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LOCAL PRODUCTION OF APPROPRIATE TECHNOLOGY
FOR RURAL WOMEN *

Prepared by the

Unit for the Integration of Women
into Industrial Development

* This document has not been edited.

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Abbreviations

ACMD	Atelier de Constructions Métalliques Diverses
ACREMA	Atelier de Construction et de Réparation de Matériels Agricoles
ADAMA	Association des Ateliers de Matériels Agricoles
AFN	Association des Femmes de Niger
APICOMA	Atelier Pilote de Construction de Matériel Agricole
ATI	Appropriate Technology International
CEEMA	Centre d'Enseignement et d'Expérimentation du Machinisme Agricole
C.DERMA	Centre de Développement Rural et de Machinisme Agricole
CILLS	Comité Interrégional de Lutte Contre la Sécheresse au Sahel
CMDT	Compagnie Malienne pour le Développement des Textiles'
CNEA	Centre National d'Équipement Agricole
CNPAR	Centre National de Perfectionnement d'Artisans Ruraux
CRPA	Centres Régionaux de Promotion Agro-Pastorale
DGCF	Direction Générale de la Condition Féminine
DMA	Division de Machinisme Agricole
DNACoop	Centres Régionaux de Promotion Agro-Pastorale
DNAS	Direction Nationale des Affaires Sociales
EEC	European Economic Community
E.MA.MA	Entreprise Malienne de Maintenance
FAO	Food Agricultural Organization
FEER	Fonds de l'Eau et de l'Équipement Rurale
GDP	Gross Domestic Product
GIPATO	Groupement Inter-Professionnel des Artisans du Togo
GNP	Gross National Product
GTZ	German Agency for Technical Co-operation
IBE	Institut Burkinabé de l'Énergie
IFAD	International Fund for Agricultural Development
ILO	International Labour Organisation
IMF	International Monetary Fund

MECMA	Société Malienne d'Etude et de Construction de Matériel Agricole
NFLS	Nairobi Forward-Looking Strategies for the Advancement of Women
NGO	Non-governmental organization
ODEM	Opération de Développement de l'Elevage de Mopti
OPEN	Office de Promotion des Entreprises Nigériennes
PROCELOS	Programme Régional de Promotion des Céréales Locales au Sahel
SIDFA	Senior Industrial Development Field Adviser
SMECMA	Société Malienne d'Etude et de Construction de Matériel Agricole
SOCABE	Société Coopérative des Agriculteurs de Bérégaougou
UFB	Union de Femmes Burkinabé
UNC	Union Nationale de Coopératives
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNFM	Union Nationale des Femmes du Mali
UNIDO	United Nations Industrial Development Organization
UNIFEM	United Nations Development Fund for Women
UPROMA	Unité de Production de Matériel Agricole
USAID	U.S. Agency for International Development

I. PREFACE: ORIGINS OF PROJECT

Women are the main food producers in Africa. They spend long hours on various tasks related to food production: subsistence farming, transformation of foods, milling of cereals, transport of water and wood, etc. Many studies have shown that women in rural Africa work consistently longer hours than men on more labour-intensive chores. Their access to inputs - equipment, credit, extension services, etc. - is, however, considerably less than that of men, towards whom technical assistance efforts have been almost exclusively oriented.

The development of appropriate food processing technologies for women is a primary objective for any policy designed to integrate women in development, aiming both to alleviate women's daily work and to contribute to the generation of income for women.

The Nairobi Forward-Looking Strategies for the Advancement of Women (NFLS) particularly emphasize the importance of developing appropriate labour-saving and income-generating food processing technologies for women: 'Rural women's access to land, capital, technology, know-how and other productive resources should be secured. ... Appropriate food-processing technologies can free women from time- and energy-consuming tasks and thus effect improvements in their health. Appropriate technologies can also increase the productivity and income of women, either directly or by freeing them to engage in other activities. Such technologies should be designed and introduced, however, in a manner that ensures women's access to the new technology and to its benefits and does not displace women from means of livelihood when alternative opportunities are not available. Appropriate labour-saving technologies should utilize local human and material resources and inexpensive sources of energy. The design, testing and dissemination of the technology should be appropriate also to the women who will be the users.' (para. 184)

The United Nations Industrial Development Organization (UNIDO) is requested both by the United Nations System-Wide Medium-Term Plan for Women and Development (E/1987/52) for the period 1990-1995 and by the UNIDO General Conferences' decisions to contribute to the fulfillment of the NFLS. Within its sector of activity, UNIDO gives priority to the development and manufacture of improved labour-saving agricultural and food-processing technologies appropriate to women's needs and means. In this effort, UNIDO has been co-operating with the United Nations Development Fund for Women (UNIFEM) and the International Fund for Agricultural Development (IFAD).

Specifically, UNIDO proposed to take advantage of workshops established with UNIDO assistance for the development and production of appropriate technologies for women. In the spring of 1988, UNIDO conducted an exploratory mission to four West African countries: Burkina Faso, Mali, Niger and Togo. The mission was instructed to: survey tools and implements most widely used by women in agricultural production and food processing, to propose improvements in the design of such tools and implements likely to be accepted by and within the purchasing power of women; to look into the possibility of local production of improved equipment by local blacksmiths and by workshops established with UNDP/UNIDO assistance; to assess any technical assistance requirements of these workshops; and to prepare a plan of action encompassing design, prototype development and batch-level production of tools and implements as well as the development of socio-economic support measures.

The mission team, which spent three weeks in each of the four countries, comprised a mechanical engineer and a sociologist, who were funded by UNIFEM, and a food technologist financed by IFAD. 1/

To follow-up on the proposals of the team, and to formulate plans for the next project phase, a second mission to Burkina Faso, Mali and Niger was jointly organized by UNIDO and IFAD in December 1988. It comprised of an IFAD-funded engineer and staff from the Unit for the Integration of Women into Industrial Development, UNIDO. 2/

The two exploratory missions provided UNIDO with material for a project document entitled 'Local production and dissemination of improved cereal processing equipment - pilot project'; this has been submitted to UNIFEM and IFAD for funding.

The present final report consolidates the findings of the two exploratory missions. It incorporates the main conclusions of the four country reports prepared on site during the first team's stay in each nation, the individual consultants' reports, and relevant studies and statistical data. The report was prepared by Corinna Küsel, associate expert with the Unit for the Integration of Women into Industrial Development, who also took part in the second exploratory mission, in co-operation with Nancy Hedin, intern with the Unit.

1/ The mission members were Adama Doukouré, sociologist, and Michael Walsby, mechanical engineer, (both funded by UNIFEM), and Philippe Bauchau, food technologist, (funded by IFAD).

2/ The members of the second mission were Edoardo Guadagni, engineer, (funded by IFAD) and Corinna Küsel, associate expert, (funded by UNIDO).

The report first provides an overview of the main characteristics of the countries surveyed, outlining in particular the specific problems and constraints they have in common.

The next chapter summarizes the findings of the two missions, analyzing in specific the main obstacles encountered during the development and introduction of appropriate technologies for women. The major conclusion drawn from this analysis is that the lack of careful consideration of socio-economic conditions and the failure to introduce appropriate support measures are more serious weaknesses than technical failings in this process.

Next comes a survey of some of the main food processing technologies used by rural women, examined in terms of appropriateness to local conditions, of need for improvement and possibilities for local reproduction. As activities related to cereal processing are among the most strenuous daily chores of rural women in West Africa, they will be the major focus of this chapter.

Then follows - on the basis of the main conclusions pointed out in chapter III - an outline of the main support measures required in order to avoid the shortcomings described and to ensure women's access to the technologies introduced and to their longterm benefits.

Chapter VI outlines the project proposal which has been developed, entitled 'Local production and dissemination of improved cereal processing equipment'.

The text is concluded by final remarks on rural women and development.

The annexes comprise: analyses of the production sites and workshops which were reviewed for their capacity to locally produce improved equipment; a survey on the existing infrastructure with regard to Government institutions and other support services; a summary of other initiatives reviewed by the first mission; and a list of persons and institutions visited.

II. CHARACTERISTICS OF COUNTRIES SURVEYED

The four countries surveyed have in common that they are among the poorest in Africa, lacking raw material endowment and vulnerable to the harsh weather conditions of the Sahel. Three of the countries (Burkina Faso, Mali, Niger) are also seriously handicapped in their development by their landlocked position in the desert Sahel region. The majority of their populations depend on agriculture, and subsistence farming accounts for a high percentage of land under cultivation.

Agricultural production is limited by generally unfavourable climatic conditions, inadequate water supplies and poor, badly eroded soils. All of the countries suffered considerably during the Sahel drought 1968 - 1974, and were also adversely affected by the renewed droughts of the late 1970s and early 1980s. The continued drought of recent years has undermined achievement of self-sufficiency in food production which, after the heavy rainfalls of 1988, again appears possible.

A brief statistical survey of some of the most important characteristics of the four countries follows: 3/

In Burkina Faso, approximately 80% of the population (total population is presently over 8 million) depend for their livelihood on the predominantly subsistence-oriented agricultural and livestock sectors of the economy (accounting for about 43% of the country's GDP). Agricultural development is limited by lack of water supply and heavy soil erosion. The main staple crops are rain-fed millet and sorghum; cash crops are chiefly cotton, groundnuts and sesame. There have been important Government investments to build up cash crop production. The manufacturing sector, which is still rudimentary, focuses mainly on food processing. It accounted for 14% of the country's GDP in 1984. In general, all sectors of the economy are constrained by the country's limited resource endowment, the difficult climatic conditions, the scarcity of roads, and the long distance to seaports. Foreign trade is characterized by a chronic and substantial deficit, which is only partly offset by remittances from emigrants and foreign development assistance.

Large numbers of Burkinabé leave the country to take up seasonal employment in neighbouring nations, in particular in Côte d'Ivoire and Ghana.

In Mali (the second largest country in francophone West Africa, with a population of approximately 8 million), the great majority of people work in agriculture as well, producing around 45% of GDP. Millet and sorghum are mainly produced at a subsistence level. There are two chief areas of rice cultivation: the inland delta of the Niger, and the 'Office du Niger' irrigated scheme in the Ségou region. The 'Office du Niger' is one of a number of key state-run schemes in the agricultural sector. Export crops are mainly cotton and

3/ The following figures were taken from Africa South of the Sahara 1989 (Europe Publications Limited; London; 1988), and the Country Profile (the Economist Intelligence Unit; London; 1987-1988 for Burkina Faso and Niger; 1988-1989 for Mali and Togo).

groundnuts; they are also promoted in specific zones under the aegis of special agencies, in particular the 'Compagnie Malienne pour le Développement des Textiles' (CMDT). The manufacturing sector's contribution to GDP - an estimated 7% in 1983 - is largely dependent on domestic agricultural production for its raw material base, e.g. raw cotton. The economy as a whole is highly dependent on the state of the agricultural sector, and the stable growth of production there is a precondition for growth in manufacturing.

Niger, another landlocked Sahelian country, is the largest state in West Africa, with an estimated population of 6.7 million. Despite its uranium resources, Niger is one of the poorest countries in the world. The most important economic activity is agriculture, which employs over 90% of the population and contributes close to 50% of GDP. It is also mainly subsistence-oriented, the main food crops being millet and sorghum; most important cash crops are groundnuts. Livestock rearing, the second source of foreign exchange earnings after uranium, was also severely affected by the droughts. The slump of the uranium market in conjunction with repeated droughts has caused severe crises in the economy. The structural adjustment programmes implemented by the Government to address Niger's severe economic problems have as a major goal the strengthening of the agricultural sector. The Government also plans to divest itself of control in several of the country's largest enterprises, and will shift emphasis to small-scale versus large-scale manufacturing. Manufacturing, almost exclusively in the form of processing of agricultural commodities, accounted for less than 2% of GDP in 1986. Industrial development is also adversely affected by strong competition from imports, aggravated by the largely unrecorded and not import-taxed cross border trade. In particular, the long frontier with Nigeria and the unconvertibility of the Nigerian Naira (causing a strong demand for the FCFA) seriously undermine the achievement of competitiveness in Niger's industry.

Togo, with a population of more than 3 million, was classified in 1982 as one of the least developed countries. Though the service sector is the largest contributor to GDP (48% in 1986), the larger part of the population is employed in agriculture (i.e. around 70%). Agriculture accounts for around 32% of GDP and about one-half of export earnings. The most important food crops are cassava and yams; also, to a very limited degree, millet, sorghum and maize. Cash (and export) crops are mainly coffee, cocoa and cotton, which are all negatively influenced by world market fluctuations. Manufacturing accounted for around 7% of GDP in 1986. Togo disposes of a reasonably good raw materials base for agro-industries, and small-scale processing could become a growth sector. First, however, Togo must recover from the costly failure of ambitious attempts at large-scale industrialization in the 1970s; the International Monetary

Fund (IMF) is supporting Togo's efforts in this direction. Togo's economic development is seriously hindered by a huge debt burden: by 1987 total external debt (at US\$ 1.2 billion) was equivalent to 102% of GNP.

