PrOpCom

Making Nigerian Agricultural Markets Work for the Poor

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Value Chain Study of Small-Scale Agricultural Mechanization

By

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Consultants

February 15, 2007

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The Road to Success is Always under Construction
- Mesaki Oyewobi
Workshop Participant

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Table of Contents

Executive Summary

The purpose of this study is to analyze the small agricultural equipment and machinery value chain, identify constraints and opportunities that are present in the value chain, and indicate possible actions PrOpCom might take in support of the chain. The impetus for the study is concern that low productivity of labour in agriculture in Nigeria may be due, in important measure, to the lack of financially attractive farm and agro-processing small mechanical technologies. This report has benefited from an all day workshop with a cross section of stakeholders from up and down the value chain and from around Nigeria.

Nigeria has a fairly recent history of supporting small agricultural mechanization, especially at the national level. In 1989 the government mapped it current strategy for promoting agricultural mechanization in its Agricultural Policy for Nigeria. It charged the National Centre for Agricultural Mechanization (NCAM) to function as a key institution for promoting agricultural mechanization by stimulating and coordinating research and development of agricultural machinery. Over 140 research Institutes, universities, polytechnics and other technology development institutions are involved in technology development at the present time. The PCU and ADPs lead the extension effort, and numerous centres and programs support various other dimensions of the programme. Donors have provided support for most of this period, usually through development projects, though few had any direct agricultural mechanization component. Since 1999 there have been several presidential initiatives that support specific commodity and farming systems development programs that have agricultural mechanization components.

Nigeria's technology centres have worked more in isolation from each than was envisioned in the legislation creating NCAM. In general, they have a stock of fabricating equipment that is relatively sophisticated but severely underutilized, secure salaries but low levels of operating support, and a focus on equipment design rather than outreach. There appears to be little attention given to how the equipment actually performs for the end user and little evidence that economic factors get much weight in evaluating technologies. Recently, the government has emphasized the need for the technology centres to become more self-reliant for funding. This has stimulated production for the market of all types of agricultural equipment and machinery by the technology centres themselves.

There are probably over 1,000 private sector fabricators of agricultural machinery in Nigeria, and possibly many times that amount. Past attempts to list them have been less than thorough and the information provided on those listed is quite incomplete. Whatever the real number now, the conclusion is the same: there is already a critical mass of fabricators such that identification of profitable technologies could provide the basis for a rapid diffusion of such technologies if the system were better organized.

Private sector firms vary from quite sophisticated operations to single man operations that are not even on the NCAM list of fabricators. They produce a wide range of equipment, with an emphasis on processing technologies. Many of them design the machinery they produce, although most appear to copy.

Typically local fabricators find the materials they need in local markets. Often they simplify the designs they copy so as to be able to produce and sell their products cheaper than their more sophisticated competitors and imports. This type of knock-off production enables potential users with limited means to enter the industry more easily by substituting lower priced, higher maintenance-cost, machines for machines that require more investment capital. Many such users, no doubt, find such technologically inferior products to be economically superior under their particular circumstances.

Fabricators producing agricultural mechanization technologies for end users include black smiths, artisans, micro, small and some medium scale entrepreneurs. They are widely distributed throughout the country. They usually have five or less permanent employees, and have relatively poor technical and management skills. They produce a wide range of machines including hand tools, draft animal implements, ridgers, shears, milling machines, cassava processing machines, oil palm processing machines, grinding machines, threshers, shellers, hullers, expellers etc. They tend to have poor linkages with ADPs, PHTCs, technology centres and financial service providers. They tend to produce on order and do not do much marketing. They do, however, tend to have good relationships with end users, which facilitate feedback for improving their products.

The bulk of Nigeria's imports of agricultural machinery come from India, China, Japan, Brazil, Pakistan and the UK. The two largest importers we interviewed brought in about 5,200 cereal grinding mills, 1,800 rice hullers/polishers and 15,000 2"-4" water pumps. Both companies import from China and India. There are many other importers of agricultural machinery; we interviewed only eight.

The larger importers reported that the cost and time of clearing goods through the port is much improved from former times. Some of the smaller ones, however, report continuing problems with non-receipted "endorsements" and VAT charges which are technically not payable on agricultural machinery. Obtaining a Risk Assessment Report (RAR) is also a problem, with delays often causing assessment of demurrage charges. For containers duly and officially cleared from the ports, police harassment along the road is virtually absent.

