traditional forms of organizing. For example, the small work groups of women in parts of West Africa have organized into larger groups to qualify for loans, especially loans for expensive technologies. This type of organization may not only be necessary to obtain the technology but it is frequently needed to provide a structure to maintain it.

Studies have shown that cooperatives based on the traditional village structure are more likely to succeed than those created solely on the guidelines of the government agency or NGO providing the credit. The successful adaption of the traditional associative structure of the village--both women's and men's groups--to the modern context facilitates the process of adopting a technology (Stamp 1990).

Case studies in the literature also show that traditional women's groups have played an important role in maintaining the power balance between men and women. Strengthening these groups could improve women's relative position in society. For example, by channeling cash from cooperatively grown crops into self-help projects, women have prevented the appropriation of their profits by their husbands.

A common problem faced by women's groups is the "take over" of their new technology, or the proceeds from it, by powerful male village leaders (Ahmed 1985, UNIFEM 1987, 1988). By organizing at the village level women could maintain better control of their technology.

In summary, technology has become increasingly available to women over the last two decades. Efforts have been taken to address the problems of appropriateness

and access. Furthermore, some researchers have recently begun to evaluate the original premise of the integrated project model, that a successful technology implementation will release women's time for economically productive activity.

Studies surveyed by Carr and Sandhu (1987) reveal that women often spend their time improving the quality of family life--sewing or caring for children for example--instead of producing food or income. The authors concluded that women often cannot take advantage of time saved because of a lack of access to land or credit. In citing their study Stamp (1990) notes, "This point demonstrates the necessity of taking the complex socioeconomic approach when planning technology transfers" (Stamp 1990, 61).

For the case of expensive labor-saving technologies such as diesel powered mills, the issue of income generation becomes an essential one. If women cannot convert their saved time from accessing a grain mill for example, they will not be able to continue to pay milling fees, and the technology will go unused. With only limited use, mills cannot generate the capital necessary to pay for fuel and maintenance, let alone loan payments. The "self-generating mechanism" cited by Carr is broken. Freudenberger has found this to be the overwhelming case for grain mills introduced into rural villages in West Africa (Freudenberger 1994).

Evaluations of Milling Technology

The appropriate technology movement placed an emphasis on developing and

disseminating practical and affordable technologies for women. However, capital intensive technology does not always negatively affect women. It does, however, require the tangential development of women's organizational, managerial and maintenance skills in addition to credit.

Theoretically, diesel powered grain mills could save women hours of daily labor. There are, however, four key issues to consider. First, mills are an expensive technology and women must acquire credit to purchase them. Furthermore, in small villages, credit access is often limited to groups of women. Therefore, purchasing a mill often requires a level of organization that may not be found in the traditional village social structure.

Second, mills require a constant input of parts, fuel, and labor. In most cases women are charged a user fee to cover these expenses. Economically speaking, a women must be capable of earning the milling fee--during the time saved by milling--in order for mill use to be worth her while. In many rural villages few economic opportunities are available for women to increase their income to pay milling fees. Efforts to introduce income generating schemes in tangent with grain mills as part of a single integrated project have frequently failed because of women's limited economic opportunities. Women's lack of economic opportunity is in turn a function of access to both natural and economic resources.

Third, there are technological issues. Mills must be selected and sized for the appropriate application. This may depend on the crops grown and consumed in a

region that is in turn a function of the environment and other social factors. Choice of the wrong mill and/or improper maintenance may lead to early mill failure.

Finally, there is the issue of power in the village. Men usually hold political power in West African villages. They often control the distribution of resources in a village. Men have also typically controlled modern technology. Men could use this power to take control of either the technology or the proceeds from milling. By forming new groups or by strengthening traditional structures, women can counter men's power at the village level.

Diesel powered grain mills provide an interesting challenge for project planners and implementors working in rural West African villages. In examining the impact of mills, it is important to examine the complex interaction between the society and the technology and to pay particular attention to the dialectical nature of technology transfer, a process that can either disequip or empower village women to engage in genuine development (Stamp 1990).

A review of studies on grain mills shows that only a few follow-up studies have been conducted to determine how widely the benefits of milling technology have been distributed among village community members or the reasons behind grain mills failures. When studies are undertaken, they typically involve random interviews of village women and are often based on recall methods of information gathering. Errors using this type of methodology are high, particularly when the study group is illiterate (Carr and Sandhu 1987).

Data from these studies have estimated that grain mills save some women in parts of Africa between 0.8 and 2.5 hours of work per day (Carr 1991, Lorenso 1988). More often time-savings values given are for potential time savings. For example, research done in Gambia and in Botswana estimated that women could save up to four hours per day by using a grain mill (UNIFEM 1988, Barrett 1993). These studies are misleading, however, because they consider only the time women will save on hand grinding and not the time they will need to spend on income earning activities to pay milling fees.

Women in many West African societies are responsible for paying their own milling fees. Research has shown that mill users are often of two types: regular and irregular. In Senegal for example, regular users--using the mill daily--receive cash from their husbands to use the mill. Irregular users rely on their own incomes (UNIFEM 1988).

Some attempts have been made to show where women re-apply time saved. For example in Botswana, of the 2.5 hours saved, women spend 57% on household activities--washing clothes, cleaning the yard, collecting fuelwood--and 41% was spent on productive activities such as pottery, agricultural work, beer brewing, and others (Carr 1991, 60). In other cases water lifting and fish smoking technologies have saved women time but this time has not been transferred to an increase in productive activities (Carr and Sandhu 1987).

Few attempts have been made to estimate the economic benefits derived from

mills. It is difficult to obtain reliable information on women's economic activities. Furthermore, economic theory holds that this is neither necessary nor desirable. There is an appealing economic principle that the consumer is the best judge of the value of goods or a service and that this value can be measured by the consumers "willingness to pay" (Carr 1991).

Freudenberger (1991a, 1991b, 1994) has evaluated several grain mill projects in West Africa. She concluded that mill sustainability is dictated by women's willingness to pay. Furthermore, the reason many of the mills installed in small villages in West Africa are either currently out of operation, or operating--but at an economically unsustainable level--is because women make the rational economic decision not to use the mill.

Economics of Milling

In accordance with the "willingness to pay" principle, a woman's decision to use or not to use a mill is both a function of a her ability to earn income and her responsibilities to the household budget. In Senegal and The Gambia, the processing fees for grain usually are the women's responsibility. In addition women are responsible for providing condiments for the meals, covering part of the health, clothing, and school expenses of herself and her children (Freudenberger 1994).

Sene-Gambian women have two sources of income: lump sums, from the sale of cash crops or small animals, and more regular revenues from activities such as

gardening and selling milk or snack food. The lump sums commonly are used to purchase household and personal items such as clothing and cooking utensils, and the regular income is used to pay for condiments, soap, oil, and kerosene. Milling fees would fall into the second category (Freudenberger 1994).

Freudenberger finds that for many women the expense of grain processing--200-400 cfa[3] per week--roughly doubles the amount women spend on all other weekly expenses. She concludes that if the revenues do not increase concomitantly after the technology is introduced, women face a choice between spending their income on milling or continuing their purchase of food supplements and other household items. Sene-Gambian women report that they invariably give priority to food and household expenditures (Freudenberger 1994).

Freudenberger estimates that based on a hand grinding rate of six kilograms of grain per hour, a woman spends approximately 90 cfa per hour to use the machine. According to Freudenberger, "More careful time-studies are needed to evaluate the return to labor in women's income generating projects, but it is unlikely that many rural activities guarantee a return greater than 90 cfa per hour" (Freudenberger 1994, 19). Other estimates for milling costs in the region, however, place the rate at 54 cfa per hour (Hyman 1991).

There are no reliable data on individual hourly labor rates for women since

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[3]The cfa is the currency for Francaphone West Africa. The value at the time of this research was approximately 300 cfa = $1. The cfa was recently devalued by fifty percent.

women usually work in groups. A surrogate rate can be estimated--based on group rates for women's work--at 50-80 cfa per hour. For comparison, women's agricultural output is worth 40-65 cfa per hour (Hyman 1991). Using Hyman's estimates, which are for rural Mali, women could potentially use grain mills to liberate time to engage in profitable income generating activities.

A Framework for Assessing Mills

Freudenberger (1994) has developed a framework for assessing the success and sustainability of rural technology. There are two important factors to consider when measuring technological success: (1) how broadly distributed the benefits of the technology are in the present, and (2) how long into the future these benefits can be sustained. Technologies, such as grain mills, require a relatively high level of investment and operating capital. A certain threshold level of use or "through-put" is required for economic viability. A user fee must be established such that a portion of the proceeds can be set aside for operating costs, repairs in the mid-term, and replacement costs in the long term (Freudenberger 1994).

Using evidence from grain mill and de-huller projects in Mali, Senegal, and The Gambia, Freudenberger proposes that village technological sustainability depends on three factors: (1) effective consumer demand, (2) reliable operation of the machinery, (3) good management procedures, which are the essential link between the other two (Freudenberger 1994, 16).

Each of the three sustainability components can be analyzed in isolation. Consumer demand depends upon the number of people in the catchment area, the amount of grain needed to be processed, the availability of cash to pay processing fees, and the socio-cultural acceptance of the services being offered. Operating reliability depends upon the technical viability of the machinery, the availability of fuel and parts, and the presence of trained maintenance and repair people. Good management is a function of good training and honesty.

Applying this method Freudenberger has concluded that for small villages in West Africa: "The constraint which is the key limiting factor appears to be the shortage of cash (or payment in-kind) needed to pay processing fees" (Freudenberger 1994, 18).

Freudenberger's work contains an evaluation of an integrated project that demonstrates the fundamental difficulty of implementing the integrated model; women's income generating opportunities are limited. The example included both a labor saving technology--a grain mill--and an income generating component--a vegetable garden. Freudenberger concluded that the garden failed to generate sufficient income to allow women to access the mill, especially considering the time allocated to garden work,

> The garden demands too high a labor input for the revenues generated and the mill is too expensive for the time it saves. It does not...make sense for women to use the proceeds from her garden to pay for milling services (Freudenberger 1991b, 19).

In her analysis, Freudenberger (1991b) recommends that revenues from the income generating component be regular throughout the year. Gardens are a seasonal activity in West Africa and therefore, not appropriate for use in an integrated project. Furthermore, the goal of the garden is to produce both vegetables for home consumption and for income generation. It is a mistake, she concludes, to design a project with such conflicting objectives; alternative income generating activities should be considered to gardening.

Mills in the Malian Context

Diesel powered milling technology has been introduced into many areas of Mali. Most towns and large villages have several privately owned diesel mills in operation. In smaller villages (less than 1500 people) mills are still a rarity (Fischer 1992).

Private mills in towns and cities relieve many women of the task of milling by hand for a small fee. Women in villages in rural areas make frequent requests for mills from donor agencies. In the Manden area of western Mali, grain mills were cited by women as the second most important technology in terms of improving their work potential. Only plows and oxen ranked higher in terms of benefits. "Women regard the grain mill as a labor saving device that would liberate time and energy to devote to income earning activities" (Leury 1989, 20).

The pricing of milling fees has been shown to influence the number of women

who choose to access mills. A comparison of two cooperatively owned grain mills in Mali demonstrated that access to a mill can be improved through cooperative action.

Charges for commercial and cooperatively run grain mills in Mali currently range from 10-15 cfa per kilogram of millet or sorghum. The women in the village of Dissan in southeastern Mali have set their milling fee at 5 cfa per kilogram, barely enough to cover operating costs. To earn additional revenue to pay for repairs and amortization, the entire active women's group puts in a half day of agricultural labor each Sunday during the farming season. Approximately 94 women make up the group and they are paid 5,000 cfa for their labor. This money is placed in the mill operations fund (Fischer 1992).

The result of this pricing strategy is that 50-100 percent of the grain consumed in the village passes through the mill. This compares with only 10 percent of a neighboring village that charges 14 cfa per kilogram (Fischer 1992, 25).

Although this strategy improves accessibility, which appears more equitable, this is not necessarily the case. Older women are often relieved of the task of pounding grain, yet they are members of the village women's group and provide labor to subsidize the milling fee. A potential conflict could arise since the elder women often have decision making power in villages. However, villages with a long history of cooperation could develop strategies for compensating those who do not benefit directly from the mill.

Another strategy that could improve mill through-put and lead to greater

sustainability is the use of mills to grind other products. In addition to the common grains of millet, sorghum, and corn, mills can also accommodate shea nuts and peanuts. Changing the plates and cleaning the mill are the only difficulties involved.

A Conceptual Research Framework

The above review of the literature demonstrated both women's need for new labor saving technologies and the difficulties involved in sustainably introducing technologies to women. Due to their dual roles in production and reproduction, women have severe time constraints that limit their ability to earn income. Furthermore, the prevalent bias in the development process has made it more difficult for women to earn income. This bias resulted when development planners and policy makers failed to consider the complex gender roles and relationships that characterize African rural life. Men have been able to use their power and access to technology to control a greater proportion of village resources.

Most researchers have taken a static or steady-state approach to analyzing women's technology interventions. They have not examined the dialectical nature of these interventions. This is in contrast with the literature on male technology studies where the resulting changes in land use and labor distribution patterns have been well documented.[4]

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[4]See Carney (1994) and von Braun (1989) for an analysis of the impact of irrigation technology on women's labor and land rights compared to men's.

Freudenberger's (1994) work concluded that women's lack of income is the main reason mill projects fail. Integrated projects have not been successful because the income generation components do not provide women an adequate return for their time and effort. Carr and Sandhu (1987) concluded that women cannot reallocate time savings to productive activities because they lack access to resources.

These authors have not systematically examined the changes that occur in women's time allocation in relation to gender specific roles and responsibilities and access to various resources. Important village resources have limited availability; men and women in the village must determine the new distribution of resources that will result after the introduction of a technology. This process may involve cooperation and conflict.

The political ecology approach provides a general framework for examining this type of problem. It is further refined for this research by adding a gender component. According to Bryant,

> Third World political ecology represents an attempt to develop an integrated understanding of how environmental and political forces interact to mediate social and environmental change...this encompasses the constantly shifting dialectic between society and land-based resources, and also within classes and groups within a society itself (Bryant 1992, 12).

The term political ecology had its origin in the critique of anthropology and cultural ecology of the late 1970s. Cultural ecologists working in rural villages uncovered substantial data on local ethnoscientific knowledge and the relations between cultural practices and resource management. Critics argued that cultural

ecologists erred by placing these findings in an overarching regulatory structure derived from self-correcting properties of closed living systems. Many societies studied were actually a part of a larger political economy (Watts and Peet 1993).