These countries face many of the same obstacles in their progress towards stability and self-sufficiency, mainly:

- economic crisis has meant that infrastructure is neglected, hindering supply and marketing activities;
- they are trying to plan for development without vital human resources such as a trained managerial pool, skilled labour, and a general systematic programme of education and training;
- the domestic economies have a very low degree of monetization, producing sluggish demand and a scarcity of capital assets such as equipment and spare parts;
- insufficient attention is given to stimulating domestic demand, and to areas of potential growth in the agricultural sector.

These macroeconomic problems have their parallels at the micro-level, which are experienced in particular ways by rural women:

- While the economies of these countries can be said to suffer from low monetization, rural women in the Sahel often dispose of no income whatsoever. This is not because they do not work or earn money; on the contrary, they are often the sole support of their family unit. However, women's income is frequently not their own to spend, either going to their husbands or to meet the needs of the family. For these women, labour-saving devices pose the same dilemmas as capital assets to manufacturers: their availability is a moot point unless credit is provided to purchase them, and unless they generate sufficient income to allow repayment of loans.

- The low level of technical expertise evident in the industrial sector has its equivalent at the village level, where artisanal shops are few and local women have no experience in machine operation or maintenance. Imported equipment is too expensive, cannot be locally repaired, is not suitable for women's use, or all of the above.

- Administrative skills are weak at the industrial level of society and in rural areas also women must face the difficult task of evolving to permit successful management of group or individually-owned equipment.

- The problem of capitalization from abroad, which has caused massive external debt burdens at the national level,

must be avoided to the extent possible in bringing appropriate technologies to rural milieux. Improved tools must be manufactured from local materials, so that they are integrated with the natural resource base. Spare parts and maintenance must be coordinated so as to reduce dependence on the proliferating number of foreign equipment manufacturers who have contributed to technical co-operation projects without special attention to follow-up.

Credit, income generation, administration and training: these are the pillars which will support the construction of technical assistance projects for appropriate food processing technology. The findings of the exploratory missions lent support to this assertion and the project proposal which is based upon their work (see chapter VI) has this tenet as its philosophical underpinning.

III. FINDINGS OF THE MISSIONS: MAJOR OBSTACLES ON THE GROUND

1. Introduction

The guiding principle of the project has been to 'valorize' workshops established with UNIDO assistance for the development and manufacture of appropriate food processing technologies for women. To this end, the exploratory missions surveyed activities carried out and technologies used by rural women in the Sahelian countries, and proposed improvements in the design of tools and implements currently in use. Local production facilities/workshops were to be identified and evaluated for their ability to manufacture improved tools.

During the course of the missions, however, it became evident that it was not the technical/production side which constituted the main bottleneck: the most common problem was rather a lack of consideration and understanding of socio-economic and cultural conditions and a failure to introduce appropriate support measures to ensure women's long-term access to technologies developed and introduced. Investigation showed that there had been no dearth of international effort aimed at introducing new improved technologies; indeed, such projects abound. But these efforts have frequently been unsuccessful, and women in particular have not adequately benefitted from them.

The high expectations linked to 'appropriate' technology have also largely not been met: the 'appropriateness' to local conditions and traditional patterns has mostly been determined in the First World, where these technologies were in general developed, without any direct involvement of the target group. 'Appropriate' technology transfers often repeated the mistakes of prior transfers in not being amenable to local conditions in developing countries. They assumed technology would be the

panacea to underdevelopment, without taking into consideration underlying economic, social and cultural conditions and constraints.

The following problems were especially stressed by the two exploratory missions:

- Technological developments are not fully exploited, as little co-ordination exists, efforts are duplicated, and structures for series production and/or dissemination/commercialization are not sufficiently developed;
- Women's needs and working habits are frequently not sufficiently considered when designing technologies, and/or activities traditionally carried out by women are taken over by men as soon as mechanized and monetized;
- Women lack the financial resources to acquire or utilize labour-saving technologies, as their incomes are meager and credit is not accessible to them;
- Problems in administration or maintenance due to lack of training and proper support measures often cause the early breakdown of equipment.

2. Women's status in development planning

Development planning has in many cases unfortunately resulted in a deterioration in the status of women at the same time that male status has improved. This happens due to the interaction of social and productive systems which explains, for example, the division of labour by sex in village societies, and which has profound implications for the distribution of costs and benefits when technological change occurs. The influence of social norms has not been a focus of development planning, though its influence frequently explains the success or failure of a given project.

A case study is provided by agricultural modernization, which has over the past several years focused on the popularization of cash cropping and the institution of new irrigation schemes (a switch from 'extensive' to 'intensive' farming). When intensive farming of cash crops is counted as part of the modern sector, we can say that social norms and the evolution of development have led to the creation of a two-sector division of the economy - traditional and modern - which is almost a two-sex division. The benefits accruing to men from modernization have often operated to move women to the very margin of subsistence. Two examples of this phenomenon are provided in connection with cash cropping and irrigation:

The impact of new irrigation schemes: irrigation systems are installed to facilitate cultivation of cash crops, such as rice, for export as well as for food. In theory, earnings from the irrigated crops would be used to meet the needs of the household, but in practice women have not been relieved of their responsibility to produce the range of crops necessary to feed the family and meet other needs from their own finances. Notwithstanding, as a study done in Kenya shows 4/, the husband's demand for his wife's labour on his larger, more productive plots of land increases substantially with irrigation, especially at harvest time (though time spent bird-scaring and weeding also increase before harvest). In addition, the wife acquires the responsibility for feeding those labourers hired by her husband, with the result that it is no longer possible to produce a surplus of her subsistence crops to sell or trade. Wives receive a portion of the cash crop payment for their labour, but in amounts which vary according to inclinations and which rarely cover the needs of the family. The results of the scheme for women, then, were that they became more dependent on their husbands for cash (though the latter were under no obligation to provide it), they had less control over their labour, their workloads increased and their output and income dropped.

The impact of cash cropping: the introduction of intensive cash cropping - crops such as coffee or cocoa - has exacerbated the divergence of interests between men and women and has served to create competition between them for fertile land. A study in Ghana 5/ showed that cocoa cultivation caused men to abandon the land clearing tasks they had done in support of women's farming before and to reserve all of the most fertile land for their own use. The proceeds from cocoa went back into supporting cash crop production, or into purchasing the men's own personal and prestige items. Women, farming on smaller, lower-yield plots, found it necessary to shift into less labour intensive - and less nutritious - crops as more of their time and strength was demanded for cocoa cultivation. Once again, the result for women of this development plan was that their incomes fell, work burdens increased, and nutritional standards fell.

4/ Bina Agarwal, 'Women and Technological Change in Agriculture: The Asian and African Experience' in Technology and Rural Women: Conceptual and Empirical Issues, ed. Iftihar Ahmed (London: Allen and Unwin, 1985), p 103.

5/ Bina Agarwal, 'Women and Technological Change in Agriculture: The Asian and African Experience' in Technology and Rural Women: Conceptual and Empirical Issues, ed. Iftihar Ahmed (London: Allen and Unwin, 1985), p 106.

Another retarding factor for women has been their lack of access to credit and the lack of information about existence of technologies to lighten their workload. Extension workers and bank representatives are usually men, and they find it easier and more socially acceptable to deal with the male head-of-household. Also, it is usually men who have the time and social freedom to travel to meetings or credit institutions or visit the demonstration sites where extension services take place; women are impeded by time constraints or, in some cases, the impropriety of meeting singly with unknown male representatives. Women's access to credit is further limited as they rarely have the assets - houses, land - to meet collateral requirements for credit. Illiteracy also prevents women from meeting procedural requirements for loans. Extension services themselves are often characterized by shortcomings. They concern generally intensive farming inputs - mechanization, fertilizer, pest control - which are only relevant to male cash cropping. In some cases, extension workers have given training to men in skills which have been the exclusive domain of women, giving them competition. Extension services for women have focused mainly on home economics (childcare, cooking, birth control), not the small-scale farming, cultivation of indigenous trees or small animal care which absorbs much of their effort.

These social problems have already been documented. Similar problems occurring in the introduction of appropriate technologies were investigated by UNIDO's two exploratory missions, and are summarized below.

3. Lack of co-ordination

Various efforts to produce and introduce tools and machines for food processing in the Sahelian Countries were reviewed by the two missions. Presently, cereal processing equipment introduced in the countries visited is almost exclusively imported - mostly from Europe or India. A variety of problems related to the introduction of mills and other equipment stems from the nature of imported equipment. Importation contributes to the high cost of machines, and therefore of milling. Often, spare parts for foreign equipment are not available on the market: they are not sufficiently or at all delivered with the start-up package of an assistance project, and frequently no measures are taken by agencies to guarantee subsequent supply. This problem is aggravated by the diversity of equipment introduced in these countries, which makes the provision of villages with spare parts and an effective training of technicians in maintenance and repair virtually impossible. These problems are due to lack of standardization of equipment and of co-ordination among agencies, as well as to the proliferation of imported equipment and lack of national production capacity.

Increasingly, however, efforts can be observed in the Sahelian zone to develop prototypes for local fabrication, with a view to increasing the value added in the country, creating employment, better adapting technologies to local conditions, and facilitating maintenance and repair. Prototypes are mainly developed by national workshops (under the supervision of ministries), and by projects sponsored by international agencies. The role of private workshops without outside assistance in technical innovation is minor.

It seems, however, that technological progress is not proceeding as fast as desired since exchange of information, co-ordination and co-operation among agencies are insufficiently developed. Many parallel developments are taking place, and it appears that every project is 're-inventing the wheel'. No national institution exists which could efficiently control and co-ordinate technological development and provide for consultation prior to development or introduction of equipment. In addition, technologies developed tend not to reach their target group, as no structure for dissemination exists.

Consultation and standardization do not mean uniformity of equipment introduced; each region has different nutritional habits and transformation methods. In particular, technologies have to be adapted to the scale of operation (e.g. a small rice cultivation unit can be sufficiently equipped with a pedal-thresher whereas a large commercial rice plantation needs a motor-thresher to operate profitably).

Conclusions: Better exchange of information and consultation should prevent the further proliferation of equipment makes in use. Projects should provide for an initial consultation to determine which materials will lead to greater standardization of industrial development. Such a consultation will facilitate improvement in maintenance and repair capacity, as well as the availability of spare parts. Information-sharing among agencies could also prevent duplication of technological developments and permit more consistent technological progress and an increase of benefits for the target group. This could be ensured, for example, through co-operation arrangements between a national and regional institutions, such as the 'Comité Interrégional de Lutte Contre la Sécheresse au Sahel' (CILSS). Such arrangements would provide for consultation and co-ordination, test of equipment and the establishment of guidelines for the dissemination of technologies.

4. Lack of appropriateness of technologies to women's needs

Most of the technologies reviewed by the exploratory missions were oriented towards activities traditionally being carried out by women. Ironically, however, the requirements of

the end-users often appeared not to have received sufficient consideration. In general, women were not consulted during the design stage. Thus equipment is often mismatched to local women's priorities, customs, and administrative ability (as often no management indoctrination is provided), or is otherwise not adapted to the environment. Women may for example find equipment not suitable or acceptable if it requires a complete change of traditional working habits, nutritional preferences or social structures of work.

In particular, benefits of new technologies do not reach women if they cause changes in the traditional organization of work: most activities remain women's exclusive responsibility only as long as they are carried out traditionally, in a labour-intensive, strenuous way. As soon as a new technology is introduced and material gains can be made, the activity is taken over by men. This may be due to a variety of factors: the technology may not be adapted to women's needs and traditional working habits; technical assistance, training etc., may have excluded women; men may be quicker to capitalize on the monetary benefits to be derived from the modernized activity; or women may be afraid of using the new equipment, particularly when it is engine-driven (women for example say that starting a motor requires too much physical strength, though they are strong enough for extremely strenuous grinding with pestle and mortar).

A specific problem is the cultural preference for training men in new technologies (e.g. mill operators are almost exclusively male). Men are much more prone to leave the village than women, who in general are more deeply rooted. Thus training women would offer a better investment in the future of the village; in addition, it has been shown that women are often more responsible and conscientious in the operation and maintenance of machines.