The dealer network in Nigeria is really quite good. Most of the importers of small equipment we spoke with distribute through independent dealers that buy from multiple importers. None reported any difficulty getting what they need. Many of the dealers also sell locally fabricated equipment and, indeed, fabricate equipment themselves. Not all stock spare parts, but those that don't say generic spares are available in the local market and they cannot sell OEM parts because of their high cost. Most provide installation and post sales service as well.

Dealers were as likely to report commercial credit problems as fabricators. The issues were the same, high non-interest charges, high, required turnover of funds in order to generate higher commissions on turnover (COT), and strange charges on statements. Most seem to get the bulk of their financing from advance payments required of buyers of imported equipment.

When it comes to government it is clear that its effect on the agricultural mechanization value chain is enormous and is enormously complex. We include it with donors in the value chain because, with respect to direct fabrication and imports of agricultural machinery, the two operate in similar ways. Both distribute their equipment through the ADPs as well as directly to end users. The main difference between them and the private fabricators is that they focus more on moving money and materials than on sustainability. Government and donor delivery systems also typically give little attention to ongoing servicing and other post-delivery issues, apart from importing a set of spare parts to keep it operating for the first year.

Maintenance of agricultural machinery outside of government services also does not seem to be a problem in the value chain. Nearly every distributor and dealer we talked to services the machines it sells and usually installs them as well.

The governance structure of the agricultural mechanization value chain is not well developed. NCAM does not coordinate technology development as it is supposed to do. The technology centres have developed many prototypes but there is little proper evaluation

of these technologies with respect to their financial, economic, and sometimes even technical, effectiveness. The ADPs are unable to fulfill their obligation of promoting agricultural mechanization technologies because of lack operating funds. Finally, there are very weak relationships between technology centres, fabricators, the ADPs and end-users

There are practically no technology, resource or policy rents, or barriers of entry for those who want to be involved in importation, fabrication, sale or servicing of farm and agriculture related equipment. The major rents in the agricultural equipment value chain are extracted by banks. Problems are not uniform, but they appear to be pervasive. The major costs with bank credit are not the relatively high interest rates that prevail throughout Nigeria, but the other charges that come with it. Stakeholder associations are mostly non-existent and those that exist are weak. There are very few informal rules we were able to identify.

Patent rules are not enforced in the sub-sector but this does not seem to be a problem at the moment. There are, however, instances of big companies losing market share to artisans producing lower cost, lower quality knock-offs that are in high demand in local markets.

There are numerous champions all around the country, among fabricators and end users. These are people who are willing to take risks, use their own resources for technology and product development, and who desire to operate in the higher value niche of the market. They are the Ben Franklins of Nigeria. They desire increased cooperation with technology centres, with a view to improving on the quality and volume of their production. They are willing to work with smaller end users to improve the quality and quantity of products. We found these people all over in our work. They represent, perhaps, the single most important resource, apart from prudent government policy, for improving the agricultural machinery value chain.

The major constraints on improving the small scale agricultural mechanization value chain are lack of information, including financial feasibility information, about the machines and technologies that are available; poor coordination of the activities of technology centres with respect to development of technologies; poor links to finance; and, erratic government policy.

There are also major opportunities. Most of these centre around establishing mechanisms for promoting resource and information sharing between technology centres, fabricators, champions, dealers and end-users; ensuring proper financial feasibility studies are conducted on technologies that appear ready for extension; and creating parallel privately owned legal structures to provide information, extension, technical support and finance for such technologies and the business adopting them.

The value chain workshop format we used for gathering information for this report proved to be an excellent mechanism for tapping the energy of people up and down the value chain. Most of these actors see clearly the need to put major emphasis on the private sector and greater interaction between technology centres as driving forces for improving agricultural mechanization. The workshop format provides an opportunity for everyone to see how interdependent they are, how the fortunes of one affect the fortunes of all. Most importantly, it provides an example of how to go about harnessing the collective energy of value chain actors for agricultural transformation.