Political ecology addresses the human/environment linkage as a dynamic relationship. Historically, local communities devised agricultural systems that had evolved to provide food security through complex interactions between socioeconomic institutions and environmental resources. The integration of rural communities into national and international economies has, however, transformed the agricultural system upon which the local environmental management strategies were based (Campbell and Olson 1991).

The political ecology framework has been used previously to focus on the socioeconomic hierarchies and power relations regulating land use and management in West Africa. Carney (1994) examined labor and rights access to environmental resources in the context of changing land use patterns in The Gambia. New irrigation technology and new markets for garden produce led to conflicts between men and women over the distribution of work and benefits of increased household earnings. Male attempts to control female family labor were met with resistance by women.

The political ecology approach can be further refined by incorporating a framework for examining the role of gender in a community. The Harvard Analytical Framework was initially developed as a tool to for integrating gender awareness into project design (Overholt 1985, Moffat 1991, Kabeer 1994). This framework provides

a useful means to organize and present pertinent information on gender and is therefore, appropriate for this research.

The Harvard Analytical Framework (HAF), sometimes called the Gender Roles Framework, is composed of four interrelated components: Activity Profile, Access and Control Profile, Analysis of Factors Influencing Activities, Access, and Control, and Project Cycle Analysis (Overholt 1985).

The Activity Profile delineates the economic activities of the population by age and gender and then by ethnicity or social class. It can be used to examine time allocation patterns on a seasonal or daily basis. The Control Profile identifies what resources individuals can command to carry out their activities as well as the benefits derived from them (Overholt 1985).

It is important to differentiate between access to and control over resources. Land is a key resource in Africa. Women may be able to gain access to land but may not have ownership or long term control over it. Without permanent control, women are discouraged from making investments in the land, such as adding fertilizers.

The Analysis of Factors Influencing Activities, Access, and Control examines the dynamic forces--political, social, environmental, or physical--that can either enhance or impede the accomplishment of a project's objectives.

The final component of the Harvard Analytical Framework is the project cycle analysis. This process involves asking which activities the project will affect and how the issues of access and control relate to these activities. This thesis examines how a

diesel mill project affected women's access to and control over important resources and how this in turn affected the project's success.

The Harvard Analytical Framework has been criticized by Kabeer (1994) for basing its methodology on the activities rather than the social relationships between people. This leads to the treatment of the gender division of labor as a relationship of separation, by activity, crop, or field for example, and to the neglect of the social interconnectedness of production processes. As Whitehead (1991) has noted, the division of labor in Africa is about connection as well as separation. Women and men must engage in a cooperative relationship involving the exchange of goods and services; this coincides with a separation of roles and responsibilities by gender.

In response, Kabeer has developed the Social Relations Framework (SRF). The SRF is useful for understanding gender roles and responsibilities in terms of five distinct but interrelated dimensions of social relationships within institutions: rules, activities, resources, people, and power (Kabeer 1994).

In the SRF, power relations between people, men and women in particular, are fundamental to the control over and access to resources, in addition to the distribution of responsibilities and benefits. Productive activities are generally carried out through a variety of social relations and in a variety of institutional contexts. In West Africa, the important socio-political institutions are the household and the various men's and women's social organizations of the village. Gender relations are interwoven into these social relations providing a structure for the division of resources,

responsibilities, claims, and obligations between the different social groups of men and women within the village (Kabeer 1994).

Diesel powered mills place a new burden on the village to produce products that can be sold for cash in order to pay to import parts and diesel fuel. This burden is born primarily by the women, but in a small village with limited resources--land, water, labor, and capital--this demand will create new tensions over access to and control over these resources. The political ecology, Social Relations, and Harvard Analytical Frameworks overlap and combine to create a conceptual framework for examining the dynamic interactions and changes that occur when a technology is introduced into a small rural Malian village.

CHAPTER 3

METHODS

Research Design

This research employed several different methods during three months of data collection. The methods used were primarily qualitative. Qualitative methods rely on three principal forms of data collection: open-ended interviews, direct observation, and review of documents (Moris 1993). All three forms of data collection were used during the fieldwork. Quantitative milling data was also examined for each village. Because this study was carried out during a relatively short period of time, Rapid Rural Appraisal (RRA) techniques were incorporated into the research to improve reliability. The methods chosen reflected the needs and circumstances that presented themselves during the field work in Mali. The researcher's prior familiarity with the Maninka culture greatly enhanced the data collection process.

Interdisciplinary Research Methods

The interdisciplinary nature of this study required a research framework that could examine the interaction between environmental, economical, socio-cultural, and political, factors. The approach applied many of the principles of a relatively new research method referred to as Rapid Rural Appraisal (RRA). RRA applies standard

research methods in combination to achieve a mixture of qualitative and quantitative results (Chambers 1985, Freudenberger 1990).

Rapid Rural Appraisal (RRA) is a generic term for mixed-method research involving short periods of fieldwork, usually less than one month, and exemplifying a truncation of the formal survey process in combination with some useful aspects of key informant interviewing. In the RRA method, a multidisciplinary team continuously analyzes data collected to increase knowledge of the community in an on-going process. Several different methods of data collection are utilized to reduce researcher bias and to insure that a cross section of data sources are tapped. One key to successful implementation of multiple method research is triangulation. Triangulation can take several forms: different methods are used to cross check results, different theories are examined to explain outcomes, different investigators test quality, and different subjects can be varied in scope, time, and space (Moris 1993). The use of triangulation facilitates the collection of quality data in a short period of time.

During the fieldwork phase of this study, data were collected through prolonged observation, short term observation, key informant interviews, informal interviews at the mill site and other public places, informal interviews of small groups, and examination of the village milling records and project reports of Project 3AG.

Objectives

The objective of this research was to answer the following questions.

1. What are men's and women's roles and responsibilities in Maninka Society?

2. How do men's and women's access to resources differ?

3. How do women earn income to access mills?

4. How are women's limits to income generation restricted by limits on their access to resources?

5. Where do women re-apply the time saved from using diesel mills?

6. How has a woman's regular use of the mill changed her daily and seasonal work pattern?

7. What are the men's perceptions of the women acquiring access to credit and technology and their need to access resources? Do they support or combat the women's efforts?

Sample

The study sample included the women and men of four villages in the Manden. Each village's women's group owned and operated a diesel powered mill. Because the research team resided in Tabou Village, this population was intensively observed during the three month field study. Trips were made to the other three villages Sindala, Keniero, and Makandiana, during the study period. The project reports of Project 3AG on these villages and several other villages were examined.

Procedure

A research team of one married couple conducted the study from January through March 1994. The study coincided with the end of the harvest, a period when

the work pace of villagers slows. It is an ideal time for conducting interviews. Out of respect for the Maninka culture and to improve the validity of the results, the male and female researchers employed different data collection techniques. The male researcher focused on conducting random interviews and observations of women in public spaces such as, milling sites, gardens, wells, and markets. The female team member conducted prolonged observation and informal interviews of women in their homes. There were many group sessions involving both researchers.

The village of Tabou was chosen as the primary site of investigation for three reasons: (1) the village represented the milieu, (2) the women's group had owned and operated a mill in Tabou for over three years and patterns of use were well established, (3) the principle researcher had lived in the village for two and one half years and was familiar to many residents. To return to the region and not reside in Tabou Village would have been a cultural faux pas.

All women who frequented the mill in Tabou Village were interviewed and observed on a nearly daily basis. The women in the hamlets of the village were also visited and interviewed.

Each of the other villages was visited at least twice. During these visits women were observed and questioned while waiting to use the mills. Random visits to various households and gardens for informal interviews were also conducted.

Interviews were often conducted at opportune moments and were frequently unplanned. Women traveling with nuts to be milled were stopped on the road and

questioned and many women were questioned at the local markets.

Interviews were frequently carried out in a participatory fashion. The researcher helped women to measure and count shea nuts waiting to be milled. He also learned to operate the milling machinery. This both gave the researcher a purpose, in addition to collecting and recording information, and served to lighten the atmosphere making it easier to ask questions.

Key informants from each village provided valuable information and facilitated the research. The researcher had pre-established contacts in each village from previous Peace Corps service. These people served as key informants and helped to schedule visits and set up interviews. They also provided feedback for discussing ideas and testing theories. They contributed housing, food, and other services invaluable to the process of gathering information in rural Africa.

Jomaganjan Keita, the village chief of Tabou, provided a historical perspective on a range of issues. These included changes in the environment, farming methods, Islam, and men's and women's social relations, particularly the division of labor. The mothers of several of the researcher's counterparts added a women's history including a description of changing work patterns and technology over the decades. The mill operators in each village were also interviewed. Mill operators often had insight into patterns of mill use that the researcher failed to observe during a short visit or by examining records.

Two key informants provided background information on the projects and the

Maninka milieu. The director of the organization Project 3AG, Youma Diallo, provided necessary background information and reports for each mill project. Bagi Konate, a renown hunter and a member of the Project 3AG staff provided information and discussion on the culture and characteristics of the Maninka people.

The female team member conducted day long--from dawn till dusk--observations and informal interviews of nine randomly selected women in the village. She then selected four of these women for further observation. Once a level of trust was achieved and the subjects felt comfortable, the researcher was able to probe deeper and ask sensitive questions regarding personal life, social relations, and income.

The researchers conducted several group interviews as a team. These informal interview sessions conducted in the afternoons or evenings accompanied by the traditional Malian tea uncovered some of the most useful information. The sessions involved mixed-sex groups of key informants. They allowed the researchers to acquire feedback on hypotheses and to formulate new questions to ask. Many of these group sessions were followed by individual interviews.

All interviews were conducted in the local language of Maninkakan with the rare exception of some questions being asked in French when the subject topic demanded (see Appendix C for a list of frequently asked questions). Results were normally recorded on note pads except during lengthy interviews when tape recordings were made. Throughout the study period effort was taken to understand both the women's and men's perspectives on the issues.

Limitations

Time constraints limit the ability of any research team to conduct a thorough study. Financial constraints limited this study to a three month period. While both researchers had lived for over two years in Mali, language and cultural differences prevent a complete understanding of social phenomena. However, the researchers were able to rely upon trusted and knowledgeable key informants and cultural guides to accelerate the pace of integration and data collection. The combination of a team of researchers, one male and one female, greatly enhanced the gender analysis portion of the research.

CHAPTER 4

BACKGROUND AND CONTEXT[5]

This description of the physical environment of the Manden region and the social, and economic environments of the Maninka people provide the background for investigating development projects in the area. This chapter ends with brief history of the introduction of grain mills into the area by the NGO Project 3AG and a discussion of the traditional milling process verses modern diesel mills.

Mali has a population of 6,308,320 settled in an area covering 124,000 square kilometers (see Map A). Mali is one of the twenty poorest countries in the world with a per capita income of $270. The life expectancy for women is 50 years and for men, only 47 years. Mali's infant mortality rate--an important statistic on women's health--is the highest in the world (World Bank 1992).

Agriculture is the mainstay of the Malian economy. Eighty percent of the population lives in rural areas. The major export crops are cotton, peanuts and cattle. Mali also exports a small amount of gold.

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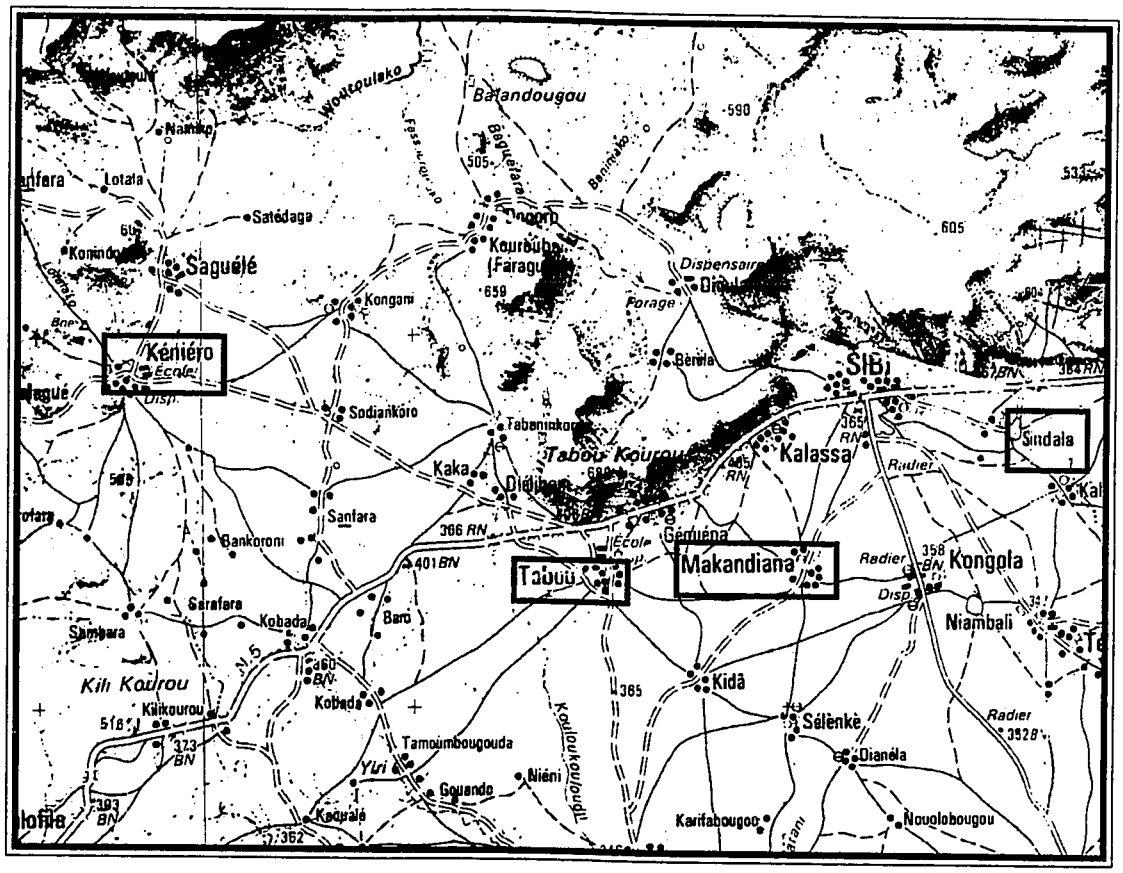
[5]The description of the Manden and Maninka people presented here is primarily based on information gathered using participant observation and key informant interviews. The information gathered was collected during a two and one half year period when I lived and worked in the Manden. Unless otherwise referenced all of the following information was collected by the author in the field.