Conclusions: In general, tools designed for women should keep as close as possible to the traditional working process. Traditional technologies and working habits have to be investigated before designing a new technology, and women have to be consulted during the design stage. Technical assistance projects should assist and stimulate women to maintain full responsibility for their traditional activities after these have been upgraded. In particular, women have to be trained and encouraged to utilize equipment newly introduced. The projects should aim at slowly and cautiously overcoming the attitude - of both women and men - that women are not capable of dealing with new technologies. The introduction of the Malian shea-butter press reveals an interesting aspect: though a complete mechanization of shea-nut processing is possible (by using a mill), this press (which is also cheaper) leaves important parts of the traditional production process unchanged - with the concomitant result that the activity and its

benefits have remained till today women's exclusive responsibility. The press project also stipulated that all related tasks (administration, operation, routine maintenance) be taken over by women.

5. Limited access of women to labour-saving equipment

Any effort to develop equipment to alleviate the work of rural women has to take into account the extremely limited purchasing power of women.

In general, monetary resources are scarce in the rural environment, and no large amounts for investments are available. Investments can often only be afforded by a co-operative or a village association and on the basis of credit. Rural women face an even more difficult situation: most African households are characterized by a clear-cut division of responsibilities and of obligations between men and women. Thus alleviation of duties attributed to the wife is not of interest to the husband, and he will not provide money for investments in labour-saving equipment. Women's access to their own financial resources are even more constrained: the meager incomes of rural women go toward meeting the subsistence needs of their families, and thus they can't apportion any money to invest in labour-saving equipment. In addition, equipment permitting savings in time and alleviating women's work does not generate income, therefore it remains out of reach to women.

Even when a technology has been distributed to a community, the problem of lack of purchasing power persists: in many cases not all women were able to use the village mill because of lack of money. Only women who undertook a complementary economic activity - small commerce, sale of fruits and vegetables - were in a position to regularly use the mill.

Without credit - accompanied by adequate support measures - acquisition of equipment is almost impossible for rural women in West Africa. However, rural women lack access to credit as they do not meet bank lending requirements for collateral, all assets being held by the husbands. Yet extensive research shows women to be more conscientious than men in repaying loans.

Conclusions: The lack of purchasing power remains the crucial problem for any project aimed at alleviating women's work. It is absolutely necessary that this market aspect be carefully analysed before attempting to disseminate improved technologies. Revolving loan funds and other kinds of 'soft' credit must be provided to give women access to labour-saving equipment. Specific support measures are, however, essential to assure proper utilization and administration of funds. Before introducing a credit scheme, the economic capacity of the beneficiaries has to be carefully evaluated to avoid

investments which are not economically viable. Introduction of labour-saving equipment has to be accompanied by measures to assist women to develop complementary economic activities which enable them to acquire or utilize the equipment introduced.

6. Problems related to the dissemination of technologies

Experience, particularly in the dissemination of village mills, shows that the failure of these programmes was in most cases due to lack of careful consideration of social and economic factors. Major problems were caused by the lack of appropriate criteria for the selection of villages, failure to develop adequate support and follow-up measures, lack of appropriate training, and failure to establish maintenance and repair systems, as well as insensitivity to women's role in the village society.

Often, problems with a village mill arose because the village itself had been poorly selected. In many cases a mill proved to be not economically viable, as the village was too small to make the mill work profitably, or a high percentage of women could not use it because they lacked complementary income. No study had been undertaken to reveal the socio-economic capacity of the village and to evaluate economic feasibility prior to introduction of the technology.

Other problems encountered related to difficulties in administration and ownership of equipment. Technical assistance projects often failed to give owners basic instruction in management and administration which would enable them to cope with the various associated obligations: the charges derived from the operation of the machine have to provide for energy, salary of the operator, funds put aside for maintenance, repair, and spare parts, depreciation of the machine and/or repayment of a loan. Proper control of funds has to be ensured. Fuel economy must be taught. In addition, group ownership was often characterized by an unclear allocation of responsibility among members. This had particularly adverse consequences for book-keeping, control of funds, and maintenance of equipment. Major problems emerged particularly in cases where men intervened as they became aware of the funds generated by the mill.

Maintenance and repair represent another main stumbling block in the operation of such machines. Major problems identified were the failure of projects to establish adequate maintenance plans, to train operators in routine maintenance procedures as well as normal operation of equipment, and to adequately train local technicians in advanced maintenance and repair. Maintenance and repair was often only ensured during the project; no provisions were taken to establish a long-term viable maintenance scheme.

Conclusions: Only a careful choice of the target village, development of support measures preceding and following the implantation, financing schemes adapted to socio-economic conditions, proper training of operators and establishment of a maintenance and repair scheme, definition of responsibilities of the administrative committee, measures to create complementary income-generating activities, and establishment of a programme for the utilization of benefits to the advantage of the women can help to overcome the shortcomings of present technology transfer programmes. 6/ Equipment should only be introduced on explicit demand, only where it contributes substantially to reduce women's workload and where sources of income to pay for the charges for milling can be made available. The women's committee should be encouraged to keep full responsibility for all tasks related to administration and management. In particular, women village groups have to be carefully indoctrinated before the introduction of equipment. Allocation of responsibilities has to be made clear to members. Some basic training in administration/management skills is essential to ensure proper control of funds and economical operation of equipment.

7. Concluding remarks

The above observations point to a common finding which has been highlighted in several investigations, as the following quotations demonstrate:

The Final Report of the Ministers' Conference on Women and Food Technology Conference, Arusha, 23 - 27 May 1988, stresses particularly that main problems are related to technology design, training and credit:

'Women often are not consulted by engineers about the design or location of a new technology. As a result, many technologies have proved to be unacceptable or have failed to show an improvement time- or energy-wise over existing traditional technologies. In addition, many studies have illustrated how improved technologies are often beyond the financial means or skill levels of village women who usually have less access than men to cash and training.'
(p.33)

'... it has been found that it is often not the technology itself or its transfer that causes problems. Rather it is social factors - such as the appropriateness of the technology for the group it is trying to serve. In order

6/ see also FAO: Les programmes d'installation de moulins villageois; Rome 1986, p. 16.

for a technology to be acceptable, the designers need to consult the beneficiaries. The designers of the improved technology should have paid attention to traditional methods, cultural attitudes and user preference.' (The Tech and Tools Book - A Guide to Technologies Women Are Using Worldwide; International Women's Tribune Centre and Intermediate Technology Publications; 1986, p.63)

The mission research shows that the transfer of appropriate technology must be accompanied by appropriate social support measures which incorporate the right balance of tradition and innovation and which will permit women to take full advantage of efforts to save their labour and increase their purchasing power. Such an approach will in turn permit donor agencies to better tailor technical assistance programmes to their recipients, improving their success rate locally while strategies for more large-scale implementation evolve.

IV. ANALYSIS OF APPROPRIATE FOOD PROCESSING EQUIPMENT FOR WOMEN

1. Introduction

The two exploratory missions were tasked to examine the main food processing activities performed by rural women. Technologies introduced were assessed for suitability to local conditions. The need to make improvements was to be reviewed, and possibilities for local production of the improved equipment were examined. The following criteria were taken into consideration when analyzing technologies: purpose; facility of use; cost; profitability; possibilities for local reproduction; and maintenance facility.

The following activities/technologies were reviewed in particular: processing of grains, i.e. threshing, hulling, and grinding; cassava grating; oil extraction; improved stoves; and conservation of fruits and vegetables.

An important finding of the mission was that the choice of technology should depend on local conditions (crop patterns, nutritional habits, processing traditions). They also emphasized that the type and brand of equipment chosen should not only depend on technical and economic criteria, like performance, price, etc. An even more important criterion is the question of types and brands already widely used in a region: in order to guarantee that a technology is easily accepted, that skills are available for operation, maintenance and repair, and that spare parts are accessible, homogeneity should be a goal.

2. Processing of grains

Processing of cereals, along with the transport of water and the collection of fuelwood, is among the most

time-consuming and physically exhausting daily chores of women in West-Africa. Millet and sorghum are the most common cereals in these regions, followed by rice or maize.

The threshing and winnowing of cereals are activities still done almost exclusively by hand. Threshing may be done once in a harvest cycle or more often, according to need, depending on the region. It is a labourious and time-consuming process, involving beating harvested plants to separate the grain from the chaff. Threshing is in many cases men's activity; however, in certain regions/ethnic groupings it is also carried out by women.

The hulling and grinding of grains, however, is exclusively women's work. Pestle and mortar and the millstone ('meule dormante') still represent the primary technologies for transformation of millet, sorghum, maize and rice.

Pounding in a wooden mortar is the most common method of separating the pericarp of the grain in the rural Sahelian zones. Before pounding, the grains are cleansed of impurities. The next step is winnowing, which separates the hulled grain from the bran and the chaff. The grains are then pestled a second time in the mortar. Lastly, they are washed several times under water to eliminate the bran completely and are put into the sun for drying. All this represents an extremely strenuous production technique. It must be repeated every day, and depending on the size of the family, takes 2 to 3 hours daily (without calculating the time for the subsequent preparation of meals).

The 'meule dormante' is comprised of two stones. The bigger one, the millstone, is flat (the 'mother'); the other is smaller and oval (the 'daughter'). The 'daughter' is rubbed rhythmically against the 'mother' to grind the grain. The user has to be on her knees or in a curved position. Flour obtained still contains the bran. It takes about one hour to mill one kg of millet with the meule dormante.

The advantage of both methods is that they are easy to practice. Pestles and mortars are produced locally and are affordable to the women. The pestling permits complete elimination of the bran without destroying proteins and vitamins. Both technologies conserve all nutritional ingredients. The drawbacks of these technologies are that they are repetitive, time-consuming and exhausting. It takes about one hour to hull the grain and to mill 1 kg of flour with the mortar. It has been estimated that women spend about 2 to 3 hours every day on this work. The flour obtained is not homogeneous, and it contains fragments of the pestle. The curved or genuflected position required during the operation causes health problems and extreme fatigue in the users.

The mechanization of cereal processing is considered by rural women to be an enormous relief. There exists a variety of mechanization technologies at different scales: the ones most relevant in the region reviewed by the mission were threshers, dehullers and mills (motor-mills, animal-drawn mills and manual mills).

threshers for rice, sorghum and millet were inspected. Though a number of multi-purpose models exist, in general different types are required for rice and millet.

Rice threshers have been relatively widely introduced, particularly in Mali, the main rice producing country in this region. Local production appears to be relatively advanced in this country: for example, the VOTEX rice fan, a Dutch model, is being reproduced by a Dutch technical co-operation project (ARPON, in the context of the 'Office du Niger'). A large part of the thresher is imported in an assembly kit, though other parts are cut and welded locally; the assembly is carried out in the medium-size project workshop. The rice fan, which is turned by a 3.5 to 5 HP engine, can, with minimal adjustments, also be used for threshing other crops such as wheat or sorghum, but not for millet. It can be carried to the fields - by four people or on a cart. Its price in Mali, including a 4.5 HP engine, is FCFA 1,000,000, at which price the workshop operates profitably. As rice is commercialized, income derived should allow both for loan repayment and savings toward a replacement for the depreciating thresher.

Treadle/pedal rice threshers are also available in the region. In Niger, the workshop ARMA has, from a Chinese/Indian system, developed a well functioning prototype; pedal threshers are also produced by the state-owned workshops in Niger. They are sold at a price between FCFA 120,000 and 150,000. Treadle threshers which can be adapted for motor drive are also manufactured by SISMAR in Senegal, and the workshop TROPIC in Cameroun. A pedal thresher can, in view of its capacity, be considered a viable alternative to an engine driven model in the case of smaller plots. For larger plantations, as common in the case of rice, a motor-thresher will easily operate profitably, as the paddy is commercialized in most cases.

For the threshing of millet, the situation is different. Millet requires motor-driven equipment, and pedal-threshers are not viable in this case.

One relatively sophisticated model, which can be utilized for the whole variety of crops available in Africa, seems to be least commonly introduced in the Sahelian Countries. This French product, 'Bamba', is, however, sold at a very high price.

A limited number of local prototype developments, some using recycled material, are on-going. In Niger, an artisan-entrepreneur has developed some prototypes, as has the

'Centre d'Enseignement et d'Expérimentation du Machinisme Agricole' (CEEMA) in Mali. In Niger, the artisan-entrepreneur offers threshing of the millet in the city as a paid service. The 'Entreprise Malienne de Maintenance' (E.MA.MA.) in Sikasso is presently developing a prototype of a locally produced thresher modelled on 'Bamba'.

Regarding millet, the profitable operation of a thresher at a village level presents a major problem. As millet in many cases is not commercialized, but only a household crop, a thresher will often not be economically viable. A solution in many cases is to cover a number of villages with one transportable thresher. As threshing is not limited to a fixed schedule, it would be possible to carry out a weekly or monthly tour within the region.