Value Chain Study of Small-Scale Agricultural Mechanization

By
Femi Ajibola and Tom Zalla, Consultants

1.0 Introduction

In December, 2006 PrOpCom hired the above consultants to collect a series of information and data about the small scale farm implement and equipment value chain, and to use this information to undertake basic value chain analysis of the farm mechanization value chain. The analysis includes basic background and data concerning the value chain, a basic mapping of the value chain, an analysis of the governance structure of the value chain and avenues for upgrading the chain. The study notes some constraints and opportunities that are present in the value chain, and indicates possible actions PrOpCom might take in support of the chain.

Promoting Pro-Poor Opportunities in Commodity and Service Markets (PrOpCom) is an innovative project funded by the Department for International Development of the United Kingdom (DFID) to facilitate functionality and efficiency of Nigerian commodity and service markets in such a way as to assure these markets benefit the poor. PrOpCom's goal is to improve livelihoods by facilitating growth and pro-poor outcomes in commodity and service markets and to contribute to the overarching (DFID/Nigeria) goal of poverty alleviation in support of NEEDS and the attainment of the Millennium Development Goals. PrOpCom is using a "Making Markets Work for the Poor" (M4P) approach to address the systemic reasons that prevent commodity and service markets from functioning effectively for the poor in Nigeria. In doing so, the programme will contribute to delivery of the vision for growth in the non-oil economy outlined in NEEDS. The project purpose is to support systemic change in markets on which the poor rely to produce pro-poor outcomes and opportunities such as:'

- Enhanced incomes;
- Increased jobs;
- Improved access to markets;
- More options and choices; and
- Reduced risks.

During the first two-year pilot implementation phase, PrOpCom is focusing on rice as the primary commodity and Soya bean as secondary commodity. The value chain analysis of agricultural mechanization has a broader focus, but with special attention to these two commodity groups

PrOpCom facilitates, not implements, change. The programme facilitates change with and through local structures, firms, and individuals. PrOpCom is therefore just a catalytic agent. Like all catalysts, it merely speeds up the process while leaving the intended beneficiaries (local market actors) to run the show. It is about Nigerians taking charge of their own development. For this Nigerian ownership to occur, the programme aims to help the programme's Nigerian partners to create a vision that can motivate and direct them to reach goals that are mutually agreed.

PrOpCom emphasizes market-led development. The programme contributes to removing constraints to efficient market operations and linking market actors to work together and serve each other on a sustainable basis. It does this by working with business associations,

service providers and other intermediaries who already serve functions along market chains in which the rural poor have a stake. By facilitating fundamental changes in the functioning of markets and the rules of the game governing access by the poor, the programme seeks to promote systemic change and self-sustaining growth.

2.0 Background of Issue and Methodology

PrOpCom sees low labour productivity as a constraining element in agricultural sector growth, and only scattered and minimal level of government and donor support for this emerging issue. It seeks a better understanding of what the private sector is doing to help address this issue.

There is clear evidence of low labour productivity in the rice value chain as well as most of the other commodity chains in Nigeria. A recent study by Accord Consultants notes high costs of labour intensive activities within and along the rice commodity chain. Among these costs are such things as planting, harvesting, par boiling, threshing and destoning. A recent study by the SMSE project also highlighted the fact that while Nigerian farm labour costs about the same as those in Thailand, the productivity of Nigerian labour is so much lower that it makes the commodity value chain, in this case rice, non-competitive to Thailand or any other countries' production of rice. High agricultural labour costs induced by urbanization and oil driven growth make it difficult for much of agriculture to get the quantity of labour it needs with current production technologies. The situation appears to be much the same with other agricultural commodities.

Mechanization is only one dimension of agricultural productivity. In the case of rice and many commodities, low yields relative to international norms, unreliable input supply both in quantity and more particularly in quality, poor farm to market transportation and an even poorer electricity infrastructure, all these increase the investment and capital costs of mechanization per unit of output and reduce its profitability at all levels. Single season production patterns in many parts of the country for many commodities make economic utilization of equipment and machinery difficult at best. Add to this the fits and starts of an ever changing government policy and the effect of periodically dumping on local markets waves of heavily subsidized inputs and machinery that create serious disincentives for private sector involvement.