Map A: Map of Mali

Map B: Relief Map of Study Area



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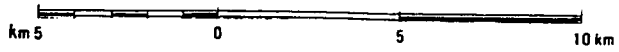

Unpaved Road	1 2
Unmaintained Road	1 2
Trail	1 2
Study Villages	

The Physical Environment

This study was carried out in the Manden region of Mali in Sahelian West Africa (see Map B). The Manden[6] region is located in the southwestern corner of Mali, south and southwest of the Capital Bamako extending to the Guinean border. The Manden is traversed by the Niger River, which flows northeast to the Capital. Numerous small streams fill and flow into the Niger and the Bafing, a headwater of the Senegal River, during the rainy season from June though October. Some depressions retain water until the end of January, but by February these are completely dry.

The Manden lies within the Sudanian zone, a belt of savanna woodland receiving an annual rainfall of about 1100 millimeters (Church 1974). The savanna woodland is characterized by strands of trees broken by grasslands. Frequent burning by humans, to hunt out animals, improve visibility, or to clear out land for cultivation has altered the landscape. Non-fire resistant trees have been eliminated while grasses have been admitted (Cashion 1984).

Rainfall is the most vital element in this Savannah climate. The annual variation from the mean rainfall of 1100 millimeters is 25-30% (Harrison 1987). Moreover, rainfall patterns are highly variable in quantity and spatial distribution. Agriculture, the subsistence activity of 80% of the population, is hindered by the

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[6]The term Manden is the indigenous toponym for the area in south-western Mali where this research took place. The Manden is the heartland of the Manding family of peoples. The area is sometimes referred to as the Manding (Dalby 1971).

erratic rainfall. Sixty-five to seventy percent of the total falls within only three months--from mid-June to mid-September. Heavy rains during this short period leach out important nutrients, cause soil erosion, and make road construction and maintenance difficult. Rainfall replenishes the river, ground, and subterranean waters.

A drought can be expressed in meteorological, agricultural, or hydrological terms (Glantz 1987). Drought can mean different things to different people, depending on their rainfall needs. Agricultural drought occurs when there is not enough moisture available at the right time for growth and development of crops. Crops have varying moisture needs throughout their growth and development cycles, and therefore, the timing of rainfall is crucial in rain-fed agriculture in determining the success of the harvest. Hydrologic drought occurs when stream flow falls below a determined level. This level is frequently defined in terms of human needs such as adequate water for rice production (Glantz 1987).

Drought affects all aspects of life in the Manden. Areas that once supported rice now lay fallow. Wells are deeper and go dry earlier in the dry season thereby increasing women's work load. Depressions, streams, and ponds dry-up sooner making cattle watering more difficult. Because rainfall is not only lower, but more sporadic, farmers have difficulty in gaging planting cycles; a brief dry spell after planting may ruin a crop.

Agricultural yields have been unstable over the past two decades because of recurring drought (Fischer 1992). The current drought has been the longest and

perhaps most severe of this century (Sivakumar 1991).[7] Declining precipitation is cited by farmers as the principal reason for major changes in their agricultural systems (Bingen 1994).

When early rains are sporadic many people resort to working their fields by hand rather that waiting for an oxen-drawn plow. This is due to a shortage of plows in the villages compounded by a short planting season. The overall effect is a reduction in the total acreage planted and the size of the harvest. In the Manden this has particularly negative consequences for women who are last to receive access to plows.

The Manden has three distinct seasons. The cool dry season--November through mid-March--coincides with the harvest and gardening months. This season is characterized by shorter, cooler days. The Harmattan wind blows cool air from the Sahara Desert. During the day the sky is often filled with dust. The hot dry season begins in mid-March and lasts until the rains commence in June. This is a time when water and vegetables are scarce, day time temperatures rise to above 50° C. There is little agricultural activity during these months except for field preparation. The rainy season begins in June and lasts until September or early October.

The amount, distribution, and duration of rainfall are factors determining

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[7]The current West African drought began in the late 1960's. There is an ongoing debate over whether the recent pattern of lower rainfall is part of a regular pattern of long and short periods of drought or representative of permanent change. It has been established that the period preceding the current drought was one of unusually high rainfall.

natural vegetation, types of fauna, and systems of agriculture and animal husbandry in this part of Africa. Flora plays an important role in both the economic and social life in the Manden. The shea tree provides a nut that is processed into oil by women. Women also use the leaves of the baobab tree and the seed pods of the nere tree in their cooking. Palm trees are used to make a wine and to construct chairs, beds and baskets. Many hardwoods are used to fabricate doors, mortar and pestles, handles for hoes and axes, and were traditionally used to fabricate masks and small artifacts. Bamboo and a variety of tall grasses are important materials for hut construction. A number of species provide wild fruits and berries. Hunters and other practitioners of traditional medicine collect various parts of trees, bushes, and animals to concoct cures for a variety of ailments (Cashion 1984).

The terrain is marked by the presence of the Manden plateau. Shear cliffs and rocky plateaus--composed of paleozoic sandstone--often rise to 800 meters in height. These mountains contain mineral resources of iron, bauxite, manganese, diamonds, and gold (Cashion 1984). Soils are classified as ferrisols, but there is a wide variation of soil types in the area. Land bordering the Manding Mountains is generally sandy but the depressions may have a high clay content. The hill tops on the plateau are often composed of hard ferruginous crusts called laterite and are usually denuded of any vegetation. Laterite is red in color and is used to gravel roads (Church 1974).

The Villages Studied

The research site is composed of four villages, Sindala--population 728, Makandiana--population 487, Keniero--population 1463, and Tabou--population 1396 (Diallo 1994). These villages are all located between two and twenty kilometers from the main market town of Siby (refer to Map B). The villages are part of the Siby Arrondissement. Siby encompasses 50 villages with a total population of 32,589 of whom 15,544 are women.

A remarkable characteristic of the Siby area are the cliffs of the Manding Mountains that separate the area into two areas with distinct land management patterns. The plain is heavily settled compared to the rocky, hilly plateau. The cliffs rise 350 meters above the plain and are most prominent near Tabou Village. The main research sites in this study lie on the plain near the base of the Manding Mountains. The soil at the base of these cliffs is sandy and provides a good environment for growing peanuts, millet, and mango trees.

The principal ethnic group in the region is the Maninka.[8] There are also a small number of Fulani, a pastoral people who live among the Maninka often herding and caring for their cattle. Ninety percent of the Maninka population are agriculturalists, relying on rain-fed agriculture for their livelihood (Leynaud and Cisse 1978).

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[8]The Maninka ethnic group belongs to the family of Mande peoples who occupy a large region of West Africa. Maninka are often referred to in the literature as Malinké, the French term for these people.

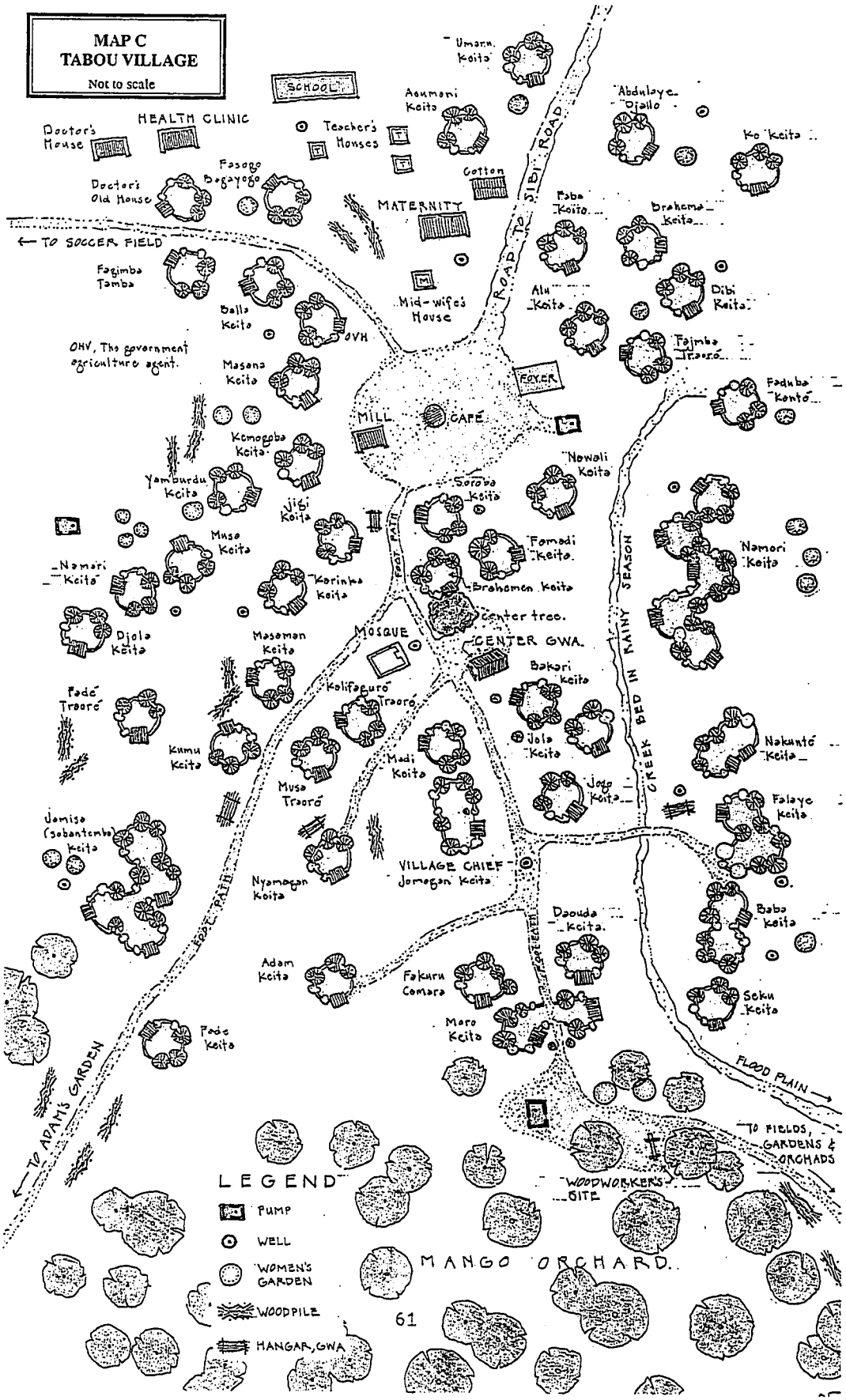
Gender Relations and Agriculture

Maninka settle in villages comprised of clusters of small clay and straw dwellings usually located near a reliable water source (see Map C). Currently most villagers draw water from shallow hand dug wells of five to twenty-five meters in depth. Some villages also have pumps drawing water from deep bore holes. A few small villages or hamlets still draw water from streams.

In the Siby area, where this research took place, villages are frequently found near flood plains or seasonal streams that provide rice farming areas in the rainy season. Areas adjacent to flood plains often have fertile soils and high water tables, ideal conditions for gardening. Streams may also provide a source of fish.

The area immediately surrounding the village is often the most fertile and is farmed intensively. This area called "soforo" is usually planted with rapid growing corn variety that reaches maturity in only three months. The soils surrounding the villages are fertilized by the cattle and other animals that congregate around the huts during the dry months. Women also throw food scraps on this land adding to soil fertility. Corn serves as the village's safeguard against grain shortages. It is harvested before the staple crops of millet and peanuts have matured, a period when the harvest work load begins to increase and other food supplies have decreased.

Expanding radially outward there are fields in various states of fallow and productivity. These are both men's millet, sorghum, peanut, and cotton fields and women's peanut fields. Fields are often inter-cropped with beans, millet or hibiscus.


MAP C
TABOU VILLAGE
Not to scale
SCHOOL
HEALTH CLINIC
Doctor's House
Teacher's Houses
Umaru Koita
Aoumani Koita
Abdulaye Djallo
Ko Koita
Fasago Bagayogo
Doctor's Old House
Cotton
MATERNITY
Faba Koita
Brahema Koita
← TO SOCCER FIELD
ROAD TO SIBI ROAD
Fagimba Tamba
Balla Koita
Mid-wife's House
Alu Koita
Dibi Koita
OVH
OHV, The government agricultural agent.
Fajmba Traoré
Masana Koita
FOYER
Faduba Konto
MILL
CAFÉ
Komogba Koita
Nowali Koita
Yamburdu Koita
Soroba Koita
Jigi Koita
FOOT PATH
Musa Koita
Famadi Koita
Namori Koita
Namori Koita
Korinka Koita
Brahamen Koita
Center tree.
CENTER GWA.
MOSQUE
Djola Koita
Maseman Koita
Bakari Koita
Kolifaguro Traoré
Fodé Traoré
Jola Koita
Nakunto Koita
Kumu Koita
Madi Koita
Musa Traoré
Jola Koita
Falaye Koita
Jamisa (Sobantemba) Koita
VILLAGE CHIEF
Jomogan Koita
Nyamogan Koita
Baba Koita
Daouda Koita
Adam Koita
Fakuru Comara
Seku Koita
Maro Koita
Fode Koita
FLOOD PLAIN
TO FIELDS, GARDENS & ORCHARDS
TO ADAMS GARDEN
WOODWORKER'S SITE
LEGEND
PUMP
WELL
WOMEN'S GARDEN
WOODPILE
HANGAR, GWA
MANGO ORCHARD.

Hibiscus, which serves as a border crop between millet or peanut fields, is used to make a common spice for Maninka foods.

Few of these fields are fertilized or farmed intensively. Cotton is commonly the only crop grown with the benefit of commercial fertilizer; few villagers grow cotton on a regular basis. The traditional agricultural cycle is gradually changing as a result of the introduction of plows, donkey carts, and cotton. Few villagers, however, add even simple cow manure fertilizer to their fields.

Villagers are aware that plowing leads to increased rates of nutrient depletion. Some farmers have resorted to adding manure to combat this effect. The fallow cycle varies from 5-15 years depending on a number of conditions. Fallow fields are prime shea nut and fuelwood collecting areas. Women may also gather wood from areas where soils are too poor to support agriculture.

The major crops grown by the Maninka are millet, sorghum, fonio, corn, peanuts, and cotton. Women also grow rice in the flood plains when rain is adequate. Maninka farmers select their crops depending upon rainfall and soil conditions. Sorghum is the most extensively cultivated grain but families usually grow several different grains. Families hedge against possible insufficient rainfall and the failure of one or more crops. During successive years of drought farmers may resort to planting millet in the depressions instead of rice, counting on lower rainfall. Mangoes are an increasingly important tree crop. In some villages, such as Sindala, mango orchards have expanded dramatically in the past 30 years. Other fruit trees grown include

tamarind, guava, orange, and lime.

There is a strong gender division of labor among the Maninka that includes a system of separate economic and social responsibility. The male head of the extended family manages the family farm. Men are responsible for growing the major food crop, millet or sorghum on this land. Women grow peanuts, rice, okra, hibiscus, and a small amount of millet on separate plots.