Dehullers for rice, millet and sorghum exist both for motor and manual operation. Most common in the Sahelian region and best adapted to village use is the 'Engelberg', a relatively simple model which is widely known in developing countries. It comprises essentially a cast steel rotor with rasp bars which turns inside a cast housing with a slotted plate in the base.

In Mali, comparisons have been made by ARPON of the 'Engelberg' and a much bigger Brazilian model, 'Nogueira'. While the performance is almost the same, the latter is far more sophisticated, and correspondingly more vulnerable. It was not only much more susceptible to breakdown, but also considerably more difficult to repair. In addition, a complex organizational infrastructure was required to ensure supply of the imported spare parts. The 'Engelberg' by contrast is, because of its simple construction, easy to understand, and therefore easy to handle, clean, maintain and to repair. Most spare parts can be produced locally. Breakdowns seem to be far less frequent than with more sophisticated equipment. Attempts to locally produce dehullers in the Sahelian countries have in most cases been based on this model.

Some small hullers which are portable and hand-operated can only hull limited quantities; possibilities for upgrading should be explored.

With regard to dehullers, the crucial point again to be emphasized is the need for profitability of the operation. Hulled rice, which is both consumed by the household and commercialized, provides an example. The sale of rice (which is, however, limited, as the major part of the rice is officially collected by the State production schemes) is more attractive than the sale of paddy, as the profit is higher. In addition, the by-products can be used as animal feed ingredients or as fuel. Commercial utilization, profitable operation and depreciation is easily possible. In the case of

rice cultivation areas, a dehuller may be considered among the first priorities of women for labour-saving equipment. Again, profitability presents a much more severe problem in the case of millet and sorghum, as it is mainly hulled for household consumption.

The motor-mill is the most common technology in the field of cereal processing. A motor-mill processes about 150 to 180 kg of grains per hour, compared with 0,7 kg to 1 kg per hour from milling with mortar and pestle, with its concomitant physical effort. In rural areas, motor-mills have mostly been distributed to villages or to groups of village women (on credit or as a grant). A number of private owners are operating mills on a profit basis; this predominates in urban areas. Mills in rural areas are mostly administered by a village committee which is responsible for collecting the charges for utilization, for organizing maintenance and repair and for the administration of funds. In almost all cases, the mill is operated by a 'meunier': a male operator, often a young man or a child, who receives a small salary.

There are various types of motor-mills. The most common difference exists between the hammer-mill and the plate-mill ('meule'). The plate can be of stone (similar to the millstone) or of chilled iron, the former being appropriate to dry, the latter one to humid cereals and oleaginous seeds. The motors can be electrical, or petrol- or diesel-fired. The cooling mechanism can operate via air or water.

In Burkina Faso, Mali and Niger the plate mill is most commonly utilized; the hammer-mill (used for example in Senegal) is almost not existent. In Mali, the metal-plate seems to be more common, whereas in Burkina Faso the stone-plate is more appreciated - depending always on local customs and nutritional habits. In some regions, women also utilize the stone-plate for grinding humid cereals; in other cases, two mills have been installed to meet the different requirements. A solution to this problem is a mill with an exchangeable plate. This makes it possible to equip the mill according to local habits, and also allows for the on-site exchange of the plate according to the cereal to process.

Obviously, a motor-mill makes possible enormous savings in time and effort for rural women. It is therefore much sought-after by village women, who often consider it their very first priority. However, a number of severe problems are frequently linked to the introduction of motor-driven equipment in a rural environment; this has become obvious in several mill distribution programmes. These problems - lack of money for the utilization of mills, administration of funds, maintenance difficulties, supply of spare parts - are explained in much more detail in chapter IV. They are aggravated by the general difficulty that mills in rural areas often do not generate income, but serve only the demand of the village itself. (Only

in urban areas do private owners operate mills on a commercial basis.) Thus, money for the utilization of machines has to come from other sources of income which, in many cases, presents a problem. This often endangers the economic viability of the mill at the village level.

One way to reduce investment and increase profitability is to use mills and dehullers in a combined way, that is, turned by a single motor on an alternating basis. This scheme is successfully operating in various villages. Because of women's lack of revenues, however, the dehuller is often only utilized if they have sufficient money at their disposal, as alleviation of the work of milling constitutes the first priority for them - at least where millet and sorghum are the nutritional basis.

As an alternative to the motor-mill, an animal-drawn mill has been developed by the German Agency for Technical Co-operation (GTZ) in collaboration with Project Consult +Consulting Company), ENDA TM and I.T. Dello (international NGOs) and local artisans. This mill is operated by a donkey or a horse which turns around a ring. The ring can be easily built by a village mason; the mill itself can be imported or reproduced by local artisans from local materials.

Though in principle the system works well, tests carried out in Niger have revealed a need for improvement: the mill was adopted from one designed for fast operation, and it appears that low-speed systems should be adapted instead. Development and production was initiated in Senegal, where it is now most advanced. Manufacture and dissemination - on a relatively small scale - is ensured locally. A number of mills have been installed in Burkina Faso; tests are currently being carried out in Niger.

An assessment of the viability and suitability of this technology reveals the following: compared to an engine-driven mill, the capacity of the animal-drawn mill is relatively low (about 12 to 20 kg per hour, depending on the fineness of the flour and whether a donkey or horse is used.) An animal-drawn mill presents a viable alternative to a motor-mill in those cases where the latter cannot operate profitably, particularly for villages with a population between 200 and 800 inhabitants, or for distant villages where the supply of fuel and spareparts present considerable problems. Though the price is not considerably less than for a motor-mill, almost no maintenance and operation costs are generated, no training in operation is needed, and life expectancy of the mill is considered much higher.

It should be noted that motor-driven and animal-drawn mills are not solutions which exclude one another, but rather are appropriate to different circumstances. Both technologies should be developed on a parallel basis.

Manual mills, however, present a different picture: they do not appear to present a viable alternative. Tests have shown that their productivity is very low - in fact it is hardly higher than with the traditional method - and the process of milling is similarly tiresome. Furthermore, they are adapted to the needs of a single family, for which the investment may be considered too high. Whether manual mills exist or can be developed with a considerably higher performance and a reasonable price must be investigated; these could be appropriate for very small villages.

3. Peeling and rasping of manioc

Manioc/cassava is produced and consumed in Togo, where it constitutes an essential basis of daily nutrition. Cassava is commonly consumed also in Niger, though there it is mainly imported from Benin.

Peeling and rasping of cassava is one of the most time-consuming and tiresome activities generally performed by women. A number of technologies on different scales currently in use were examined by the missions.

Manioc has two barks. The first one is fine and brown, the second one thick (1 to 2 mm) and white. The two barks are first peeled off, often with the help of a knife.

The next step in the transformation of manioc is rasping. The 'râpe artisanale' (artisanal rasp) consists of perforated sheet iron and a wood support. The peeled and washed roots are rubbed against the perforated sheet iron. During this operation, the woman stands in a crouched position over the rasp. It is a very exhausting work, causing pain in the kidneys and the back, and scratches in the hands of the women.

The advantage of this type of rasp is that it can be produced locally at a very low cost. The drawbacks are the low output, which is around 15 kg per hour and person, losses of around 4%, as the woman cannot rasp the pulp to the end in order not to cut her fingertips, and the difficulties of cleaning the rasp.

The 'râpe cylindrique manuelle' is very much utilized in the area of Tchamba (Togo). It consists of perforated sheet iron wrapped around a piece of wood of a diameter of 20 to 25 cm. The central metal axle turns in a pair of bearings (mostly taken from an old car). The cylinder is rotated via a handle operating the central axle. It is operated by two persons, one moving the handle and one pressing the manioc pulp against the toothed surface of the rotating cylinder.

This rasp is also produced locally. Its advantage is its higher capacity compared to the artisanal rasp. The losses are, however, even higher, as rasping the pulp to the end is more difficult.

There exists also an engine-driven rasp ('râpe cylindrique motorisée') which processes around 200 kg of manioc per hour. It can be locally produced; only the engine and the transmission belt are imported. In those countries with an important manioc consumption, local artisans have also taken up the production of engine-driven rasps.

The main problem of both the manual and engine-driven cylindrical rasp is the frequent breakdown of the bearing and the high price.

4. Karité-nut extraction

Karité-nut extraction is another very important female activity in the Sahelian zone.

The Karité tree grows south of the Sahel in West Africa, in regions where light rainfall preclude the palm tree. The oil, or 'butter', of the karité tree nut is used in cooking and in traditional medicine, and therefore it has considerable economic importance in West Africa. (Karité butter is also used in Japan, Europe, and Canada, chiefly for cosmetics.) Karité butter production is exclusively women's work, and is for them an important source of revenue.

The traditional method of production is long and arduous. There are many steps, among them: harvesting the nuts, boiling them, drying them in the sun, shelling them, milling and mixing/kneading, and re-boiling. It takes women approximately 50 hours to extract about 7 kg of shea-butter from 30 kg nuts; in addition, relatively large quantities of precious fuel wood and water are used.

Mecharizing oil extraction is possible either by utilizing a mill, or with different types of presses. In Mali, a karité press was developed by the GTZ, which is powered by a commercial hydraulic 30 t jack. The jack enables the women to apply the great pressure required to extract the fat from the shea-nuts.

Experience in Mali shows that per day approximately 70 kg shea-nuts can be processed with the press (2 or 3 times more than with the traditional technique.) It has proven to alleviate women's workload considerably. Even more important, the higher yield achieved with the press has enabled the women to earn additional income with the commercialization of the surplus.

The presses are being manufactured locally in Bamako with the hydraulic jack being the only imported part; thus no motor - the most vulnerable part - is needed.

The introduction of the shea-butter press in Mali presents an interesting example of mechanization which has not caused the takeover of the production process by men. An important reason seems to be that in this case large parts of the traditional process remained untouched, and the social organization of work was not changed. In addition, women were strongly encouraged by project staff to take over all duties related to the administration and operation of the equipment.

In sum, the shea-butter press has proven very successful in Mali, where it has already been introduced in far more than 50 villages. This success has been mainly due to a most careful dissemination strategy which provided for credit, training in administration, operation and maintenance, and other support measures.

In contrast, tests of the press in Burkina Faso have shown that it is not popular. In Burkina Faso efforts have mainly been concentrated on the development of alternatives, such as screw- or lever-operated technologies.

5. Improved Cooking Stoves

Improved cooking stoves are equally one of the first priorities of appropriate technology in the Sahelian zone. Their introduction is among the primary measures to halt deforestation in the region, to alleviate women's work load, and to increase their revenues. Improved stoves allow for considerable savings in fuelwood, and contribute to reducing the time women have to spend on its collection (varying according to the region, but usually taking several hours of the day).

In central and suburban areas of Burkina Faso and Mali improved cooking stoves appear to be widely used. Transportable metal models seem to be most commonly introduced. Rural areas could not be assessed, but it can be assumed that production and dissemination have not progressed that far, and efforts to ensure further propagation should be concentrated there. In Niger, probably the country with the most serious problems regarding fuelwood supply, introduction seems to be still less advanced.

Some areas for possible assistance were identified:

The University of Lomé in Togo has developed two designs for improved cooking stoves using stones, a 2 mm steel plate and a 12 mm reinforcing bar. The improved design gives a 40% saving in fuel and a 30% saving in cooking time over traditional stoves. Tools required for the stove manufacture are a hammer, chisel, and anvil. If metal shears and a rolling machine were available, the new stoves could be produced much more quickly (it now takes one man one month to produce 50

stoves) and more cheaply (the present cost is FCFA 5,200 per stove). The University would like to bring in 16 rural artisans to train in the new stove design but it has not the funds for the plan.

'Dolotières' is the name given to the women of Burkina Faso who make the millet-based beer 'dolo'. Dolo production is exclusively the domaine of women and it is an important source of revenue to Burkinabé women. Traditionally, the beer is made in 50-liter cauldrons kept on simple fires which consume large amounts of wood. The 'Institut Burkinabé de l'Energie' (IBE) has developed a way to reduce wood consumption by 50% with an improved fireplace. The IBE would like to set up 20 workshops to produce the improved fireplaces and would like to see dolotières trained in their use and repair. The IBE would also like to train dolotières in the rational use of firewood, basic sanitation and simple bookkeeping. The IBE foresees beginning with a small number of dolotières -about 20- who can assist in popularizing the improved brewing techniques and product. The method of choosing the beneficiaries and workshop sites will have to be calculated by the ministries concerned; special attention would have to be given to creating revolving funds for the dolotières which they could use to finance their work until proceeds permit repayment of loans. Such a project would not only improve the working conditions of the dolotières and raise their revenues (because fuel costs would decrease), but would also contribute to the fight against deforestation and improve the quality of dolo.