All of these things make a study of the agricultural mechanization value chain especially important today. In particular, they point to the necessity of closely examining the economics of particular technologies in specific input/output/policy contexts and in the particular areas of the country where they will be used. This is particularly true in the context of the very high interest rates that many entrepreneurs face. Moreover, focussing too narrowly on labour productivity (defined as the value of output per unit of labour), to the exclusion of the economic cost of increasing that productivity, risks retarding self-sustaining growth instead of promoting it.

The authors undertook this study between December, 2006 and February, 2007. We visited nine states along the Kano-Lagos axis and three states along the Umaliki-Zaria axis. We visited technology centres, universities, government agencies involved with agricultural mechanization, donors, ADPs, importers, dealers, fabricators, end-users and champions, i.e. individuals who go above and beyond their own interest as a stakeholder, to the next level of advocacy, feedback and identifying and breaking bottlenecks in the agricultural mechanization value chain. The first report on our findings was presented to, and discussed with, a small group of technicians from the USAID MARKETS project and from PrOpCom. This was followed by an all day workshop consisting of stakeholders at all levels. This report is the output of all of those activities and interactions.

3.0 History of Agricultural Mechanization in Nigeria

Agricultural mechanization is the use of power and machinery (hand tools, implements and more complex machines) to assist in undertaking operations which contribute to the production and processing of agricultural crops, livestock and fisheries products. The objectives of the agricultural mechanization policy of Nigeria are presented in the Agricultural Policy for Nigeria (1989) as:

- Reduction of the drudgery of agriculture by providing mechanical power to replace some of the labour required in agricultural business.
- Reduction of the high cost of agricultural production which arises from high labour wage rates and the share of labour cost in the total cost of agricultural production.

The Government has mapped a number of strategies to achieve these objectives. These include: promoting private machinery hiring units, providing training for fabricators and mechanics, identifying and promoting the manufacture of efficient and effective small agricultural machines, including draft animal equipment, establishment of the National Centre for Agricultural Mechanization (NCAM) to function as a key institution for promoting agricultural mechanization, active encouragement of technology centres, including universities and research institutes, and promoting local fabrication of this equipment.

To achieve its mechanization objectives, Government has mandated NCAM to coordinate research and development activities in agricultural mechanization. PCU (Programme Coordination Unit, formerly FACU) and the Area Development Programmes (ADPs) in each state have established mechanization units which are to provide extension of mechanization inputs to farmers. The Post Harvest Division of the Federal Department of Agriculture (FDA) has established Post Harvest technology Centres (PHTCs) to provide training and extension to farmers, processors and fabricators in post harvest technology. The Engineering Division of FDA has also established Agricultural Machinery and Machinery Operators Training Centres (AMMOTRACs) in Misau and Akure to provide short, medium and long term training to agricultural machinery operators and mechanics. It has also established the Rural Artisan Training Support Unit (RATSU) in Ilorin to provide training for blacksmiths and rural artisans. Training, research and development for agricultural mechanization are mostly undertaken in technology centres which include universities, polytechnics, research institutes, industrial development centres, incubation centres and colleges of agriculture, all widely distributed around the country.

Up to the early 1990s, assistance to agricultural mechanization was limited to that provided through World Bank support to FACU and the ADPs and through FAO, EC, IFAD, ILO, ODA etc. support for agricultural development projects, although none of these had any direct agricultural mechanization component. There was also some less direct support arising from UNDP assistance for reducing post harvest food loss and UNIDO assistance to the SME (small and medium enterprises) industrial sub-sector. The intent of this assistance was to build the capability of the Industrial Development Centres (IDCs) to provide training and advice and assistance to SMEs, many of which are wholly or partly engaged in manufacturing agricultural machinery.

In the mid 1990s, UNDP implemented an agricultural programme that had a distinct agricultural mechanization component designed to address the supply and demand constraints of agricultural mechanization. It focused on the needs of the small holder farmers and processors. The programme focused on the enhancement of the capacities of the public institutions involved in the promotion of agricultural mechanization to better perform their duties so as to increase production and utilization of agricultural mechanization inputs.