Women are given a peanut field to farm by their husband. Men are required by custom to clear fields and harvest peanuts for women. Most field work--clearing, planting, weeding, and harvesting--is performed with simple hand tools including hoes, knives, and axes. Some women pay male plow owners to turn their fields for them, usually costing them 3000 cfa as payment. Women's inability to access agricultural technology severely limits their productive ability, however, men also have difficulty gaining access to plows. A notable feature of this region is the existence of only 445 plows among 17,045 men (Diallo 1994).

Women's domestic duties--cooking, pulling water, collecting fuelwood, and caring for children--impose time limits on their agricultural potential. Women also spend a significant amount of time collecting shea nuts, a process that overlaps with the planting period. Some women will leave the village before dawn with flashlights to collect these valuable nuts when the tree is in the nut bearing stage.

Men and women farm both cash and food crops. Women consider peanuts their most important crop economically followed by rice. Women work principally on

their own peanut and rice fields. They also farm small vegetable gardens. They have no obligation to farm the men's millet fields. When women do work on men's fields they normally farm in groups for cash payment. The rate for one half day of women's work is 200 - 250 cfa.

Some agricultural practices are shared. Planting and harvesting may be done by both women and men. This often serves to lessen agricultural bottlenecks. For example, both men's and women's peanut fields are harvested by groups of men and women because the peanuts must be removed to prevent premature germination or before the earth completely dries out.

The flood plain is traditionally considered women's domain in dry-land farming regions. In these areas, women are often the only rice farmers. Rice is an important crop both economically and socially. It is the preferred food to offer special guests and at festivals. When rains are plentiful and rice harvests good, women may sell their excess rice.

Maninka women also grow vegetables in small garden plots--usually less than five square-meters in area. Some Maninka women farm vegetable gardens within the boundaries of their compounds. These small plots provide women with vegetables during the rainy months. The most commonly grown vegetables are for use in the sauce. These include tomatoes, onions, okra, squash, "ngoyo" (a bitter tomato), and several varieties of leafy vegetables. When women can access a reliable water source within the village compound they may continue upkeep on their gardens year round.

Frequently, however, women must leave the confines of the village huts to find a reliable water source for gardening.

Areas adjacent to flood plains often have high water tables and fertile soils, ideal conditions for gardening. After the harvest, women will repair the fences surrounding small garden plots bordering the flood plains and plant vegetables. Historically, women would spend the greater part of the day during the dry season working in the garden and washing clothes and dishes with water from the wells. Proper fence maintenance is critical because cattle and goats roam freely during the dry months and can ravage an unprotected garden in minutes. Vegetables are watered from shallow hand dug wells usually located in the gardens. Furthermore, vegetables are an important resource for women as they make up an essential element of the Maninka diet.

Household Economics and the Responsibilities of Women and Men

Among the Maninka farmers married women are responsible for providing the elements of the lunch and dinner sauce. The typical lunch sauce has a peanut base and contains chopped leaves from the squash or ngoyo plant. The dinner sauce is made up of okra, onions and dried fish. Gardens often provide these and other vegetables for the sauce.

Women's time requirements are most severe during the rainy season. Women will rise before dawn to make breakfast or leave the household to collect shea nuts.

Women then prepare the meals and/or draw water from a well or pump. After the breakfast porridge, men head to the fields while women remain behind to wash the dishes and prepare the next meal or to pound grain for the following day's meals. Women often leave the compound before 10:00 in the morning to take the men's meals to them in the fields. After eating, women will work in their fields until it is time to prepare the evening meal or until dusk. Women often return to the village with fuelwood and shea nuts. They combine several tasks since the walk to the field may be as much as 5 kilometers.

The Maninka society is organized around the extended family. In principle, the male head of household dictates the male division of labor. In practice, this responsibility is often given over to the eldest son in the compound. This man will decide who will perform the various tasks to be done in the field or around the household. Men are responsible for the upkeep of all private and public buildings in the village. They repair the roads and are involved in community construction projects such as dam building or well lining.

Individual males may be involved in a variety of income generating projects in addition to rain-fed agriculture. They plant orchards and gardens, practice trades such as blacksmithing, carpentry, and masonry, and are involved in small commerce. Some men also hunt wild game such as boar, fowl, rabbit, and various small mammals during the dry season.

The male head of the extended household is responsible for paying the taxes to

the state. He also may pay for school fees and some medical care. He provides the staple grain to the woman who will prepare the three daily meals.

Women arrange the cooking responsibilities around the "gwa", the Maninka term for kitchen. The gwa is composed of all women living in the same extended family. Cooking is done on a rotation basis. Each women in the gwa cooks in turn. A women will cook lunch, dinner, and the breakfast porridge from the grain provided.

The woman charged with cooking the meals for the day is also responsible for providing the condiments for the sauce. Depending on the size of the gwa, women may cook daily or as infrequently as once every two weeks. In addition to providing condiments for the meals, women are also responsible for purchasing soap, kerosene for lanterns, and household utensils. They may cover some of the costs of health care and clothing for children. Women also provide dowries for their daughters' weddings. During lean years when grain reserves are depleted, women may also be asked to contribute grain or cash to feed the family.[9]

Grain shortfalls commonly occur during the month of August. This month is referred to by the Maninka as the "kungo waati" or hunger period. During this time there are few avenues for earning cash for either men or women villagers. Grain

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[9]Both men and women claim they pay for items such as medicine and clothes for children. I have observed both men and women paying for medicine and clothing. The dynamics of the decisions made at the household level are complex and variable. It is rare however, for a man to contribute money to purchase condiments unless he receives a salary. Buying meat for a special occasion is an exception, as is the meat provided by hunters.

prices are also at a seasonal high. To purchase grain women will process shea nuts into oil and exchange the oil for grain at the market. In some cases, when the cost of grain is prohibitive, women will cook a dish composed of millet husk or peanut leaves and shea oil to feed their family. Women's only sources of income during this period are from shea oil sales and paid agricultural labor.

Maninka women cite rain-fed agriculture as their most important economic activity, followed by shea oil production. Small commerce and vegetable gardens also provide women income, particularly during the dry months (Leury 1989).

In the villages studied, peanuts are women's most productive crop followed by rice, if growing conditions permit. Shea nuts are collected during the onset of the agricultural season in June. The fresh nuts are often stored for future use but are also processed immediately after collection. Shea nut oil is the most important source of cooking oil in the area.

Social and Political Organizations

The village chief is the political leader of the Maninka village. This position is most often inherited by the oldest male in the village, but there are cases when younger men are chosen to play the active role of decision making. The chief (dugu-tigi) and his council--composed of the male elders from his same initiation group--work together to reach decisions on matters of concern to the entire village. All decisions on village community projects and expenditures pass through these leaders.

The Hunter Society is a traditional men's group. The organization allows people of any race to become members. Membership requires a pledge to follow the hunter honor code, followed by a period of initiation. Hunters meet frequently during the dry season to hunt and hold festivals. The hunters have recently organized at the national level.

The women also have a leader or "kuntigi", who along with the other women from her age group or "filan", make decisions concerning women's issues in the village. Each filan also has a leader and the group is called by her name. The government has attempted to formalize the women's association by creating a national women's party (UNFM). The party asks that villages elect a president and a cabinet. These positions are usually distributed among the members of the senior age group.

Maninka society is polygynous. Polygyny may reduce the amount of time women devote to labor intensive tasks such as food processing, fuelwood collection, cooking and other domestic chores. In theory this would allow women more time to spend on income generating activities (Grigsby 1992). Women also form informal work groups to reduce labor requirements. The importance of rainy season activities may provide some explanation for the existence of women's cooperative work groups.

Women in Mali and other West African countries organize themselves into informal groups in order to perform some of their more difficult and labor-intensive tasks. These informal groups are referred to as reciprocal labor exchange groups or rotating labor associations (RoLAS) (Grigsby 1992). In Maninka society these groups

are called "Kari." Kari groups are most often arranged around age but may also be formed around clan names, paternal village, or a combination of all of the above. Each group selects a leader and the kari is called by her name. They serve both social and economic functions in the Maninka society.

Kari work groups provide women with informal outlets for congregation and conversation and they may allow women to take advantages of scale. Tasks such as weeding and harvesting that must be done quickly during a critical time-period are efficiently managed by RoLAS. Maninka women also perform a variety of labor intensive tasks in kari groups, including fuelwood collection, shea nut processing, and peanut shelling.

Kari groups are also a women's protection against illness. If a woman is unable to weed or harvest a crop her kari will often perform the task for free. Kari groups also serve an important social function in Maninka culture. Kari groups will often organize to provide labor in men's fields in return for cash. Traditionally women provided this service in exchange for a gift of salt and meat for an end of the harvest festival. Today, most kari groups work for cash.

Traditional Milling Verses Diesel Machines

Grain processing and shea nut grinding are two of the most arduous and time consuming tasks Maninka women perform. Grain processing is primarily an unpaid domestic chore, although many women also process grain to sell in various forms. Oil

from shea nuts is used both in cooking and for income generation.

Most grain consumed in villages in Mali is processed in the traditional manner. This process involves three steps: threshing, dehulling, and grinding. Threshing--the removal of the grain from the husk--was traditionally performed by women but has now been almost universally taken over by men.[10] Formerly women threshed grain using a mortar and pestle. The current practice is to place the grain in a pile and to beat it with a heavy-headed stick until all of the grain is separated. Men usually perform this task in a large group. In some cases villagers will rent a truck and drive it over the grain repeatedly until separation occurs. Threshing machines have also been introduced into the region.

The first step in turning raw grain into an edible product is dehulling. This entails removing the outer layers of the bran. Sorghum and millet, two mainstays of the Maninka diet, contain tannin in the bran. Tannin is a bitter, slightly toxic substance that must be removed by dehulling.

Dehulling is universally a woman's task in Mali. It is most often achieved by pounding grain in a large, wooden mortar and pestle (see Appendix A for

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[10]Men perform the bulk of the labor required to thresh the grain at the end of the harvest. This allows for easy transport and storage to a granary in the village. Formerly, women threshed the grain before preparing the meals. Grain was stored in granaries in the fields. Some men explained that the reason they now thresh the grain is because one year a vandal burned all of the grain stores in the fields. Men decided it was necessary to guard the grain in the village. They threshed the grain first to make transport easier. Some older women feel that men took on this task to relieve women of this work.

photographs). Water is added to swell the grain, loosening it slightly from the bran. After pounding, the grain is winnowed or washed to remove the bran. This process is repeated several times to clean the grain thoroughly. After dehulling, the grain is usually placed in the sun to dry before being ground into the final product (Fischer 1990).

Grinding follows dehulling in the grain processing chain. The purpose of grinding is to reduce the size of the grain particles, making it easier to cook and digest. To pound the grain to the proper consistency women will remove it from the mortar and sift out the flour. Women usually serve meals requiring both the cracked grain and the flour during the day to simplify processing. Maninka women usually cook three meals per day: a porridge in the morning, a cracked grain dish called "nyen-nyen kini" for lunch, and a millet flour dish called "to" for dinner.

Dehulling and grinding are both considered laborious time consuming work by women. Grinding is usually thought to be the more difficult of the two tasks (Freudenberger 1988). Both grinding and dehulling machines have been introduced in West Africa.

Shea Nut Processing

Oil from the shea nut is the most commonly used cooking oil in the Manden. Shea oil sales are women's second most important source of income. Producing oil from shea nuts is a lengthy process involving many steps. Songs and celebration

frequently go along with the work.

Because of the difficulty of the task, women will often process shea nuts in groups of up to seven. Women will typically collect and store their own supply of nuts. Perhaps once a week, the group will get together and process a measured amount of one member's nuts. The next week they will process another member's nuts.

The shea were harvested, de-pulped, and dried. They were then stored or converted to oil. The oil extraction process involved decortation, pounding, grinding, cooking, whipping, skimming the oil, and storing (Hyman 1991).[11]

The process of grinding the nut is very difficult and has been the focus of technology development efforts. After the dried nuts have been roasted and the shells removed, they are pounded in a mortar into a powder. The pounded nuts are ground by hand with either a stone or a wooden roller on a flat stone supported over hot coals. The heat increases the amount of oil extracted. It also makes the task extremely arduous.

Mills and oil nut presses have been devised to eliminate this task. Mills heat the nut when grinding and can extract a greater percentage of the oil if done properly. This has had an influence on their rate of use and acceptance by women. When equipped with a powerful engine, grain mills can be used to grind both grains and nuts.

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[11]See Hyman (1991) for a complete description of shea oil making.

There are two principal types of motorized grinding mills in use in West Africa, plate mills and hammer mills. Plate mills are the dominant milling model found in Mali. These mills have two vertically oriented steel plates enclosed in a grinding chamber. One plate is stationary and the other is turned by the engine. Grain or nuts passed between the plates are cracked and ground into smaller pieces. The plates slowly wear down and need to be sharpened or replaced periodically (Fischer 1990)(see Appendix B for photographs).

A Brief History of Cooperative Milling Societies in the Manden

Kari groups form the basis for the establishment of women's mill societies. The first known cooperatively owned grain mill in the Manden belonged to the women in the village of Balandugu, located about 20 miles west of the capital Bamako. These women decided to form a cooperative to collect money in order to purchase a mill. The money was pooled and given to a man to harbor. When the women went to get the money to purchase a mill, the man had disappeared. The women eventually found a sympathetic American women and a local forestry agent who helped them purchase their mill. Stories of men confiscating women's savings and earnings involving mill projects are common (Unifem 1988).

When the women in the Maninka village of Sindala heard that women in the village Balandugu had acquired a grain mill they decided to form a cooperative to

purchase their own mill. They agreed to combine all of their traditional work groups into one large cooperative and farm peanuts to earn cash for a down payment on a grain mill.

After the women had successfully farmed peanuts together for several years, two men from Sindala were requested by the women to ask a Peace Corps Volunteer in a nearby village to help the women purchase a mill. The volunteer put the women of Sindala in contact with Youma Diallo, a representative of Oxfam United Kingdom. Oxfam agreed to provide the village with a loan for the mill because they had demonstrated their ability to organize into a group and save capital. The village women were required to produce a down payment. The men agreed to donate the benefits of their cooperative's millet harvest of two years to the women to help meet the down payment.

Shortly after the women in Sindala received their milling machine, women in other villages began forming cooperatives in the same fashion by combining traditional kari work groups into one large group. For example, the women in the village of Tabou formed a group that included all married women in the village. The cooperative is currently managed by the oldest women's kari in the village, "Saran Kari" named after the first leader of the group. Saran kari also includes two male members who were selected by the women.