6. Conservation of fruits and vegetables

Conservation of fruits and vegetables is another important food processing activity of rural women. This sector was, however, not a major focus during the two missions, as UNIDO is already carrying out a large-scale project aimed at the upgrading of solar drying techniques in the Sahelian zone.

In general, the countries reviewed meet all the necessary conditions for good solar drying prospects: lots of sun, relatively low humidity during most of the year, a high average temperature, and a surplus of garden produce during the harvest periods. Most fruits and vegetables are only available during harvest time, and a large part of agricultural produce perishes therefore because means of conservation are lacking.

Though rural women have been engaged in solar drying for a long time, their techniques are rough and do not include any hygiene measures. The advent of good quality control and packaging could help these countries increase commercialization and improve food standards locally, and could even help them to find export market for dried produce.

In Burkina Faso, the IBE has developed various technologies to improve techniques for drying. A problem is that solar dryers, which are often produced from imported material (e.g. plastic) are too expensive for individual households. Now the IBE has begun to make dryers 'en banco', that is, out of the locally produced clay bricks. Another solar-drying technology developed by the IBE is a drying hut. This technology allows onions to be kept for about 10 months, including the time periods when onions are very expensive. Calculations demonstrate that the investment of approximately FCFA 100,000 can thus be amortized in one year.

V. SUPPORT MEASURES REQUIRED

1. Introduction

The main conclusion drawn from the findings of the exploratory missions, as pointed out in chapter III, can be summarized as follows: in the development and manufacture of appropriate food processing technologies for women, it is not the technical/production side of technology which in general constitutes the main bottleneck. Project success or failure is dependent rather on whether social, economic and cultural conditions in the project region are properly taken into consideration, and whether support is given to the beneficiaries to acquire and utilize the technologies introduced.

The missions concluded that women's access to technologies and their long-term benefits has to be ensured through a dissemination strategy which is in line with the socio-economic considerations stressed. The development of appropriate support measures and organizational schemes is a conditio sine qua non and must include: guidelines for the careful selection of villages and beneficiaries; the introduction of a revolving fund; definition of the role of facilitators; elaboration of training programmes for operators and owners; and the establishment of a maintenance and repair scheme. All measures must take full account of socio-economic conditions and traditional structures prevalent in the region.

These aspects are particularly relevant for communal utilization of equipment, i.e. the cases of village mills, dehullers and threshers, which have been examined by the exploratory missions. Private ownership and entrepreneurship are still something rather extraneous to a rural environment, and particularly to rural women. Accordingly, the following chapter will mainly deal with the introduction of labour-saving equipment on a village level.

The following elements will have to be incorporated in the dissemination strategy:

2. Credit scheme

In order to make the technologies accessible to the target group, financial credit has to be provided. The credit scheme must be based on observed traditions of the area, and it must encourage commitment and responsibility.

The goal of the scheme must be the generation of revenues by the machines: the women will charge themselves for their use in such a way as to permit repayment, in full or part, of machine purchase loans. Caution must be taken that a too-high price of the service does not inhibit women from utilizing the village machine. Calculations show that repayment of credit should be easy for villages of about 1500 inhabitants, where all women are utilizing the mill/dehuller. Lack of purchasing power may, however, prevent women at times or even definitively from using this service.

Socio-economic conditions in the village (purchasing power, sources of income, demand and feasible profits) have to be most carefully evaluated beforehand. Equipment should only be provided on a credit basis if economic viability has been assured, and repayment of the loan is feasible under the circumstances. The recipients of credit assume a considerable obligation, an unsound investment can change their situation for the worse. Thus does credit sometimes become a retarding factor. The duration of credit has to be sufficiently long to avoid too burdensome obligations.

The distribution of equipment on credit - instead of on a grant basis - is expected to strengthen commitment and responsibility, and thus to contribute to the long-term functioning of the project.

In the case of communal ownership and utilization of equipment, provisions should be taken to use part of the revenues derived for the benefit of women's associations. One possible provision might be a fund from which credit could be given to group members on a rotational basis.

In rural Africa, there exist a variety of traditional savings associations among women. These traditional ways of building savings and administering funds were reviewed by the exploratory mission in the countries visited.

Among the most important forms of savings and credit are the 'tontines' - informal associations where every member pays a certain amount into a pool on a weekly or monthly basis. They exist in different guises. In 'tontines monétaires', every woman pays a certain contribution in cash, and the money accumulated is redistributed to the members on a rotational basis. These exist both in the countryside and in cities. The 'tontines en nature' receive contributions in kind which can be sold to pay for unforeseen expenses or obligations of one of

the members (marriage, funeral, etc.). Women join 'les tontines basées sur le travail' to develop an income-generating activity. Such a system was adapted for example to the introduction of the shea-butter press in Mali: the women cultivated one field in order to finance expenditures related to the shea-butter press with the income derived.

These traditional savings associations supply the foundation for most investments in the poorer classes of society. However, in many cases they are mainly used to finance ceremonies and celebrations, and not for productive purposes. It has been recommended to increasingly use them for the development of income-generating activities, or as collateral in order to receive better credit conditions from banks. Credit schemes for the introduction of appropriate technologies could be built on these local savings associations.

Another tradition supportive of the distribution of village equipment is the idea of 'nams', as they are called in Burkina Faso, or 'samariya' in Niger, or 'tons' in Mali. In Burkina Faso, for example, a 'nam' works as follows: one village receives one mill, the so-called 'father', which will, as soon as enough earnings have been accumulated, 'give birth' to another, a 'daughter'. As the daughters in Africa always leave their father's home, this mill will be sent to another village, where it will - given good administration - generate other descendants, i.e. mills. In the first village, eventually the 'father' will 'give birth' to another mill, this time a 'son', which will stay in the village and can replace the father in the long run.

3. The selection of beneficiaries

The selection of beneficiaries has to follow specific principles.

The main precondition for the selection of beneficiary villages will be a preliminary evaluation of their social and economic conditions. This study should reveal: the size of the village; crop patterns; economic activities; the availability of sufficient cereals for processing; the respective nutritional habits; the localization of mills in the surroundings; the proclivity of neighbouring villages to also utilize the mill. Of particular importance is the capacity of the village to support income-generating activities for women which permit them to acquire and utilize technologies introduced. Other decisive aspects are social cohesion, the existence of a women's association and its organizational capacity.

The prospective owners should play a major role in the process of decision. They should be informed about the availability of technologies, about the organizational schemes and modalities for credit, and then decide if they wish to

acquire equipment. A careful informing and counselling of potential owners is extremely important, and should be performed as an advisory or extension service. Future owners assume a considerable commitment (particularly financial) requiring a most careful consideration of their domestic/communal responsibilities, and of external concerns, such as sufficient market demand. Preferably, the initiative for the acquisition of technology will come from the beneficiaries, who must express an explicit interest. An evaluation and discussion of needs at the village level should reveal the women's priorities by ascertaining which technology can make the most substantial contribution to alleviation of their work. An application system might be established to organize selection. Potential owners must then make known their provisions for administration of equipment and indicate their level of interest.

4. Organization and administration

Another decisive element of dissemination is that proper administration of funds and equipment made available be assured by the village/women's association. Collective ownership schemes are often characterized by an unclear allocation of responsibility among group members. This has particularly severe consequences for book-keeping, control of funds, and maintenance of equipment. It is most crucial that funds are put aside to ensure repair, loan repayment and savings toward replacement equipment.

Group ownership can only function efficiently if responsibility is clear to members, and if the group receives some training in basic administration and management skills. In most cases reviewed, administration was carried out by a committee, normally composed of a president, a vice-president, a treasurer, and a secretary. The committee is not paid for its work, but a small remuneration should be made where the collection of fees for machine utilization is not carried out on a rotational basis, but by only one woman (or two). While the details of the administrative programme as well as the appointment of persons in charge will be left to the women's association, a number of guidelines should be observed: at least one literate woman should be among the committee members, to act as secretary. If this is not possible, women should be encouraged to participate in literacy courses and/or they should be trained in using accountability forms for illiterates (though calculation will still represent a problem). It is also desirable that the committee members, particularly the treasurer and the cashier, be elder women who are fully respected in the community. They might also be in an easier position to combine this duty with household chores. In general, preference should be given to those villages where women are motivated to assume full responsibility of all aspects related to the administration of equipment. Women should also be encouraged to take over the work of operators.

Distribution of equipment to women's associations stimulates and strengthens group organization. The successful organization of a common activity will improve women's positions in the village community (in the organs of which they generally do not participate), and may encourage them to develop further joint activities.

5. Maintenance scheme

The involvement of local artisans in follow-up is critical. Local artisans have to ensure maintenance and repair of equipment, production of spare parts, and training of operators.

The introduction of a maintenance and repair contract can support the maintenance scheme. There should be a contract between owners and a technician, by which the latter is obliged to maintain the machines regularly (according to a schedule established) and to repair them in case of breakdown. The owners must agree to pay him regularly a certain sum for maintenance and defined charges for repair (the exact schedule/combination of fees should be decided on-site, when local conditions have been examined). This scheme would guarantee a regular maintenance of the machines at a reasonable price and would provide the technician with a regular income. In case of breakdowns a prompt and qualified repair will be ensured. The technician will ideally already have experience, and should have a small workshop. He/she should be equipped with spare parts (on the basis of credit), and be provided with a means of transport. Artisans to be involved in maintenance and repair as well as in production should already be installed in the region and dispose of a small workshop with sufficient equipment. No new workshops should be created as demand may not be sufficient.

6. Training programmes

Careful instruction and training is most crucial to ensure proper administration and operation of equipment. Training programmes must particularly address maintenance technicians, village women (the administrative committee) and operators.

The technical content of the training of maintenance technicians should encompass all aspects of maintenance and repair of engines, and fabrication of spare parts. Basic instruction in management and administration is also essential, comprising not only book-keeping and stock-keeping, but also elementary management principles to help the artisans conduct a profitable operation. The principles and obligations of the maintenance and repair contracting scheme to be designed should be familiar to them.

The training programme must also provide for the training of operators. They should become versed in: daily maintenance; inspection; identification of machine failures; characteristics of good milling/hulling; limits of the machines; and safety and hygiene rules. The method of co-operation between owner-operators and women users should be defined.

Most crucial for the viability of a credit scheme is proper instruction of the owners in management and administration of funds. Group ownership requires that particular attention be given to the careful training of the administrative committee. Before the distribution of equipment, careful informing and counselling of potential owners on organization, modalities for credit, and obligations assumed must begin. The assignment of responsibility and the provisions for administration of equipment should have been made clear. For larger equipment, instruction in basic principles of management and administration is essential: book-keeping, administration of funds, obligations of the credit scheme, economical operation of machines, responsibilities regarding maintenance and repair.

7. Role of facilitators/'monitrices'

Very important for all aspects of the dissemination concept are local facilitators - 'monitrices' - who play a strategic role during dissemination. 'Monitrices' must be women from the project region. Their role is to assist in the elaboration/adaptation of all plans related to the dissemination process and to participate actively in the training and instruction of the users. They must be acquainted in detail with the principles and strategy of the project, and receive a thorough training in basic management and administration principles, operation of the machines, and organizational structures.

VI. PROJECT OUTLINE

The information, conclusions and recommendations discussed above have been sifted and synthesized into a project proposal entitled: 'Local production and dissemination of improved cereal processing equipment - pilot phase'.

The project proposed aims at overcoming the problems described. Its objective is the development, testing and local production of food processing technologies appropriate to women's needs and traditional working habits to alleviate women's daily chores, and to ensure women's access to these technologies and to their long-term benefits. The strategy of the project will be two-pronged, ensuring that technical assistance avoids the pitfalls analysed above, and that the plans for distribution and use conform to the socio-economic considerations which have been stressed.

To this purpose, technologies developed or disseminated in the region will be evaluated for appropriateness to women's needs and means, new improved equipment will be designed and tested, and a local production capability will be developed and promoted, involving local artisans. As chores related to cereal processing represent a major activity of women in West Africa, transformation of cereals will constitute the priority sector for intervention. The first activity will be to develop improved prototypes of a locally reproducible motor-mill, of an animal-drawn mill and of a dehuller: hulling and grinding of grains constitute the most strenuous tasks in cereal processing, consuming several hours of a woman's day. Discussions with village women have shown that in the Sahelian region mechanization of milling constitutes their very first priority. Mechanization of dehulling usually follows, but depending on nutritional habits, may in other regions be preferred. The parallel development of a motor-driven and an animal-drawn mill was recommended in the exploratory phase with a view to providing technological solutions adapted to different conditions.

To make these technologies accessible to women credit will be provided. The project will elaborate and field-test a system for a revolving fund which is adapted to women's economic conditions and traditional savings structure. The development of appropriate support measures will constitute another priority of the project. This will comprise guidelines for the careful choice of villages, training of owners and operators, and a maintenance and repair system, all taking full account of socio-economic conditions and traditional structures prevalent in the region.