Since 1999, there have been efforts by the Federal Government of Nigeria (FGN) to promote aspects of agricultural mechanization under several agricultural development activities, many of which are commodity specific. These include the Presidential Initiative on rice production, processing and export, Presidential initiative on cassava production and export, Vegetable Oil Development Programme, Root and Tuber Expansion Programme (RTEP), Cocoa Development Programme, Presidential Initiative on Livestock Development, National Special Programme for Food Security, Community Based Agriculture and Rural Development Programme, National Fadama Development Programme, Presidential Initiative on Fisheries and Aquaculture Development, and the Cotton Development Programme. Donors have, and are, also implementing several agricultural projects which include USAID-SPDC programme on Cassava, Fadama II, MARKETS, PrOpCom, EU MPP6, etc. The programmes have components that provide support for the promotion and utilization of specific agricultural mechanization inputs. Although targeted at specific mechanization inputs, these programmes contribute to the promotion of agricultural mechanization in general.

4.0 Public Technology Centres in Nigeria

The technology centres for small scale agricultural mechanization are comprised, among others, of universities, training and research institutes, polytechnics, industrial development centres and incubators. Some units of the Federal Ministry of Agriculture also produce technologies for mechanization of agriculture. In all, there are over 140 such institutions in Nigeria, not counting the FMA units and the incubators. They are listed in Annex I.

There are four Federal Ministries that house the technology centres. The Federal Ministry of Education houses the universities and polytechnics. There are also state universities that are managed by state Ministries of Education. In addition the Federal Ministry of Agriculture houses many universities of agriculture, and research and training institutions involved in technology development for small scale agricultural mechanization. The Federal ministry of Industry houses Industrial development Centres and Technology Incubator Centres. Finally, the Federal Ministry of Science and Technology houses several research institutes involved in developing technologies for agricultural mechanization.

Universities: There are federal and state universities as well as universities of technology and agriculture involved in research activities related to the development and use of technologies for small scale agricultural mechanization. Most of the relevant departments of these universities have the basic machines that can be used to produce small scale agricultural machinery and equipment. Most also have qualified staff who are involved in related research and development activities. Typically they do not a have strong working relationship with other universities and research institutes, and only very few of them have, or have had any collaborative activities with NCAM. Most have poor linkages with fabricators and end users as well.

Polytechnics: Polytechnics are mandated to produce technical manpower. They therefore do a lot more training than research and development. There are however some prototypes that have been developed in many of the polytechnics that are relevant to small scale agricultural mechanization. Like the universities, the polytechnics are poorly linked with each other and there is very little collaboration with universities, research institutes or NCAM.

Research institutes: There are two major types of research institutes involved in small agricultural mechanization: those established in the Ministry of Agriculture and those in the Ministry of Science and Technology. Within each of the two Ministries, the research institutes have some linkages and some level of cooperation with each other. The linkages

across ministries, however are very poor. Even within each ministry the level of coordination of R&D activities is poor and most research institutes are not familiar with details of technologies developed in other institutes. The training and research institutes have very little cooperation with NCAM.

Industrial Development Centres: IDCs are under the Federal Ministry of Industry and are charged with providing infrastructural support services and facilities for small and medium scale enterprises. They are located in every state and there are also six zonal IDCs, one in Bauchi, Oshogbo, Owerri, Zaria, and two others. There are also Technology Incubation centres in different parts of the country promoting development and adoption of technologies for small scale mechanization.

Post Harvest Technology Centres/Crop Storage Unit (PHTC/CSU): PHTCs are based in the Post Harvest Technology Division of the Federal Department of Agriculture. The headquarters is in CSU, Ibadan, and there are two other centres, one in Kano and another in Umudike. The centres have a mandate for developing improved post-harvest technologies for farmers and processors, and training farmers, fabricators and extension agents on the use of improved post harvest technologies. There is also the Rural Artisan Training Support Unit (RATSU) in Ilorin for training blacksmiths and artisans and AMMOTRACs in Akure and Misau for training tractor operators and mechanics.