Project 3AG under the direction of Youma Diallo managed all of the mills studied in this research. Project 3AG's approach to development programs is

participatory. There was input from the village organizations at all levels of the development process, including identification, execution, and evaluation of programs. Project 3AG's approach emphasizes the need to view village women as a whole, to examine all of the factors that affect their circumstances. Accordingly, the organization uses an integrated project model that works to improve different, yet interrelated activities in which women are involved. Projects implemented by Project 3Ag include improved wells, agricultural equipment, small dams, alphabetization classes, health and nutrition, grain mills, credit schemes, market gardening, and family planning (Diallo, 1992).

The basic principle of the organization is to assist the traditional women's associations in the villages in the promotion of their socioeconomic activities, supported by the men's hunter society. This includes the goal to strengthen these traditionally based women's and men's organizations. This is accomplished through providing loans to the women's associations for income generating activities and for the acquisition of time saving technologies (Diallo 1992).

A unique feature of the work of Youma Diallo and Project 3AG is the effort to involve men in women's development projects. Men are involved in operating and maintaining technology and in helping to facilitate meetings of the women's groups.

CHAPTER 4

FINDINGS

This research involved collecting data on women's activities, time allocation, income generation, access to resources, and diesel mill use in four Maninka villages. The data have been organized and presented in Activity and Access and Control Profiles according to the Harvard Analytical Framework (HAF). The data were then analyzed to understand the relationship between women's roles and responsibilities in the household and village and their ability to access additional resources to earn income to pay mill fees. In this manner, the study examined women's strategies for reallocating their time savings from using a labor saving mill to productive activities.

The Activity Profile for a Maninka village is presented in Table 1.[12] Many activities are seasonal. The Maninka yearly work calendar (Figure 1) shows how different women's and men's activities are distributed by season.

Interviews with women and the director of Project 3AG found that women have control over the proceeds from agriculture and all other economic activities. Women keep their own cash reserves separate from their husbands. Women are

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[12]The majority of this information was assembled using participant observation and informal interviews during the two and one half year period the researcher resided in the Manden. A description of this information can be found in the previous Background and Context Section. The profile was refined and additional information was collected during the three month research period.

TABLE 1: Maninka Village Activity Profile

Productive Activities	*Women*	*Men*
Agriculture		
Millet & Sorghum	x	xx
Peanuts	xx	x
Cotton		x
Corn		x
Beans		x
Rice	x	
Watermelon		x
Okra	x	
Hibiscus	x	
Agricultural Tasks		
Clear Fields		x
Plow Fields		x
Plant Crops	x	x
Weed Fields	x	x
Harvest Crops	x	x
Store Crops	x	x
Income Generation		
Cotton Sales		x
Millet Sales		x
Peanut Sales	x	x
Shea Oil Sales	x	
Vegetable Gardening	xx	x
Mango Orchards		x
Carpentry/Masonry/Metal work		x
Clay Pottery	x	
Paid Agricultural Labor	x	x
Gathering wild fruits	x	
Sale of Snack Food	x	
Reproductive Activities		
Household Activities		
Store and Pull Water	x	
Maintain/dig Wells		x

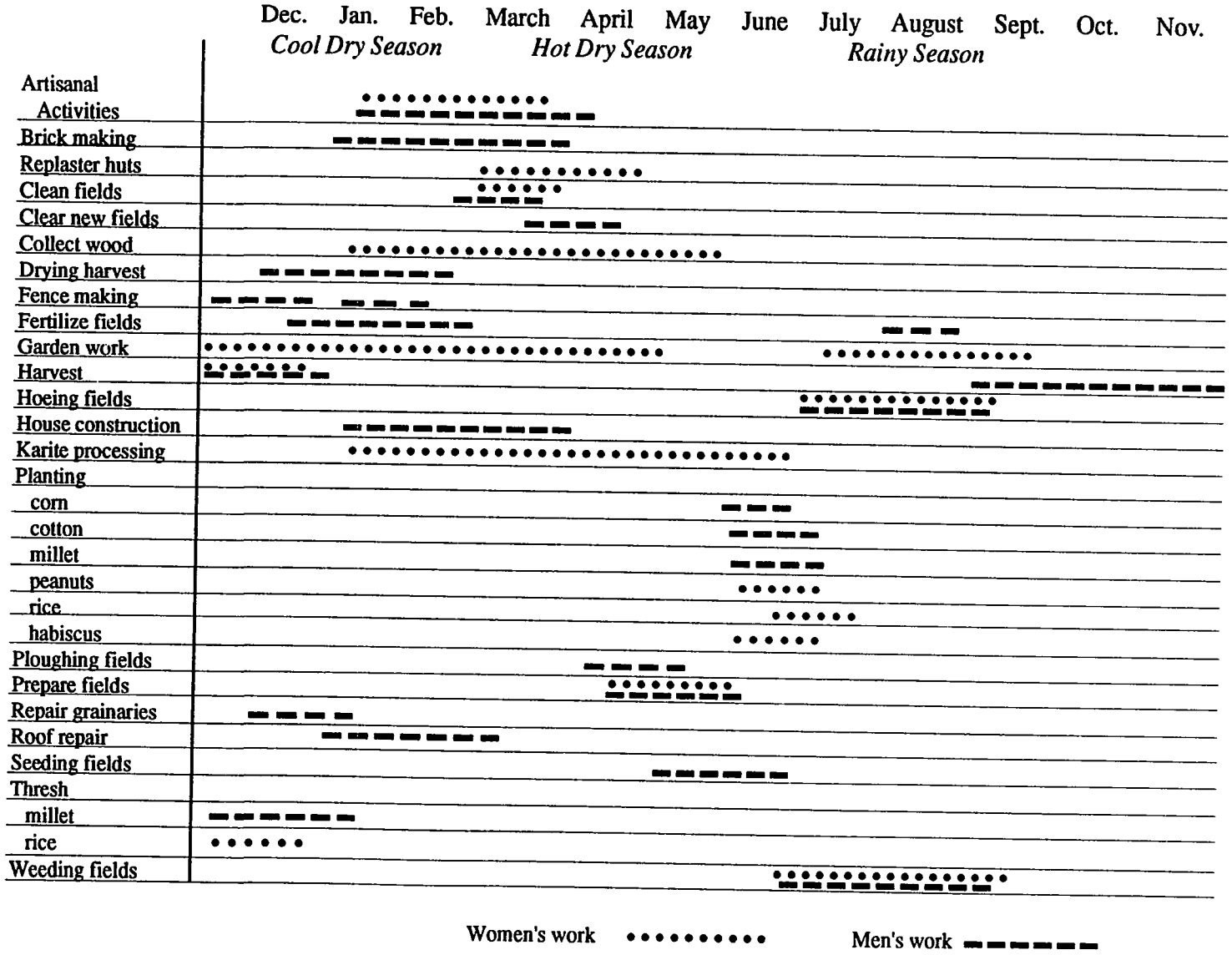
'xx' is used to signify dominant responsibility where both men and women partake in an activity.

Maninka Village Activity Profile (Continued)

Collect Fuelwood	x	
Childcare	xx	x
Cleaning/Washing	x	
Build/Maintain Structures	x	xx
Collect Natural Medicines	x	xx
Animal Care	x	x
Food Preparation		
Provide Grain		x
Provide Peanuts	x	
Thresh Grain		x
Shell Peanuts	x	
Store Grain		x
Store Peanuts	x	
Process Grain	x	
Process Peanuts	x	
Provide Sauce Condiments	x	
Cook Meals	x	
Family Responsibilities		
Pay Taxes		x
Pay School Fees		x
Provide Family Grain		x
Provide Family Sauce	x	
Provide Clothes	x	x
Provide Healthcare	x	x
Community Work		
Maintain Roads	x	xx
Maintain Community Buildings	x	xx
Projects: dams/pumps/health	x	xx
Weddings	x	x
Funerals	x	x
Dances	x	x
Village Meetings	x	x

'xx' is used to signify dominant responsibility where both men and women partake in an activity.

FIGURE 1: Maninka Yearly Work Calendar



responsible for providing all of the elements of the daily meal sauces--peanuts, vegetables, salt, and other condiments. They maintain access and control over important resources such as land, water, and forest products, primarily shea nuts. The HAF Access and Control Profiles (shown in Table 2) represent women's ability to access and control various resources.

This study found that agriculture is the main productive activity of the Maninka people in the study area; therefore, productive farm land is an important resource. Interviews confirmed that men control access to land but are required by custom to provide land to their wives. Men must also clear this land so that it can be used for agriculture by the women. Once women gain access to land, they maintain use rights as long as they continue to farm it. Women also control the proceeds from their own land.

The Consequences of Environmental Change

Interview data found that women's principal sources of income in the region came from the sale of two agricultural products, peanuts and rice, and from the sale of shea oil, garden produce, and snack foods. The relative accessibility of these important items varied considerably and depended upon the geography and natural resources of the village. These differences are represented in Table 3.

The differences between the availability and importance of resources in each village are functions of the local environment and the history of environmental change

TABLE 2

Maninka Village Access To Resources Profile

	Women	Men
Land		
Farm Land	Access & Control*	Access & Control
Garden Land	Access & Control*	Access & Control
Rice Farm Land	Access & Control	----
Credit		
Formal	----	Access
Non-formal	Access & Control	Access & Control
Technology		
Plows	Access	Access & Control
Mills	----	----
Carts	Access	Access & Control
Fertilizer		
Organic	Access & Control	Access & Control
Inorganic	----	Access & Control
Extension Services	----	Access

*Women have control over land once it has been given to them by their husbands or fathers.

TABLE 3

Resources Important to Women

(Ranked on a scale of 1-4, 4 being highest relative access)

	Water	Gardens	Rice	Farm Land	Wood	Shea	Market Access	Income Sources
Tabou	2	2	2	4	3	4	1	peanuts, shea oil
Sindala	4	4	3	1	1	1	4	peanuts, shea oil, rice, garden
Makandiana	1	1	1	2	2	2	3	Peanuts, shea oil
Keniero	3	3	4	3	4	3	2	rice, peanuts, shea oil

in the Manden. This study found that the reduction in rainfall in the region has negatively affected women's access to resources. The consequences of the drought have been different for women in each village.

The Manden villages of Sindala, Keniero, Tabou, and Makandiana are all situated adjacent to flood plains that provide excellent rice farming land for women when rains are adequate. According to interview results, women in these villages consider both rice and peanuts of equal social and economic importance. In years of high rainfall, rice is the most important crop. In drier years, peanuts play a more important role.

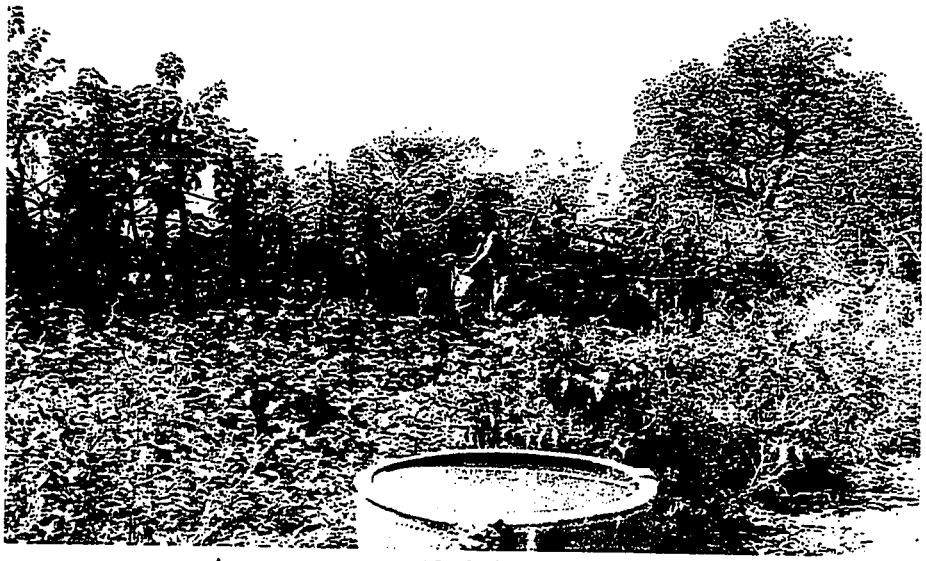
In Tabou and Makandiana, the drought has severely diminished women's ability to grow rice in the flood plains. It has also led most women to abandon the practice of vegetable gardening because wells have gone dry, collapsed, or become too deep to use for gardening.

The area near the flood plain in Tabou, where women used to garden, is littered with abandoned or collapsed wells, evidence of the gardens that existed 20 years ago (see photograph below). Women over 50 years of age recall a time when produce from the garden was available year round. At that time women spent much of the dry season working in gardens growing vegetables. Today most women in Tabou purchase vegetables at the market instead of growing their own.

In Keniero, Youma Diallo reported that women's rice harvests have diminished

An older woman explained how she used to garden in Tabou

A woman stands behind her mother's abandoned garden in Tabou



A young woman works in her garden in Sindala

as a result of the decline in rainfall. Women are still able to grow rice but with an unpredictable harvest. Project 3AG installed a small earthen dam in the flood plain in an attempt to increase women's ability to regulate and store water for rice production. Interviews and observation data from Keniero found that most women are still able to grow vegetables in small gardens despite somewhat lower water tables.

In Sindala the drought has not noticeably affected women's gardening or rice producing abilities. This is probably due to Sindala's location in a low lying area. During the rainy months the water table still rises to near the surface. Women were able to grow vegetables throughout the dry season.

Interview and observation data found that women in Keniero and Sindala grew onions, tomatoes, hot peppers, lettuce, gumbo, and a variety of leafy vegetables. The primary purpose of these gardens was to grow vegetables for use as condiments in the sauce for the daily meals. Some women in Sindala also sold their excess vegetables for cash in the nearby market town of Siby.

Environmental changes have forced women in the villages of Makandiana and Tabou to rely principally on the sale of peanuts and shea oil to meet the majority of their economic and food needs. Farming and shea nut collection are both rainy season activities. The loss of dry season gardening means that these women now have few productive activities available to them during the dry months.

Observation and interview results ascertained that women in Tabou have responded in two ways to the decrease in their ability to grow vegetables. They

purchased vegetables at the market or they substituted more peanut butter in the sauce to compensate for a lack of vegetables. Interviews with women in Tabou revealed that roughly twice as much peanut butter is required when leafy vegetables are not available. Women must ration their peanuts and shea oil carefully during the long dry season to insure they will have an income and food source that will last until the next agricultural season.

The drought was one factor that influenced change in women's access to resources. Lower rainfall levels reduced women's ability to use wells for gardening and to grow rice in flood plains. The activities of a local NGO, Project 3AG, also changed women's access to several resources. Project 3AG granted credit to the women's groups and helped them purchase a diesel grain mill and several ox drawn plows. Table 4 depicts how these developments have influenced how women allocate their time, and generate and spend income.