The activities of the project follow two veins: one mainly technical, i.e. to evaluate the viability of equipment available in the region and to design improved prototypes; and one mainly socio-economic, i.e. to develop and field-test a dissemination strategy, including a credit scheme and appropriate support and follow-up measures.

Once the viability and acceptability of the prototypes and concepts developed has been demonstrated, detailed recommendations and procedures for follow-up will be elaborated by two experts.

The activities of the technical component can be summarized as follows:

- To assess cereal processing equipment available in the region for appropriateness to women's needs, and its technical and economic viability.

- To design improved prototypes of a locally reproducible motor-mill, an animal-drawn mill and a dehuller. The design

will specify which parts will have to be imported, which can be produced in the project workshop and which can be fabricated by local artisans.

- To produce 8 to 10 pieces of each prototype for dissemination/field-testing, and evaluate their technical performance (20 villages will receive the prototypes - in some villages a motor-mill and a dehuller will be introduced jointly).

- To train local artisans in the production of specific parts/assembly of machines (as defined by step 2 above), and in maintenance and repair.

The socio-economic component will comprise the following activities:

- Research on the organization and division of work with regard to cereal processing prevalent in the region; the research will serve to evaluate the prototypes for appropriateness to women's needs, and as the basis for the design of a dissemination strategy.

- Formulation of a dissemination strategy, including the design of a revolving fund, guidelines for selection of beneficiaries, elaboration of training programmes for operators and owners, and the establishment of a maintenance and repair scheme.

- Selection of approximately 20 villages (10 in Mali, 10 in Burkina Faso) for dissemination of the technologies developed. They will then be informed and counselled on the schemes to be introduced, and supervised on the training of operators, owners and maintenance technicians.

- Supervision of the actual dissemination of machines to be introduced and evaluation of the viability of concepts and support schemes developed.

For the preparation of the next project phase further activities are foreseen. Via contacts established with counterparts and relevant workshops and institutions during the exploratory missions and at the beginning of the project, consultation will be ensured throughout the project. Toward the end of the pilot project, missions will be undertaken to Mali, Burkina Faso, and Niger to verify the capacity and the interest of these countries to participate in a follow-up phase of the project. Technical requirements for workshops/artisans and preconditions for dissemination will be explained and discussed. Suitable locations will be visited and their technical assistance requirements assessed.

Prior to conclusion of the project, a report on all activities and results of the pilot phase will be finalized. This will include final manufacturing drawings and production plans for the prototypes developed, an evaluation of the performance of equipment, a calculation of production costs, a list of equipment required for production by artisans, and training manuals for artisans, workers, and technicians. The socio-economic analysis will be documented in detail, as well as a description of all concepts introduced and field-tested, guidelines for selection of villages, training manuals, etc. The report will also include recommendations and detailed procedures for follow-up, in particular an assessment of the technical capacity and assistance requirements of workshops chosen for production during the follow-up phase, and proposals for dissemination zones.

The pilot-phase seeks to develop and field-test the referred prototypes and dissemination concepts.

Once the full acceptability, technical viability and competitiveness of these technologies is demonstrated, local production and dissemination of equipment will be promoted during the follow-up phase in all countries concerned.

During the follow-up phase, workshops will be assisted to initiate production. This will include short-term technical assistance, as well as a start-up credit (to purchase complementary equipment, if necessary, and acquire raw material). A regional division of production could evolve, wherein each country involved would specialize on the fabrication of one specific type of equipment, thus contributing to economies of scale. Spare parts for all types of equipment would, however, be produced in each country, preferably by local artisans, who will also ensure maintenance and repair.

The dissemination plan (obviously at a much larger scale than during the pilot phase) will comprise regular training seminars for artisans and technicians and a decentralized maintenance and repair scheme, and training of 'monitrices', who ensure support and follow-up in the dissemination areas. Training of operators and owners will be institutionalized at a local level through decentralized Government offices as well as by technicians and 'monitrices' involved. At the same time, distribution of equipment through other donor projects will be encouraged to achieve economies of scale and increase the benefits to women users. Care should be taken, however, that the principles of careful support and follow-up be observed.

The pilot phase will be characterized by the following institutional arrangements:

The intervention will initially be concentrated in the Sahelian zone, because of similar characteristics with regard to crop patterns and cereal processing habits, and the need to focus on a limited number of technologies. While in Burkina Faso, Mali, and Niger millet and sorghum (followed by maize and rice) form the essential basis of nutrition, in Togo cassava and yams play the major role in basic consumption, and production of 'gari' is the predominant activity in food processing.

Of these three countries, Mali has been selected as project 'headquarters'. The project will be attached to the workshop 'Entreprise Malienne de Maintenance' (E.MA.MA.), until recently recipient of joint UNDP/UNCDF/UNIDO assistance. It is located at Sikasso in the South-East of Mali (close to Bobo-Dioulasso, the second economic centre of Burkina Faso).

To permit full utilization of the workshop installations and labour force and to ensure technical support, a subcontract will be concluded with E.MA.MA. The contract will cover both prototype development and batch production. As soon as series production is initiated, the activity is expected to be self-supporting, and revenues from commercialization will cover the production expenses.

The equipment produced will, however, not only be disseminated in Mali (in the area of Sikasso) but also in Burkina Faso (surrounding Bobo-Dioulasso and Banfora). This will permit a simultaneous test of the acceptability of the technologies and the dissemination scheme in these two countries. It will also provide a better basis for further dissemination of prototypes and concepts developed during the follow-up phase.

VII. CONCLUDING REMARKS ON RURAL WOMEN AND AGRICULTURAL INDUSTRIALIZATION

In general, development strategies which focus primarily on women should be the exception and not the rule of aid projects. However, if the socio-economic development which is expected as a result of industrialization is to proceed effectively, special attention must be given to the integration of women into industrialization. This is not simply because women represent half of the population and are a major productive force, but because the specialization of labour by sex in many developing nations (particularly in African agriculture) means that many macro-economic/industrial policies will only succeed if their design gives adequate consideration to the importance of women's productive activity.

Having recognized that enabling women to participate fully in their societies is urgently required to accelerate the development process, it becomes evident that special efforts are

needed to assist the most disadvantaged rural (and urban) women. Often this means focusing on landless, female-headed households; they must decrease the time and energy they spend on subsistence activities in order to engage in more directly productive and developmental activities. When these activities are income-generating, output, income, health and nutrition levels rise, and women acquire greater self-reliance and control over the returns of their labour.

National statistical systems in developing nations have not traditionally included information on women at the rural village level. However, policy makers will increasingly require this information in all stages of development policy formulation. In this connection, FAO has outlined the kinds of descriptive and statistical data ^{7/} which should be considered in programme design. As the mission team suggested, if this kind of data base were readily accessible to donor agencies, efforts toward rural women could be much better co-ordinated:

a) Policy-making (assumes women are a focus of development policy)

- what is the contribution of women to food production;
- how do women balance productive, household and reproductive roles; what are priorities for assistance;
- how does control of family income impact on family well-being;
- do women participate in village co-operative and credit schemes.

b) Planning

- do women have access to land for their own production;
- what is the household division of labour (needed to adapt aid structures to a normal pattern);
- what are post harvest food processing and storage techniques;
- what are the characteristics of female agricultural wage workers (needed to plan manpower inputs).

c) Programme Formulation

- what are the socio-economic characteristics of households in the project area;
- what are the particular characteristics of women in these households;
- what are the farm and non-farm divisions of labour;
- what are the patterns of household decision making and participation in village organizations and activities.

^{7/} Ruth Dixon-Mueller, Women's Work in Third World Agriculture, Geneva, International Labour Organization, 1985, p 44

d) Evaluation

- assess the extent to which development institutions and services have reached rural poor women in terms of participation in village organizations and activities;
- have there been changes as a result of development assistance in: access to productive resources; workload; employment; income; decision-making.

Inclusion of the above kinds of information in baseline studies used to design development projects and programmes for rural women in agriculture should automatically improve their success rates. However, case studies show 8/ that still further analysis is needed to plan projects for rural women which will have the impact and longevity to become systemic and generative of further development activity. This further analysis would include:

- Raw materials: are there any competing uses for the materials used to make tools such as mills and threshers, nut presses, stoves or solar dryers? Who controls the supply of raw materials needed to make the project a success? What are the prospects for supply?

- Marketing and quality control: The first step in marketing is to make sure that the good or service provided in the aid project fills a clearly defined need in terms of time and energy savings, fuel conservation, opportunity for income generation or all of the above. The prices and qualities of competing or substitute goods must be determined. There must be control on the quality of the finished project; for example, we must ask whether the milled grain produced by a machine will be up to the standards of taste required by women users and their families. Then there is the problem of 'forward linkages': how will improved technologies, such as the new stoves in Lomé, reach women in outlying areas? Development specialists must pay more attention to these kinds of marketing issues.

- Commercialization: The approach of the mill and thresher project is a commercial one, vice an agency-dependent or social welfare one. This means that an important goal of the project is reduced dependency on external agencies as a result of the project. To accomplish this, the necessary commercial inputs (loans, training, demonstration and pilot-testing) are being incorporated into the project design. Commercial viability and the ability to repay the initial start-up loans are directly linked, and are a specific expected outcome of the project.

8/ Marilyn Carr, Blacksmith, Baker, Roofing-Sheet Maker; Employment for rural women in developing countries (London: Intermediate Technology Publications, 1984), p.121-138.

- Consultation of women: Case studies have shown that a technology is more likely to be accepted if it closely resembles existing technologies and does not require any significant changes in skills, consumer preferences or cultural mores. It is more likely to be successful if women are consulted during the design stage, and traditional technologies have been fully investigated. These investigations will provide guidance on whether co-operative or individual management by aid recipients of their equipment should be instituted, or some combination of both.

- Training, extension, monitoring: The project proposal resulting from the mission stresses the importance of training in bonding women to aid projects, and of monitoring each phase in acquiring useful data for project evaluation.

Of course there are other considerations vital to designing aid projects. Do rural women have time to avail themselves of the good or service offered? Is an activity labelled 'not traditionally female' because of social mores or just lack of experimentation? How can male resistance to women's increasing income be overcome? Can projects be linked with other projects to build a network of similar activities, such as foreseen in the mill and thresher project proposal?

The experience of the mission team helps assure us that asking these questions is not an academic exercise; bringing appropriate technologies to rural women is a much more complex undertaking than it seems on the surface. UNIDO anticipates that future missions undertaken to support the transfer of improved agricultural technologies to rural women will help to improve our conceptual framework for development assistance.

Annex I

ANALYSIS OF RELEVANT PRODUCTION SITES/WORKSHOPS

Once the needs of women in terms of improved tools and implements had been identified, the exploratory missions were requested to survey local production facilities for their capacity to produce and repair such improved equipment, as well as to provide training to women users in equipment operation and maintenance. The capacities of workshops as well as of local blacksmiths were assessed, and any technical assistance requirements to produce equipment designed for women users determined.

The two missions prepared an inventory of potential local production facilities, which is presented below:

BURKINA FASO

'Centre National de Perfectionnement d'Artisans Ruraux' (CNPAP) is an EEC-funded artisan training centre with two main branches located in Ouagadougou and Bobo-Dioulasso, and 8 smaller ones in other regions. 15 artisans are trained each year over a seven-month period, both in Ouagadougou and Bobo-Dioulasso. Courses are given in blacksmith skills, forge-welding and simple heat treatment of high carbon steels, motorcycle maintenance, and maintenance and repair of single cylinder diesel engines and motor-driven mills. Follow-up in basic administration is provided to the artisans. The CNPAR located in Bobo-Dioulasso could play a role in training artisans in production skills, maintenance and repair.

Workshop 'Atelier Pilote de Construction de Matériel Agricole' (APICOMA) in Ougadougou is linked to the CNPAR; both are under the supervision of the 'Ministère de Travail'. APICOMA has a fully equipped machine shop. It produces all kinds of agricultural equipment, including ploughs, cattle and donkey carts, handcarts, and wheel barrows ('pousse-pousse'). Prototypes of manual cereal processing equipment (dehuller, sheller, rice-thresher) have been developed and are presently being tested. APICOMA is subcontracting with local artisans for the production of parts. This workshop could be of value in a later project phase because of its good equipment and efficient management.