Mills Replace Hand Grinding

This research found that diesel powered grain mills in the Manden have been adapted to grind cracked shea nuts into a crude oil. The crude oil is then processed by the women who use it for cooking and for sale as an important source of income. The mill has eliminated the most difficult "grinding" phase of oil processing.

Mills are a labor saving technology. Women use them primarily to grind crushed shea nuts, millet or sorghum, and small amounts of peanuts. Women bring

TABLE 4

Maninka Village Access To Resources Profile Before and After the Women's Project

	Before Women's Project		*After Women's Project*
	Women	**Men**	**Women**
Land			
Farm Land	Access & Control*	Access & Control	Access & Control*
Garden Land	Access & Control*	Access & Control	Access & Control*
Rice Farm Land	Access & Control	----	Access & Control
Credit			
Formal	----	Access	Access & Control
Non-formal	Access & Control	Access & Control	Access & Control
Technology			
Plows	Access	Access & Control	Access & Control
Mills	----	----	Access & Control
Carts	Access	Access & Control	Access
Fertilizer			
Organic	Access & Control	Access & Control	Access & Control
Inorganic	----	Access & Control	----
Extension Services	----	Access	----

*Women have control over land once it has been given to them by their husbands or fathers.

their grain or nuts to the mill and pay a small processing fee to have them ground.

Women in the study villages have completely abandoned the traditional method of hand grinding shea in favor of machine grinding. Only women in hamlets located over seven kilometers from the mill site responded that they occasionally will grind shea by hand. Table 5 shows the revenues generated by the mills in three villages. Over 50% of the mill receipts from Sindala and 70% from Keniero were generated from shea milling rather than grain.

According to the records of Project 3AG, the Tabou mill receipts were 547,000 cfa for 1992. The expenses for that year were 288,000 cfa leaving a net profit of 259,000 cfa for the year. This profit, generated primarily by shea milling, enabled the women in Tabou to repay the loan for their mill in four years time.

Women in all four villages were asked why they preferred to use the mills to grind their shea. They gave four principal reasons: (1) grinding shea by hand is one of women's most arduous and time consuming tasks; (2) the mills heat the shea and allow a greater portion of the oil to be extracted; (3) the mill has allowed women to process all of the nuts they find into oil, formerly a portion of the nuts was sold in raw form[13]; and (4) the mill allows women to quickly produce oil from nuts.

To estimate where women reallocate their time savings generated by using the

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[13]According to a man who used to weigh shea nuts for sale, the amount of nuts sold during a particular year varied greatly and depended in part upon the amount of nuts produced. Since the arrival of the mills, unprocessed shea nuts are no longer sold at the local markets. Women earn a higher profit by processing the nuts using the mill and selling the oil than by selling an equal quantity of raw nuts.

TABLE 5

Revenues Generated By Mills
(1993 Data)

Village	Grain Milling Revenues (cfa)	Shea Milling Revenues (cfa)	Total Mill Revenues (cfa)	Year-End Cash On Hand
Sindala	189,215	209,440	398,655	828,181
Tabou	NA	NA	547,000	1,107,160
Keniero	191,160	456,775	647,935	851,570
Makandiana	NA	NA	NA	1,107,160

mill, women were asked what activities they undertook during the day while their shea was being milled at the machine. The four most frequent responses were wood collecting (50%), cooking (21%), washing clothes (14%), and processing shea oil (14%).

These responses were verified by observation in Tabou. The observation data were used to develop two different time allocation tables for women during the non-farming season. In the first column in Table 6, women's time allocation is depicted for days when she is responsible for cooking. The second column represents a non-cooking day. A comparison of these two columns shows that when they are not cooking, women devote approximately four hours per day to collecting wood. Furthermore, women were observed using most of their available time during the dry season to collect and stockpile fuelwood.

Payment for shea nut processing in Tabou Village was derived from three principle sources: revenue from peanut sales (53%), shea oil sales (35%) and snack food sales (10%). A common method of payment was to take a loan from the mill's cash box to be repaid after the sale of the oil. Women typically sell a portion of their oil and retain the rest for cooking meals or snack foods for sale.

Interviews and observations disclosed that another common practice was to pool resources to pay milling fees for one member of a group. Traditionally women process shea in small groups. Periodically, women gathered to process one member's shea nuts; each week equal amounts of shea were ground. This traditional form of

Table 6: A Maninka Woman's Daily Work Burden in the Dry Season

Hours	Cooking Day	Time	Non-cooking Day - Scenario 1	Time	Non-cooking Day - Scenario 2	Time
6am	Prepare breakfast	.75 hours	Pull and heat water for washing	1 hour	Pull and heat water for washing	1 hour
7am	Grind millet	1.5 hours	Take shea to the mill	.5 hours	Take Shea to the mill	.5 hours
8am	Start preparations for lunch	2.5 hours	Go to bush to collect wood	4 hours	Wash clothes	2 hours
9am	Cook millet and sauce	(1 hour)				
10am	Water garden/watch children	(1 hour)			Garden work	1 hour
11am	Serve and deliver food	.5 hours			Eat Lunch/rest	1 hour
12am	Eat/Wash dishes	1 hour	Eat Lunch/rest	1 hour	Collect wood	2 hours
1pm	Rest/help others with work	1 hour	De-hull millet	1 hour		
2pm	Sweep/ pull water	.5 hours	Shea processing (not milling)	2 hours	Cook a snack for children/childcare	1 hour
3pm	Begin dinner preparation	2.5 hours			Water garden	1 hour
4pm	Pull and heat water/wash children	(.5 hours)	Pull and heat water/wash children	1 hour	Pull and heat water/wash children	1 hour
5pm	Cook sauce and millet	1 hour	Sweep compound/prepare to eat	.5 hours	Sweep compound/prepare to eat	.5 hours
6pm	Deliver food	.5 hours	Relaxation	Evening	Relaxation	Evening
7pm	Relaxation	Evening				
Total		11.75 hours		11 hours		11 hours

Numbers in parenthesis represent two simultaneous activities

rotating labor has been modified to include a system of rotating credit. Each week the members of a group bring one woman's shea to be ground at the mill. Each member of the group contributes an equal portion of the milling fee.

Women are Selective When Milling Grain

This study found that the use of mills to grind grain varied significantly by village. In Tabou and Makandiana few women regularly used the mills to grind grain, while in Sindala and Keniero, a large percentage of women used the mill. Figure 2 shows a compares grain nut milling for Tabou, Keniero, and Sindala.

In Tabou the vast majority of grain consumed in the village was ground by hand. Only one woman brought grain to be milled on a regular basis.[14] Grain brought to the mill had three different end uses: the daily meal, resale as a snack food, such as millet pancakes, or personal consumption in the form of "bashi", a dry cereal snack.

Of the women who brought grain to the mill, only half brought grain for daily meals. These women frequently brought only a small portion, having processed the majority of their grain by hand. Women used the mill as a safety-valve when they couldn't finish their work by hand. Women who did bring grain for the daily meals usually said they were tired, sick, or had run out of time.

According to interview data, women's lack of adequate income was the main

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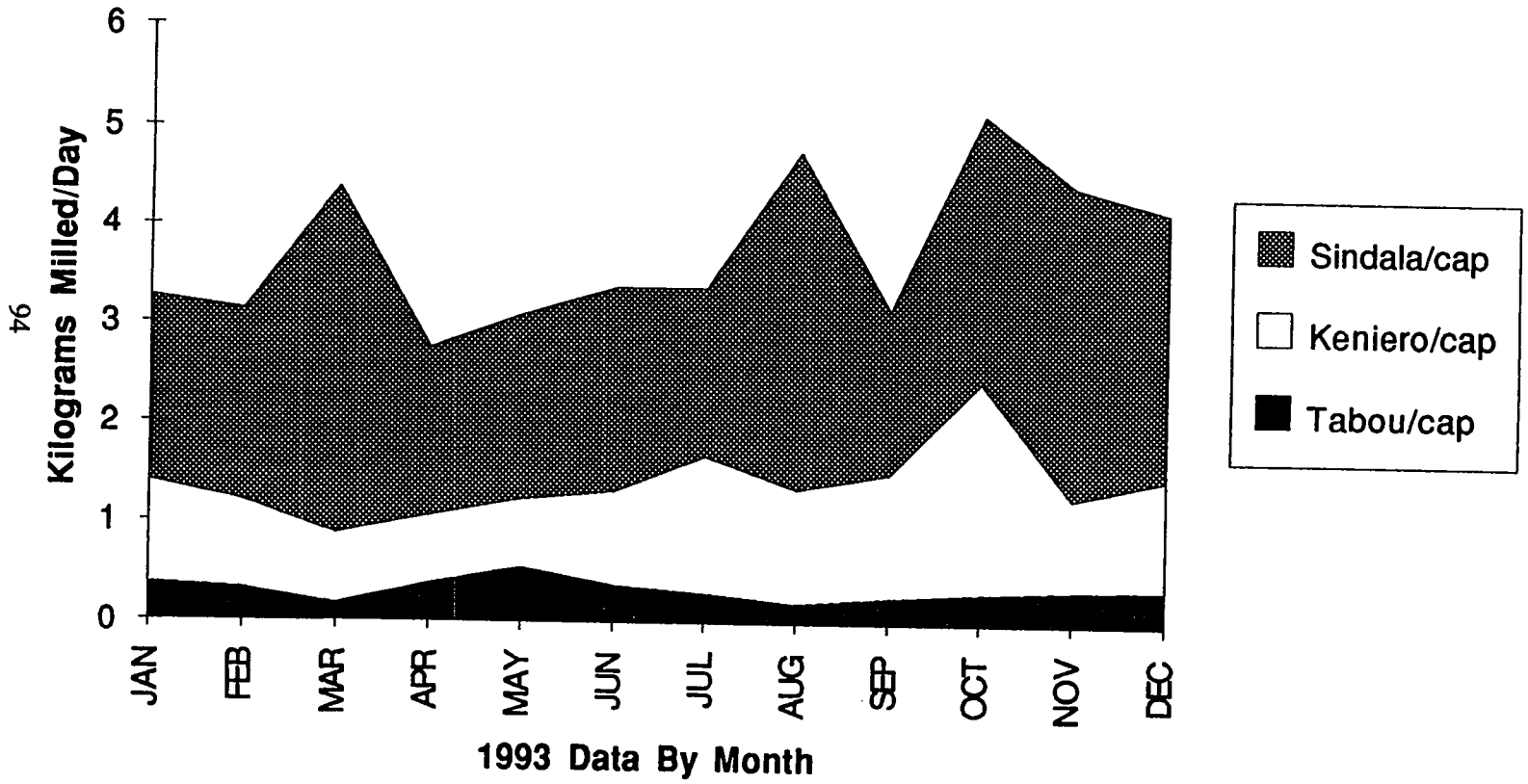
[14]The woman who milled her grain each day received money from her husband. He had recently been given a substantial sum of money from a relative working in France.

FIGURE 2: Per Capita Grain Milled



reason women in Tabou and Makandiana did not grind grain for meals at the mill. Most women interviewed in Tabou paid for milling fees with income from the sale of their peanut crop. Women sold a small amount of peanuts each week at the local market to finance weekly expenses such as vegetables and spices for the sauce and milling fees.

Women who ground grain at the mill to be resold as a snack food often paid the milling fee out of their profits from their sales. These women claimed that the mill produced a better quality, and larger quantity of flour and therefore it was worth paying to use the machine.

Women in the villages of Sindala and Keniero frequently ground grains for all three meals at the mill. There were lines of bowls of grain waiting to be processed at these mills each morning and evening. According to key informant interviews, most women in Sindala used the mill for grinding daily grain while in Keniero about 50% of the women used the mill with some regularity.

Dry Season Gardening is Compatible with Grain Milling

Gardening in Maninka villages was found to be a compatible activity with machine grain milling. In Sindala for example, women were observed leaving their grain to be milled in the morning or early evening while they went to water their gardens. Gardens are best watered in the mornings or evenings because of Mali's hot dry climate. When the women returned to the village they collected their milled grain.

In Sindala, women noted that their gardens had increased in size during recent times.

Increased Access to Plows Results in Larger Peanut Harvests

The plows purchased by the women's groups have increased women's access to plows. Plows were made available to women in the village at two-thirds the price of renting a private plow. They were also allowed to delay payment for use of the plow until after the harvest. The plows are used to turn the soil in the women's peanut and rice fields. Plowing peanut fields not only decreases the amount of time and labor women spend on weeding, it also loosens the soil, which improves the peanut harvest.

According to women interviewed in Tabou, the greatest constraint limiting their ability to increase their peanut harvest is their lack of time and inability to access plows. Men interviewed explained that they provide women with as much land as they can effectively farm.

A study conducted by Project 3AG substantiates the women's and men's claims. The study concluded that the availability of plows has improved women's productive potential. Women in the Manden village of Djulafundo were able to increase the area under peanut cultivation from 5392 to 9150 square meters after the introduction of both a grain mill and plows (Diallo 1994). The study also reported that women in Tabou had increased their peanut harvests.

This research found that women in the four villages studied earned income from four principal activities: rice and peanut farming, shea nut processing, and vegetable gardening. The degree to which women can grow vegetables is limited by the availability of water and land located near the village. In recent decades water tables have dropped, eliminating gardens in two villages.

Gardening is an important productive activity for Maninka women. Women use vegetables in the sauce they prepare for daily meals and they sometimes sell the surplus. Additionally, the study found that the price of vegetable greens for one day's meals is roughly equivalent to the cost of milling the grain for the day. Gardening was found to be a compatible activity to machine grain milling. Women can apply the time they save from grain milling by machine to gardening.

Women in all four villages use the mills to grind shea nuts into oil. Shea milling is the primary revenue generator for the mill societies in each village. Women were found to reapply their time savings from machine milling shea primarily to fuelwood collection. Additionally, women claimed that the mill produces a greater quantity of oil from the shea nuts. Finally, the combination of increasing women's ability to access plows and mills has enabled women to increase their peanut harvests.

CHAPTER 6

DISCUSSION

This study systematically examined the relationship between women's time allocation, income generation, and access to resources using the Harvard Analytical Framework (HAF). The purpose of this discussion section is to present women's strategies for reallocating their time after the introduction of a mill in their community. Women's access to resources, particularly land, water, plows, and group credit influenced their ability to undertake productive activities and benefit from the labor and time saving milling technology. Furthermore, this discussion illustrates that women's relative access to resources in the Manden is a function of both the gender roles and relationships of the household and the changing environment.

This discussion focuses on the findings from two villages, Sindala and Tabou. These villages have different resource bases and therefore, provide useful comparative case studies. They demonstrate how women's access to resources can influence mill use. Conclusions about gendered development can be drawn by comparing and contrasting the two cases.