'Centre National d'Équipement Agricole' (CNEA) is under the supervision of the Ministry of Agriculture. Four workshops are comprised in this national structure. The main and best equipped workshop among these is located in Bobo-Dioulasso. It

has fully equipped machine shop with welding bay, forge, point-spray booth, etc. Production takes place mainly in Bobo-Dioulasso, as well as in Tenkodogo; the other workshops assemble the kits produced in the main workshops. All imported raw materials arrive in Bobo and are afterwards distributed to other workshops, allowing for considerable savings. A further reinforcing of the Centre in Bobo-Dioulasso is envisaged. Prototype developments have mainly encompassed manual equipment: shea-butter presses, manual threshers, dehullers, shellers, etc. The workshop has the capacity to play a role in a later project phase.

The 'Atelier de Constructions Metalliques Diverses' (ACMD) is a medium-sized engineering company whose main product is a large steel vessel for bulk liquid transportation. ACDM produces a variety of crop cultivating and processing equipment. It also makes donkey carts which can transport 600 litres of water, and corn and peanut shellers.

I.T.Dello/Workshop Paul Nikiema in Ouagadougou produces and tests an animal-drawn mill developed in Senegal.

The 'Institut Burkinabé de l'Energie' (IBE) under the Ministry of Agriculture) in Ouagadougou is in part financed by the GTZ. It is working on conservation techniques for fruits and vegetables. The Tanghin Center for Tomato Processing (Centre de Transformation de Tomate de Tanghin), which produces dried and peeled tomatoes, uses solar dryers made by the IBE.

MALI

The 'Entreprise Malienne de Maintenance' (E.MA.MA.) was created in 1976 with the assistance of UNIDO and the People's Republic of China. Initially it was mainly concerned with maintenance and repair of trucks and agricultural machinery. Since 1983, it has been successfully producing water pumps of excellent quality and reliability at a competitive price, which are exported into neighbouring countries. Thanks to a number of technical assistance projects, E.MA.MA. now disposes of equipment adapted to all requirements and has a very well trained staff. Within the Sahelian target countries it is the workshop best equipped for and fully capable of both prototype development and series production. In addition to its excellent technical capacity it also disposes of a design office which permits all computer-based simulations and calculations, as well as a small training and demonstration centre equipped with teaching material and audio-visual devices. This workshop has been selected as main counterpart for the project proposed.

The 'Division de Machinisme Agricole' (DMA) is under the supervision of the 'Direction Nationale du Génie Rural' within the Ministry of Agriculture. The DMA is responsible, via the

'Centre d'Enseignement et d'Expérimentation du Machinisme Agricole' (CEEMA) for testing all agricultural equipment to be introduced in Mali, for developing and adapting prototypes and for training of users. The CEEMA has carried out some development of prototypes, such as threshers for millet and dehullers, in co-operation with CMDT (see below).

The 'Société Malienne d'Étude et de Construction de Matériel Agricole' (SMECMA) is a Government-owned, commercially operated workshop currently mass-producing donkey-drawn agricultural implements. SMECMA is suitable for serial production of such tools as shellers and threshers following prototype development.

The 'Base de Perfectionnement des Artisans Ruraux' in Ségou is suitable for prototype development of simple equipment but not mass production of tools. They are equipped to train users in procedures and maintenance.

The Workshop of the 'Compagnie Malienne de Développement des Textiles' (CMDT) in Koutiala manufactures a mini-dehuller, in co-operation with DMA and 'Appropriate Technology International' (ATI).

Workshop ARPON in Niono, supported by Dutch co-operation, is a well-functioning workshop, producing and assembling motor-threshers for rice, and developing dehuller prototypes.

Workshop ADAMA in Bamako is still in the planning stage. It will be funded by the Dutch, and plans to establish a decentralized network of workshops and local artisans, and to assemble mills.

Workshop for shea-butter press production in Bamako is a former GTZ/DMA project, now administered by a NGO. The press is entirely produced locally, except for a hydraulic jack.

A village blacksmith in Kalabougou works with only a few basic tools and locally obtained scrap metal. This workshop produces donkey-drawn ploughs, hoes, and axes. Given the design specifications, he could make a potter's wheel for the women potters of the village. He is also capable of manufacturing a donkey cart.

Bargondougou: Here two local engineering workshops were visited to assess capabilities for improved fish smoking equipment. They were: 'Opération Développement Élevage Mopti' and 'Rizerie Sévaré'. Both would need expert assistance to produce improved tools. However, several local blacksmiths in the town of Mopti could easily make improved utensils for the local fish smoking process.

Various artisans in Bamako representing a range of skills and material endowment were visited. An appropriate technology engineer could work with artisans to improve their designs. For example, one locally-designed cassava grater used crude steel ball bearings, which could easily and cheaply be replaced by better working wooden ones which are first boiled in oil.

NIGER

State-Owned Workshops under the supervision of the 'Union Nationale des Coopératives' (UNC); Workshops ACREMA in Tahoua; UCOMA in Zinder, C. DERMA in Dosso, AFMA in Niamey: these workshops are all producing agricultural equipment. Technical reinforcing is necessary before they could play a more essential role within the project. In Tahoua, the 'Atelier de Construction et de Réparation de Matériels Agricoles', (ACREMA) is a medium-sized machine shop which is well-equipped to produce agricultural tools. It has a machine shop, metal-forming machines, welding equipment, a paint-spray booth, etc. It produces wire mesh fencing, water pumps, transport carts, brick presses, and other tools. The shop trains about 20 artisans every year in smithing skills and welding skills, including heat treatment of high carbon steels. Follow-up visits are made to artisans when they have returned to their villages. Orders are placed with the artisans when possible. In Dosso the 'Centre de Développement Rurale et Machines Agricoles' (C.DERMA) is functioning at well under capacity. It could be used for development and production of improved design tools, engineering assistance would however be necessary. Currently, main production is focused on donkey carts, watering cans, and assorted tools.

Workshop ARMA, 20 km from Niamey, is funded by USAID. It is a very well equipped workshop, active mainly in the field of research and testing of prototypes. Its approach is to ensure the reliability of equipment.

Workshop of M. Hamidou Moumouni, Dogondoutchi: Mr. Moumouni is an artisan-entrepreneur who has developed prototypes of peanut shellers, dehullers and millet threshers/winnowers, and other equipment. He also provides these services to women at a price they can afford. He is willing to improve, produce, install and maintain machine threshers/winnowers for millet. To produce such machines this workshop would require substantial refurbishments.

In Tabalak, there exists a co-operative artisanal workshop which unfortunately has moved away from farm production into jewelry production. This is because the income base of the area is insufficient to support farm equipment sales. The shop could produce watering cans and other tools.

TOGO

University of Lomé: The University workshop could be used to develop prototype equipment, which then could be reproduced in small batches by local artisans. The University is seeking funding to train artisans in improved cooking stove manufacture.

The 'Unité de Production de Matériel Agricole' (UPROMA) in Kara, the North of the country, presently receives UNIDO technical assistance. This is a medium-sized plant, very well equipped with machine tools, power presses, cutting welding and forging facilities, and a heat treatment furnace. They produce a wide variety of equipment for cultivation and processing of crops. UPRONA has a budget for research and development of new equipment designs which has not yet been exploited. They could produce new designs in quantity if demand were sufficient.

Small artisanal metal and woodwork shops: There are several in the area which could take up batch production under the guidance of an appropriate technology expert.

'Centre Rurale d'Activité Sociale et Educationelle' in Kapaliné: this training center has good facilities and skills for woodworking, metallurgy, forging, and even aluminium casting (gravity/sandbox). However, additional training would be required to improve skills to include heat treatment and forge welding of high carbon steels. The centre could be used for prototype development of small equipment given this training, but it does not have the capacity for batch production.

In Atakpané there is a good metalwork and forging business. It employs ten people and is suitable for prototype development. It is already batch-producing farm tools and is commercially successful.

An artisanal training centre in Sokodé, serving both men and women, could be used for prototype development and small batch production. It is well-equipped for welding, forging, and woodwork.

Annex II

ANALYSIS OF INFRASTRUCTURE OF GOVERNMENT STRUCTURES AND OTHER SUPPORT SERVICES

The plan of action to be prepared during the exploratory phase should not only encompass design, prototype development and batch-level production of tools and implements but also elaboration of appropriate support measures for dissemination (outlets, credit requirements, ownership, etc.). During the course of the missions the importance of the introduction of appropriate support measures and organizational schemes became very evident. Consequently, an analysis of national as well as international structures active in the promotion of women, rural extension, and the dissemination of appropriate equipment was undertaken.

In this annex the most important organizations intervening in this field are listed and briefly characterized.

BURKINA FASO

The 'S cretariat d'Etat de l'Action Sociale': This organism plays a very active role in promoting the economic and political integration of women, and could actively support dissemination. Its structure is decentralized at the province and department level; facilitators work, according to need, in various villages.

It also co-operates closely with the 'Union de Femmes Burkinab ' (UFB). The UFB, which has a very decentralized structure covering the provinces, departments and villages, has only recently established a secretariat at national level. It is now charged to co-ordinate, in co-operation with the Ministries concerned, all activities for the promotion of women. Alleviation of women's tasks through the introduction of labour-saving equipment is a priority.

The 'Minist re de l'Action Coop rative' promotes and organizes village associations and co-operatives. It participates with Dutch co-operation in projects for 'animation f minine', and 'sensibilisation des paysans autour de barrages'. It has a section for promotion of women; one small programme for dissemination of mills exists.

The 'Minist re de l'Agriculture' has a very decentralized structure. 'Centres R gionaux de Promotion Agro-Pastorale' (CRPA) are responsible for training and dissemination of technologies; two facilitators are in charge of every 7 to 8 villages.

The Dutch play a particularly active role in fielding technical assistance projects for rural women (see paragraph 5 above).

MALI

The 'Direction Nationale de l'Action Coopérative' (DNACoop) under the supervision of the 'Ministère de l'Administration Territoriale et du Développement à la Base' is responsible for promoting co-operatives and 'tons villageois' (village associations), and for introducing the principles of co-operation in the rural and urban environment. It has a decentralized structure at the level of regions, 'cercles' and 'arrondissements' (through the 'agents techniques de l'Action Coopérative'). A section for promotion of women exists within DNACoop. In co-operation with a volunteer organization, it disseminates village mills in different regions of the country, and disposes thus already of useful experience.

The 'Direction Nationale des Affaires Sociales' (DNAS) is represented at the level of regions and 'cercles'. Dissemination of technologies constitutes a major part of their work, and women are a specific target group. DNAS is working on the distribution of improved stoves in co-operation with the GTZ.

The 'Direction Nationale de la Formation et de l'Animation Rurale' is represented at the level of regions, 'cercles' and 'arrondissements'. Two-year training courses for men and women are carried out in the 'Centres d'animation rurale' (located in the 'arrondissements'), which cover mainly agricultural production for men, and household and income-generating activities for women. After two years the trainees will assume the role of (unpaid) facilitators in their villages.

Relevant technical assistance projects pertaining to dissemination of technologies which were contacted during the preparatory phase were:

SNV (Dutch volunteers)/DNACoop: Following problems in the dissemination of mills in an earlier phase under a different executing agency, a careful evaluation of factors leading to project failure has been undertaken by UNIFEM, as well as the above organizations, and the project has been entrusted to them.

Project ARPON (Dutch co-operation) has experience particularly in the dissemination of rice-dehullers, though distribution of mills is envisaged.

CNDT/Dutch co-operation distributes various food processing technologies for women, such as mills, dehullers, shea-butter presses; dissemination strategies are presently being developed.

Distribution of shea-butter presses: relevant experience has been acquired in particular with regard to encouraging full responsibility of women for all activities related to the operation and administration of the technology, as well as in the field of credit schemes based on traditional savings associations.

IFAD-project 'Fonds Villageois' in Ségou has valuable experience in the development of a revolving fund scheme (addressed to village associations); dissemination of mills and threshers has recently been initiated.

NIGER

The 'Sécrétariat d'Etat de la Condition Féminine' is a fairly recently created organization which is in the process of elaborating its work and policy programme. It is closely linked to the 'Association des Femmes de Niger' (AFN).

AFN under the supervision of the Sécrétariat d'Etat de la Condition Féminine/Ministère de la Santé: a mass organization with a decentralized structure up to the village level; a programme for the dissemination of mills has been carried out, which is, however, considered a failure.

'Union Nationale de Coopératives' (UNC) is responsible for organizing co-operatives and village associations. It disposes of a decentralized structure; a small unit for promotion of women exists.

TOGO

In 1977 the Government of Togo established the 'Direction Générale de la Condition Féminine' (DGCF), which has put into operation several development programmes supported by non-governmental organizations and international agencies. A good number of studies, project ideas and regulatory measures to improve the status of Togo's women have already been implemented. The DGCF is well organized and could expand its contact with groups of rural women to help them become self-financing and administering.