Access to Resources Influences Women's Productivity

The purpose of the Project Analysis phase of the HAF is to determine the

activities that will be affected by a project and to predict how the issues of access and control relate to these activities (Overholt 1985). The HAF was used in this study to examine how access and control issues influenced women's time allocation and use of milling technology.

A comparison of women's access and control over resources before and after Project 3AG began working in the Manden villages was shown in Table 4. As a result of this project, women in all study villages have gained increased access and control over credit, plows, and a milling machine. The availability of agricultural land and reliable water sources also influenced women's ability to earn income. This affected how women integrated all of the elements of the project.

This research found that Maninka women's principal sources of income were from the sale of rice, peanuts, and shea nut oil; this confirmed the findings of Leury (1989). Tabou women's main sources of income were from peanut and shea oil sales. In Sindala women earned income from peanuts, rice, shea oil, and garden vegetable sales.

All women in Sindala have access to land and water for year-round gardening. The availability of water and the village's proximity to a market has resulted in the development of gardens as an important productive activity for women. Gardens provide the women of Sindala with a small but steady source of vegetables and income. The village of Sindala, however, does not have a large land holding. Sindala was exceptional in that much of the village's land is intensively farmed. Women were

often allocated space for gardens located inside the fenced areas of men's mango orchards.

The situation for Tabou Village is quite different. Tabou is one of the area's oldest villages. It has a large land holding. Except for the fields closest to the village, land is not farmed intensively. The recent decrease in annual rainfall in the region has severely hampered women's ability to engage in gardening or rice farming. As a result, women rely principally on peanuts and shea nut oil as their main sources of income and food.

Risk Affects Women's Choice to Use Mills

The relative availability of resources affects how women respond to risk. Risk is a function of a woman's ability to diversify her productive activities. It is an important factor influencing her choice to spend money on milling grain.

All Maninka farmers practice risk aversion by diversifying their crops. Nut production of the shea tree varies widely from year to year. Variations in rainfall can ruin rice or peanut crops. Women have adapted to environmental fluctuations by diversifying their activities. Women plant a variety of crops--some requiring more water than others--to hedge against variations in rainfall. In years when the shea tree produces a large crop, women will plant smaller fields and spend more time on shea nut collection. By performing a multitude of productive activities, women can minimize their risk.

It is worthy to note that peanuts, shea oil, vegetables, and other spices grown by women are both a source of nourishment for the diet and an economic asset. These items are frequently sold at the market or between individuals within the same village. Women often invest proceeds from a plentiful harvest in small farm animals, primarily goats. These animals serve as a women's savings and are sold in time of need. The combination of small animal husbandry, oil nut collection, peanut and rice farming, vegetable gardens, and wild spice and fruit collection provide women with a diversified economic base.

The loss of both rice and garden vegetables has created a difficult predicament for the women of Tabou. They have been forced into an increased reliance on unreliable harvests from rain-fed agriculture for their livelihood. Because shea nut collection also takes place during the planting season, nearly all of a woman's income is generated during this period.

A major distinction between women's productive activities in Tabou and Sindala was the periodicity and reliability of income generation. Sindala women, despite their smaller land holdings, generate small amounts of wealth from a variety of activities throughout the year. Women interviewed in Sindala believed that the women from Tabou were wealthier because they had access to more productive resources due to the abundance of land in Tabou.[15] But this study found that women in Sindala--

[15]The women in Tabou also felt that women in Sindala were wealthier. The village of Sindala has a greater number of metal-roofed huts--an important symbol of wealth--than Tabou.

who have a diverse base of productive activities that allows them to generate small amounts of income during the dry season--can use the mill for grinding grain more frequently than women in Tabou.

The finding strongly suggests that women from Tabou, knowing that their peanut and shea nut stocks must carry through the entire dry season, have become more averse to risk than women in Sindala. Risk aversion was, therefore, one reason women in Tabou were less willing to spend money on grain grinding than women in Sindala.

In her analysis of grain mill projects in Senegal, Freudenberger (1994) found that women require a steady source of income to be able to regularly access the grain mill. The findings of this research support her argument. A steady source of income, however, need not be generated by a single activity as Freudenberger suggested.

Gender Roles and Social Factors Influence Mill Use

Gender roles and responsibilities also influence a women's choice to pay to mill grain. The data on grain milling showed that women in Tabou were willing to pay to use the mill to grind grain when it was for personal use, such as for resale, but not for daily meals. Women bringing their own grain to the mill explained that they were paying to grind grain at the mill because it produced a finer quality and larger quantity of flour. Maninka social relations dictate that men are responsible for providing the grain for daily meals, but women must grind that grain. As a result,

women are not inspired to pay to stretch the grain for daily meals.

It is interesting to note that following the poor harvest of 1992, according to the Tabou miller, more grain was ground at the grain mill than in other years. He suspected that women used the mill to stretch the grain reserves when grain was scarce.

One can conclude from these results that some women are willing to spend money to grind grain or shea nuts when the product is for personal use but not for consumption by the extended family except in times of hardship.

Finally, there is another potential social factor involved in a women's decision making process. When women pay to grind their grain at the mill, they are not necessarily relieved of pounding grain entirely. Women often work in groups and cook on a rotational basis and may be required by custom to help other women pound grain by hand. The miller in Makandiana noted that women who cooked only for their own immediate families were more likely to pay to grind grain at the mill.

The Integration of Mills with Women's Productive Activities

Women are responsible for providing both the condiments and the milling fees. When short on cash, women will resort to grinding grain by hand rather than skimping on their sauce. In other words, women draw money for the sauce, and money to pay milling fees, from the same cash purse. This finding agrees with Freudenberger's (1991) results from Senegal.

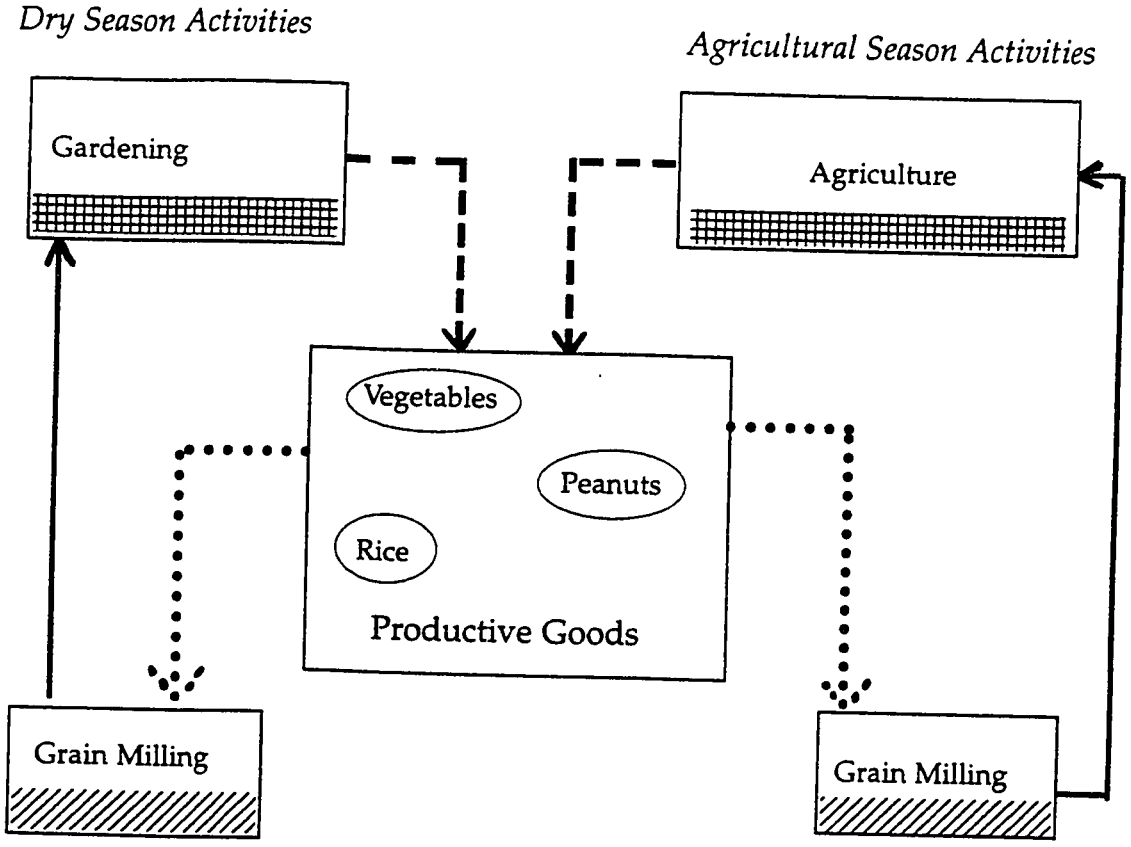
Gardens provide women with vegetables for their sauce. Proceeds from the sale of garden vegetables in Sindala also pay for part of grain milling fees. Even when women do not have surplus vegetables to sell, they can meet the important obligation of providing vegetables for their dinner sauce from their gardens without having to dispense any cash.

In Sindala, women left their grain at the mill in the morning and went to work in their gardens. Gardening was found to be a very compatible activity with grain milling. Women saved time by grinding their grain at the mill and then reallocated this time to work in their gardens. Women in Sindala have increased the size of their gardens over the past few years.

In summary, when women can grow their own vegetables for their sauces, they are more likely to use the mill for grinding grain. A comparison of grain milling data from Tabou and Sindala (refer to Figure 2) supports this conclusion. The relationship between changes in women's time allocation from grain grinding to gardening and their ability to earn income is represented by the time reallocation model shown in Figure 3.

These conclusions differ from those of Freudenberger (1991) who found that gardens were not a reliable income generating component of integrated grain mill projects. However, the Manden case differs from Freudenberger's in two important respects. First, gardens are a traditional women's activity in the Manden. They were not introduced by the project planners as a new income generating activity. Second,

FIGURE 3: Sindala Grain Milling and Time Realocation



the primary use of the gardens by Maninka women is to grow vegetables for their sauce, not for sale as was the case in Freudenberger's Senegal study. Freudenberger did not attribute a value to the vegetables women took from the garden for personal consumption. In the Manden, the value of vegetables women used in their daily sauce was not insignificant. In Tabou, it was roughly equal to the cost of milling a days supply of grain.

Changing Seasonal Work Loads in Response to the Drought

Vegetable gardening is one of the few existing productive activities women can undertake during the dry season. The loss of gardening resources in Tabou has meant that women must now purchase vegetables at the market. They commonly sell a small amount of their peanuts or shea oil to pay for these vegetables.

The following example illustrates how women have been able to alter their seasonal work patterns to compensate for the loss of gardening by increasing the time allotted to peanut farming. This example demonstrates how women in Tabou reallocated their time in response to the drought of the past two decades. More recently, women's use of diesel mills for shea grinding has allowed women to shift more of their domestic activities from the agricultural season to the dry season.

Women have shifted part of their work load from the rainy season to the dry season to allow more time for agriculture. They have done this by stock-piling fuelwood for cooking use year round during the dry season. Women in Tabou

estimated that they began stock-piling wood 10-15 years ago. Prior to this time women collected wood on a daily or weekly basis even during the wet season.

There are two hypothetical explanations for this change in the women's seasonal work schedule. The change occurred at a time that roughly corresponds with the onset of the drought. Perhaps women began collecting wood when the water tables fell to the point making gardening impossible. Or women may have needed to allocate additional time to food production because of drought-induced shortages.

It is also possible that the shift resulted from an increased scarcity of fuelwood as villages expanded and more land was cleared. Regardless, women now report that they aim to collect and store enough wood during the dry months to last through the harvest period (see photographs below). Women clearly viewed wood collection as a burden that limited their productive potential and they would ideally eliminate it from their rainy season workload. By shifting fuelwood collection to a dry season activity, women were able to allocate more time to agriculture, and to farm larger fields.[16] This study showed that women in Tabou reallocated time to fuelwood collection when they used the mill for shea grinding. Some women claimed that the arrival of the mill has allowed them to spend sufficient time on collecting wood in the dry season to gather enough wood to last through the end of the harvest.

An analysis of these findings leads to the hypothesis that the mill has allowed

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[16]This finding does not necessarily mean that women can produce more. Some women claimed they needed to farm larger plots to receive an adequate harvest as rainfall and soil fertility have declined.

A woman carries a load of wood back to Tabou during the dry season

Tabou women work together to stack wood during the dry season

women to reallocate time to agriculture by permitting them to allot more time to fuelwood collection during the dry season. Fuelwood collection is usually categorized as a domestic or reproductive chore. But in Tabou, women who reallocated their time from shea nut grinding to fuelwood collection essentially grant themselves additional time for rain-fed agriculture which is their most productive activity.

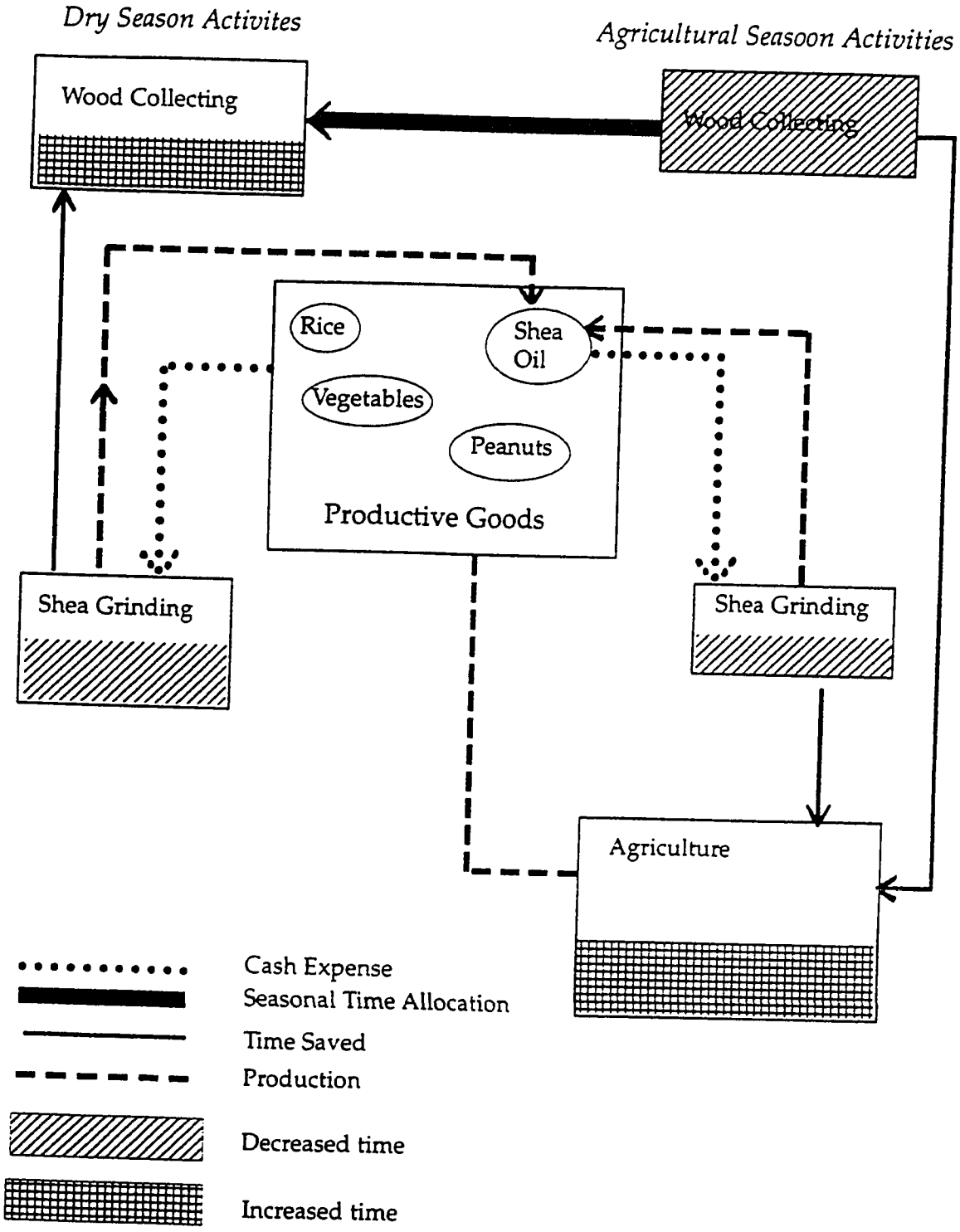
The time reallocation model shown in Figure 4 illustrates how women have been able to reallocate their time in Tabou when they used the mill to grind shea nuts. The model illustrates how this time can potentially be transferred into productive work during a different season.

This conclusion demonstrates the problem associated with depicting women's work as either a productive or a domestic activity. Studies cited by Carr and Sandhu (1987) may not have accurately evaluated changes in women's time allocation. Carr and Sandhu concluded that women in grain mill studies allocated time to domestic activities because they lacked access to resources for productive activities.

This study found that allocating time to a domestic activity during the dry season potentially increased women's productivity during the important agricultural season. Furthermore, Maninka women believe that time constraints and the lack of plows, rather than limited access to land, are the main restrictions on their productive potential.

The mills have helped women to increase their agricultural harvest in a second way. The shea nut tree bears its first fruit at the onset of the planting season. Women

FIGURE 4: Tabou Shea Nut Milling and Time Realocation



interviewed in Tabou said the mill allowed them to rapidly grind shea into oil. The proceeds from the sale of this oil enable them to purchase additional seed for their peanut fields. This completes the link between women's time savings and their ability to increase their productivity.

CHAPTER 7

CONCLUSIONS AND APPLICATIONS

According to Carr (1978) the original logic behind introducing labor saving technologies to women was to reduce their domestic workload, thereby allowing them to spend more time generating income and improving their well-being. Increased income would further allow women to gain access to more labor saving devices and equipment. The process would be self sustaining and vastly improve women's lives. After examining data from later studies, however, Carr and Sandhu (1987) concluded that providing women with technology alone did not solve their problems. Women required access to additional resources such as land and credit to earn income to benefit from technology.

This research used the Harvard Analytical Framework to examine the resources most important to Maninka women for increasing their productive work. These included land for agricultural crops and gardens, plows for increasing the amount of land farmed and the quantity of peanuts harvested, and water for gardens. The study also found that shea nut oil provided an important source of income for women.

This research demonstrated that women's ability to access important resources, to control their own incomes, and to choose where they allocate their time were crucial factors influencing the success of women's mill projects. That fact that Maninka

women had control over the products of their own agricultural labor was particularly relevant to their ability to reapply time and labor savings to productive activities. An analysis of the research findings produced two simple models that illustrated how Maninka women were able to reallocate time to productive activities when they were able to access to resources.

This study found that the HAF can play an important role in predicting the outcome of a mill project intervention. For example, the HAF can be used to assist project planners to understand who in the household is responsible for providing the staple grain. In West Africa, where men often provide the grain, women will be less likely to pay for milling services because they cannot capitalize on the grain savings derived from mechanical milling.

Freudenberger (1994) found that most grain mills in West Africa failed because an insufficient number of women could afford to use them on a regular basis. The results from this study show that when mills are used to perform more than one function, such as grinding both grain and oil nuts, they can generate a profit.

Planners of future mill projects should determine all potential uses of a mill before it is placed in a village. In areas where mills can be used only for grain grinding, careful consideration should be taken to determine whether women can earn adequate income to use the mill and whether the local population is sufficient to financially support it.

This researcher suggests that a viable strategy for improving women's income

should begin by analyzing their work calendar and existing income generating activities. Next, the potential for improvements in these traditional areas should be determined before introducing a new income generation component, such as a market garden. Because any productive activity in Africa is subject to the changing availability of resources due to local environmental conditions and national and international economic policies, diverse sources of income would be preferable to a single source.

This research found that in the Manden region plows and wells for gardens complement grain mills. The plows improved women's agricultural productivity. Furthermore, the introduction of the plows in combination with a mill resulted in a dramatic increase in the area of peanuts cultivated by women.

The study also demonstrated the important social and economic role of gardens in the Manden. The research concluded that women with gardens are more likely to be able to use mills to grind grain because they can grow their own vegetables. Therefore, a potential integrated mill project could include wells or pumps for women's gardens. However, as Freudenberger has demonstrated, it is important to remember that gardens are not always compatible with mills. It would be necessary to predetermine if women have access to land for gardening and to understand whether the gardens will provide vegetables for consumption or sale or both.

A comparison of two efforts by women in Tabou to establish gardens around new water sources illustrates some relevant issues pertaining to women's access and

control over land. In the first case, an Italian development agency installed three deep water wells with pumps in Tabou in 1989. Women initially erected fences next to the pumps, fertilized the soil, and planted gardens. A few years later, however, the man who controlled the land plowed under the women's gardens and planted his land with millet. It was found that the man had never been consulted by the development organization concerning the use of his land.

In a second example from 1994, a local NGO donated materials for constructing four wells for gardening. Both men and women were consulted during the investigative phase of the project. A man donated a piece of his land for the garden and both women and men were provided plots for gardening. Men constructed a fence around the land and dug the wells. Women supplied the food for the workers each work day. Garden plots were cleared by groups of men and women but their use was controlled by individuals.

This example serves to demonstrate the importance of women's need to control certain resources. It shows how control is often a function of the interactions and relationships between men and women. Development organizations, no matter how well intentioned, must be careful how their projects affect these gender relationships.

Whitehead's (1992) work on gender roles and household economics in African societies demonstrated that the gender based division of labor creates a need to exchange goods and services within the family. According to Kabeer (1994), these gender relations are a key factor in determining the division of resources and

responsibilities between men and women in villages.

In the context of the Maninka social system--where women control the proceeds from their own agricultural labor--the conflict described in Sen's (1990) model of cooperative-conflict is over access to agricultural resources. This study found that men only allocate the amount of land a woman can effectively farm with a simple hand-held hoe. Most of women's productive wealth--including a considerable amount of income for their personal expenses--is generated from land granted to them by men. Furthermore, the social contract between women and men requires women to provide a portion of the food and to purchase various commodities.

Research on gender in Africa frequently concludes that women cannot gain access to additional resources, particularly farm land, because men control them for their own use. The results from this study demonstrated that Maninka men were willing to allocate additional farm land to women. It revealed that women's productive ability was limited by time constraints and access to plows not access to land. The men interviewed wanted their wives to farm larger parcels because they would benefit from their wives increased productivity.

This finding supports Kabeer's (1994) notion that examining access and control over resources alone is not sufficient information for planning development projects for women. In particular, women's ability to gain access to additional quantities of resources must be examined as a function of the social relations in the household and village. Since control over resources has been traditionally held by

men, women's ability to gain access to them has been limited to what men were willing to allocate.

In this regard, as Kabeer has suggested, the HAF is not sufficient for determining project outcomes because it takes a static approach to resource analysis. It excludes an analysis of gender relations and obligations that could help to determine how the cooperative-conflict over resource allocation will proceed after a new technology has been introduced.

The conventional Women in Development approach has attempted to improve women's well-being without factoring men's position. Men's interests are rarely considered when planning women's projects. Project planners and managers often fear that men's involvement will lead to male takeover of the decision making process and of the benefits a project provides. But avoiding male participation has negative consequences as well. As Kabeer (1994) noted, the conflicting aspects of gender relations derive from the fact that men also have strategic interests that may be diametrically opposed to those of women. This is the reason the Tabou man took back his land and plowed under the women's gardens. It is the primary reason for men's resistance to redistribute resources to women and for the failure of many women and development projects.

A thorough understanding of the gender roles and relationships of a society is, however, a daunting and complex undertaking for any development organization. It would require a great deal more time and expense than most organizations can afford

to spend. The most efficient way this researcher can recommend for the gathering information sufficient to evaluate women's project outcomes is to involve both men and women in the planning process.

The diversity of gender roles and relationships in West Africa means that careful gender analysis is required before capital intensive undertakings such as diesel mill projects can begin. The HAF can provide useful information for planners seeking to understand whether a mill project will be sustainable in a given environment. However, a gender analysis involving both men's and women's participation is crucial to understanding how resources will be reallocated after the implementation of a mill project.

The success of the work of Project 3AG reflects an effort to solicit the men's participation along with the women's in each step of the development process. By instilling the men's involvement in the process of empowering women, Project 3AG avoided much of the conflict that arises out of the conventional "women's only" development approach.

This study has shown that technologies such as diesel mills can potentially benefit many women in West Africa. But, without men's involvement in the analysis process, project planners will not fully understand the underlying gender relations, roles, and responsibilities of the communities they wish to help. Without this knowledge, technology interventions designed to empower women to improve their own condition will continue to fail.

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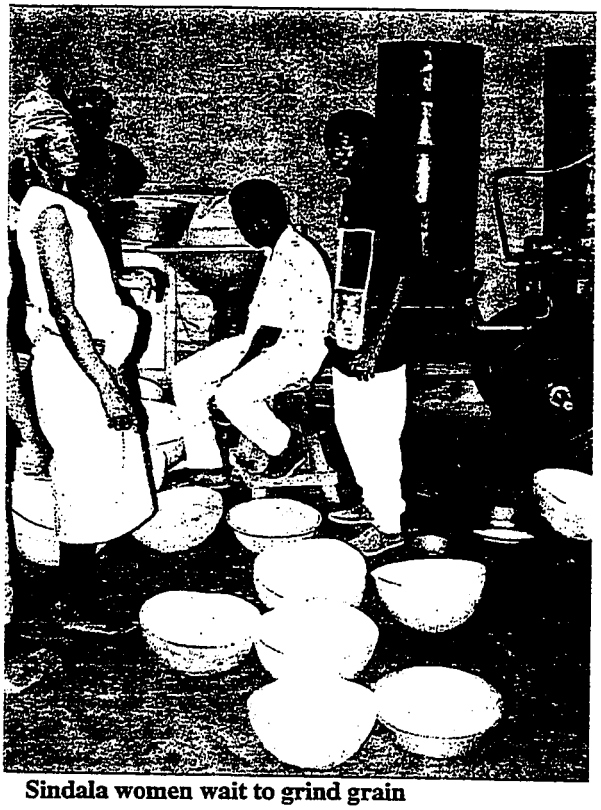
APPENDIX A: Photographs of Women's Hand Tools

Women often process grain in groups with mortar and pestle

The hoe is women's most used farming tool

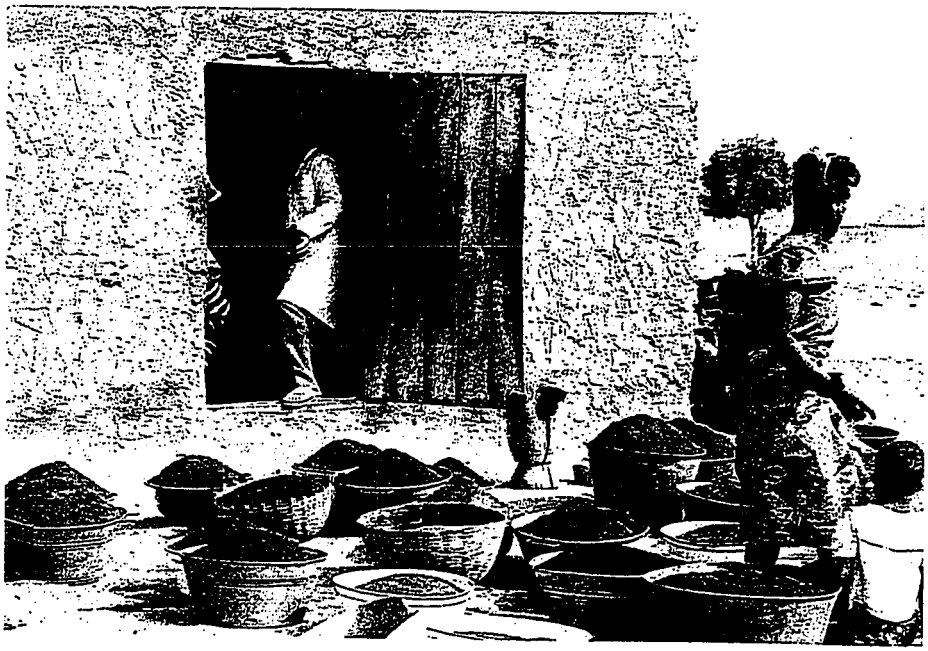
Peanut butter is ground on a flat stone

APPENDIX B: Photographs of Milling Machines in Use



Sindala women wait to grind grain

The Tabou mill grinds shea nuts



Baskets of cracked shea nuts await milling in Tabou

APPENDIX C

List of Frequently Asked Interview Questions

1. What are you milling today?
2. Why are you using the mill?
3. How did you earn the money to pay mill fees?
4. What do you plan to do with the grain/shea after it is milled?
5. Will you sell your shea oil?
6. What will you purchase with the proceeds?
7. How do you make money?
8. Did you use a plow in your field?
9. What will you do while your shea is being milled?
10. What prevents you from growing more peanuts?
11. What are your most important sources of income?
12. How many children do you have?
13. How many women in your cooking rotation?
14. How do you pay for cooking ingredients? How much do you spend?
15. What crops did you farm?
16. What family expenses do you cover? What does your husband pay for?
17. What garden vegetables do you grow? Do you sell them?