Annex III

OTHER INITIATIVES REVIEWED BY THE FIRST MISSION

While the second mission was fielded with the very precisely defined objective of finalizing a project document for the local production and dissemination of improved cereal processing equipment, the first mission reviewed a broad range of production facilities and initiatives of women's associations in order to determine a sector of intervention. They identified a number of needs and proposals for assistance. Though the resulting project cannot follow-up on every single initiative, a short summary of these findings follows which might provide a basis for complementary technical assistance efforts.

BURKINA FASO

In Ouagadougou the team visited a dolo production site: Dolo is a millet-based beer which is the most sold drink in the country. The 'Institut Burkinabé de l'Energie' (IBE) calculates that dolo production uses 20-30% of wood fuel supplies, contributing strongly to the deforestation of the country.

The team visited also the 'Centre de Transformation de Tomate de Tanghin' (funded by FAO) which uses solar dryers made by the IBE. It is run by 11 women whose output in 1987 was 6 tons. Packaging is their main problem.

In the countryside, the mission team visited Basinko, where 180 women were grouped to extract shea butter, a strenuous female-only activity. The women had been offered a press by the IBE but they preferred their traditional methods because the yield is higher and the process shorter. However, they use the IBE press for their domestic consumption needs.

The team visited next Yatenga province. In Ouahigouya, the team consulted with a group called 'Naam-Six S's'. The 'Six S's' derives from the French 'Se Servir de la Saison Seche en Savane et au Sahel' (Know how to make use of the dry season in the Savane and Sahel) and the word 'naam' means 'solidarity' in the native language. Traditional groups called 'naam's existed in Yatenga to aid widows, the old and the most poor of the villages. In 1977 the group 'Six S's' had the idea to join with them and the IBE to introduce appropriate technology. Working with the GTZ, Naam-Six S's has installed mills which serve women at a much lower price than is typical of commercial mills.

In Banfora the team met with groups of women who demonstrated traditional harvesting and preservation of fruits and vegetables. Lack of packaging techniques is an acute problem impeding income generation.

MALI

The team then visited Kalabougou, in the area of Ségou, where it talked with a co-operative of 202 women potters. The co-operative received credit for the construction of two ovens. The biggest barriers to increased productivity are the time and distance involved in collecting firewood and clay and also transport of their finished products. Besides improved transportation, a motorized grain mill would free substantial time and energy for income-generating work. In Kalabougou, the mission proposed:

(a) placing five carts with harness at the disposal of the pottery co-operative;

(b) placing one motorized mill, capacity 200 kg/hour, at the disposition of the village as a whole; training in mill operation can take place at the Ségou training 'base'.

The team felt the infrastructure and experience to successfully manage these inputs is present in Kalabougou.

Mopti, a town 650 km from Bamako, is a traditional fish-smoking center, and its products are distributed throughout the country. However the methods used are very crude and could easily be improved. The women of the village are quite amenable to suggestions, especially regarding packaging, as they estimate they lose 30% of their product through spoilage. The mission proposed that a group of women be trained in improved smoking techniques, and that a small workshop to produce plastic bags be established. A follow-up visit by a consultant one year later is recommended.

At Markala, 60 women have formed a soap-making co-operative which utilizes imported palm oil. A Karité press would allow them to replace this imported input with one available locally. The mission also visited Sévaré where the team observed the weekly market attended by rural women.

NIGER

In Niger, the team visited first Say, a town about 50 km outside Niamey. The team inspected hand and motor operated mills which had been introduced there: the handmill had broken as a result of bad design and misuse, and the motorized mill had been allowed to run without oil in the engine, causing it to break down. There are workshop facilities in Say.

Tamou is 110 km from Niamey. A scheme to fence off areas of a riverbed and the riverbank to allow for fruit and vegetable cultivation has been proposed there by a technical assistance organization. Although the gardening would be done by all members of the community, the scheme proposed that women form an income-generating group to make wire mesh fences to protect garden plots from animal damage. It has been estimated that about US\$ 12,000 is needed to provide wire and artisanal material to make fencing.

In Maradi, the team visited a technical school which has a well-equipped machine shop which could be used for development and production of agricultural tools (with appropriate funding). The team also noted that the 'Office de Promotion des Entreprises Nigériennes' (OPEN) foresees launching CONCONIGER, a small-scale enterprise for producing fruit jams and syrups at Maradi. If so, a women-run pottery glazing operation could serve to replace imported jars with locally fabricated ones. Equipment and consultancy for such an operation would cost about US\$ 37,000. It would reduce operating costs of CONCONIGER and provide income to women.

At Tabalak, the team noted that many women had recourse to a donkey to help with the transport of water and wood and other cargo, but the donkeys were under-utilized because of the high price of donkey carts (3 to 5 times the cost of the donkey). The team proposed selecting 10 women to own and maintain donkey carts as commercial transport businesses. Much thought would have to be given to selection of the cart owners and to planning of the transport network which hopefully would result. The cost of 10 donkey carts is about US\$ 3,500.

TOGO

Here, the team visited in Kpalimé, 121 km from Bamako in the Plateau Region, an artisanal centre which runs a pottery and a forge. The women potters expressed a desire to improve their techniques which are quite labour intensive.

Atakpamé is also in the Plateau Region. There a group of women has formed to manufacture soap commercially. SADA, as they are called, produce all of their product inputs, but their techniques need revision. Atakpamé also has an artisanal center which is twinned with one in Niort, France. The workers there produce a whole range of agricultural tools needed by women, who are very appreciative.

At Kpélé-Elé, the team met the training agent and the president of a women's group which was harvesting a 10 hectare rice plot for profit. For this work the women had only rudimentary tools which required them to work bent-over. Cultivation with large animal power would be more logical, but women in this area are not accustomed to keeping large animals.

At Sokodé the team met with the technical director of the 'Groupement Inter-Professionnel des Artisans du Togo', GIPATO, which manufactures agricultural tools. It is financed by the International Labour Organization.

In Tchamba the team visited a women's group which manufactures gari (a manioc-based food similar to tapioca). This group owns a grater and a press but they break down so frequently that they hamper productivity. Improved handgraters and presses are needed.

In the Kara region the team visited individual women's households to observe methods of milling and cooking. Peace Corps volunteers run an experimental appropriate technology center there and UPRONA operates a tool factory to produce medium-scale farm equipment (i.e. ox or tractor-drawn equipment, vice hand tools).

Annex IV

**INSTITUTIONS CONTACTED DURING THE
TWO EXPLORATORY MISSIONS**

UNDP offices in:

- Burkina Faso
- Mali
- Niger
- Togo

UNIFEM representatives in:

- Burkina Faso
- Mali
- Niger
- Senegal

UNIDO SIDFA:

- in Togo

Interregional Organizations:

- Secrétariat Exécutif du CILSS (Comité Interrégional de Lutte contre la Sécheresse), Ouagadougou
 - * Programme Régional de Promotion des Céréales Locales au Sahel (PROCELOS)
- Institut de Sahel, Bamako
 - * Département de la Recherche sur le Milieu et de l'Agriculture

Government Organizations:

Burkina Faso

- Direction Nationale d'Intrants et de la Mécanisation Agricole
 - * Service de la Mécanisation Agricole
- Centre National d'Équipement Agricole (CNEA)
 - * Direction, Ouagadougou
 - * Workshop, Bobo-Dioulasso
- Atelier Pilote de Construction de Matériel Agricole (APICOMA)

- Centre National de Perfectionnement des Artisans Ruraux
 - * in Ouagadougou
 - * in Bobo-Dioulasso
- Institut Burkinabé d'Energie
- Ministère de l'Enseignement Supérieur et de la Recherche Scientifique
- Fonds de l'Eau et de l'Equipement Rurale (FEER)
- Ministère de la Coopération Economique et de la Planification
- Ministère de la Promotion Economique, Direction de l'Artisanat
- Ministère de l'Information

Mali

- Direction Nationale du Génie Rural
 - * Direction de Machinisme Agricole (DMA)
 - * Centre d'Enseignement et d'Expérimentation du Machinisme Agricole (CEEMA), Bamako
- Société Malienne d'Etude et de Construction de Matériel Agricole (MECMA), Bamako
- Opération de Développement de l'Elevage de Mopti (ODEM)
- Opération Riz de Mopti

Niger

- Ministère de l'Industrie
 - * Direction de l'Industrie
 - * Direction de l'Artisanat
 - * Service du Développement Industriel
 - * Service Statistique et Evaluation
- Office de Promotion des Entreprises Nigériennes (OPEN)
 - * Direction
 - * Projet de Formation et d'Appui aux Entreprises Artisanales du Niger
- Union Nationale de Coopératives (UNC)
 - * Atelier de Construction et de Réparation de Matériels Agricoles (ACREMA), Tahoua
 - * Centre de Développement Rural et de Machinisme Agricole (C.DERMA), Dasso
- Direction des Etudes et Programmation

Togo

- Unité de Production de Matériel Agricole (UPROMA), Kara

Government socio-economic organs:

Burkina Faso

- Secrétariat d'Etat à l'Action Sociale
 - * Secrétariat d'Etat
 - * Direction de la Promotion de la Famille
 - * Direction de l'Economie Familiale, Bassinko
 - * Direction de l'Economie Familiale, Kadiogo
- Ministère de l'Agriculture et d'Élevage
 - * Direction Générale
 - * Département des Etudes et de la Planification
- Ministère de l'Action Coopérative (ex-Ministère de la Question Paysanne)
 - * Direction Générale
 - * Elaboration de Projets, Promotion de Groupements Féminins

Mali

- Direction Nationale des Affaires Sociales (DNAS)
- Direction Nationale de l'Action Coopérative (DNACoop)
 - * Direction
 - * Section de Promotion Féminine
 - * Section Projets et Programmes
 - * Programme moulins
- Direction Nationale de la Formation et de l'Animation Rurale
- Direction Nationale de l'Alphabétisation Fonctionnelle
 - * Division Promotion Féminine
- Compagnie Malienne de Développement des Textiles (CMDT)
 - * Section Formation

Niger

- Union Nationale de Coopératives
 - * Direction Générale
 - * Section Action Féminine
- Direction Nationale de la Condition Féminine
- Centre National de Perfectionnement à la Gestion
- Institut Pratique de Développement Rural

Women's organizations

Burkina Faso

- Union des Femmes Burkinabé

Mali

- Union Nationale des Femmes du Mali (UNFM)

Niger

- Association des Femmes du Niger (AFN)

Togo

- Direction Générale de la Condition Féminine
- Direction Régionale des Affaires Sociales et de la Condition Féminine, Sokode
 - * Division d'Etude et de Recherche

Technical Co-operation Projects:

Technical Component:

Burkina Faso

- Institut Technologique Dello (NGO)
- Atesta (NGO)
- Centre de transformation de tomate de Tanghin (FAO)

Mali

- Workshop ARPON (Amélioration de Riziculture des Paysans à l'Office du Niger) (Dutch Co-operation)
- Project ADAMA (Association des Ateliers de Matériels Agricoles) (Dutch Co-operation)
- GTZ - Programme Spécial Energie
 - * huile de pourghère
 - * Improved Stoves
- Workshop for shea-butter presses (GTZ)

Niger

- Workshop ARMA, within project 'Productivité'; USAID
- Lycée Technique, Maradi

Togo

- Groupement Inter-Professionnel des Artisans du Togo (GIPATO), Sokode; ILO-assisted

Socio-economic component:

Burkina Faso

- Projet Sensibilisation et Formation des Paysans autour des Barrages (Dutch co-operation)
- Groupement Naam-Six 'S', Yatenga

Mali

- SNV - Volontaires Neerlandais
- IFAD - Développement des Fonds Villageois, Segou
- Project ARPON
- GTZ - dissemination of shea-butter presses

Niger

- Programme Spécial National, IFAD - Niger

Private Workshops

Burkina Faso

- Atelier de Constructions Métalliques Diverses (ACMD), Ouagadougou
- various blacksmiths

Mali

- Fonderie Samoura
- various blacksmiths

Niger

- Workshop Hamidou Moumouni, Dogoudoutchi
- Artisanal Workshop in Tabalak

Visits to villages

Burkina Faso

- Groupement Féminin de Bérégodougou near Banfora
- Société Coopérative des Agriculteurs de Bérégodougou (SOCABE)

Mali

- Village Sakoyiba: installation of thresher
- Coopérative des potières, Kalabougou
- Coopérative féminine de Markala

Niger

- Village Kongou Konga - installation of mill

Togo

- Groupement féminin Mokpokpo
- Groupement de Kouloumi
- Groupement féminin de Soda, Atakpomé
- Groupement féminin de Kpélé-Elé
- Villages near Kara

Suppliers

Burkina Faso

- CICA-LIFTEL

Mali

- SIEMI
- SIMAGA
- SEMAFREC
- Dupé S.A.

Niger

- SIEMI