Based on our rather limited field work and discussions with stakeholders, the more active of the public technology development institutions at the present time seem to be:

- National Centre for Agricultural Mechanization (NCAM), Iloren, Kwara.
- IITA, Ibadan, Oyo State
- University of Ibadan
- Federal Institute for Industrial Research (FIIRO), Oshodi, Lagos State
- Department of Agricultural Engineering and Mechanization, Federal University of Technology, Akure, Ondo State
- Nigerian Institute for Palm Oil Research (NIFOR), Benin City, Edo State
- Department of Agricultural Engineering, Federal Polytechnic, Owerri, Imo State
- Project Development Institute (PRODA), Enugu
- Institute of Management and Technology (IMT), Enugu
- Department of Agricultural Engineering, University of Nigeria, Nsukka
- Agricultural Mechanization Research Programme, IAR, ABU, Zaria
- Department of Agricultural Engineering, Kebbi State Polytechnic
- Department of Agricultural Engineering, Federal Polytechnic Institute, Bauchi
- Department of Agricultural Engineering, University of Maiduguri

Others that seem to be important for crops of specific interest to PrOpCom are

Adamawa Agricultural Mechanization Authority, Adamawa State, Yola
    Rice planter
    Mini tractor with implements
Department of Agricultural Engineering, University of Agriculture, Makurdi
    Soybean sheller
Department of Agricultural Engineering, Federal Polytechnic, Bida, Niger State
    Bicycle type rice thresher
    Multi-crop Thresher
Department of Agricultural Engineering, Federal University of Technology, Minna
    Rice destoner
    Rice planter

Rice parboiler
NCRI, Badegi, Niger State
Rice parboiler

IITA is certainly the most pro-active of all technology centres in diffusing technologies. It helps to develop or refine the designs and then contracts with local firms for their fabrication. All of its designs are in the public domain, none are patented. It reportedly has a thresher that is 99.9% efficient for rice and sorghum. However we encountered a user (VT) in Kwara that experienced excessive breakage for seed rice with it and, after trying an imported Indian thresher, ended up using the traditional manual method.

The general character of public sector technology centres includes a stock of fabricating equipment that is relatively sophisticated but severely underutilized, secure salaries but low levels of operating support, and a focus on equipment design rather than outreach. There appears to be little attention given to how the equipment actually performs for the end user and little evidence that economic factors get much weight in evaluating technologies. Even IITA seems to focus on design and distribution with little follow-through with training on proper operation of the equipment, the circumstances under which the equipment can be expected to perform well, or with much economic analysis under firm-level operating conditions. The main focus seems to be on designing and making an operating model of one kind of machine or another, and waiting for someone to come and order one or trying it and see what happens.

More recently, Government has emphasized the need for the centres to become more self-reliant for funding. This has stimulated production for the market of all types of agricultural equipment and machinery by the technology centres. This seems, at least in part, to be compromising their role as technology developers and diffusers as private sector fabricators become viewed more as competitors than as clients. The suspicion runs both ways. We have been told by one private sector firm that shared its technology with IITA in order to improve it for everyone, that it received what the firm felt was a disproportionately small share of orders for the improved technology that resulted from such collaboration. In part this resulted from IITA inserting itself between the fabricators and the end-users instead of facilitating linkages between them so as to help fabricators develop their local market for their own benefit. Moreover, because it has donor funds to finance purchase of the equipment, it is much too easy for IITA to rely on free distribution of equipment which further undermines, instead of reinforcing, self-sustaining private sector production.

5.0 Private Sector Fabricators/Designers

In addition to these public and semi-public technology centres, there are probably over 1000 private sector fabricators, some of whom also develop their own designs, often by copying an imported machine or a machine produced by a technology centre or someone else.

5.1 Number and Location of Private Sector Fabricators/Designers

The best comprehensive data available on the number of fabricators of agricultural equipment and machinery in Nigeria is a listing compiled by NCAM in 1996 (NCAM, 2001). That listing showed that there were, at that time, over 600 fabricators, some of whom also design or modify products sold by others. This list was, clearly, not very complete for some states, did not always provide details on just which machinery the centres and fabricators produced, did not provide much coverage of animal traction fabricators and is, in any case, now outdated. However, it did include a good cross section of all types of fabricators. The

omissions seem to be as partly a result of the thoroughness of the individual collecting the data and partly due to an unclear mandate with respect to blacksmiths who fabricate animal traction equipment. The PCU is currently updating the list with input from the ADPs.

A 1997 report (NCAM, 1997) on the proceedings of a national training workshop on animal traction included studies of a sample of blacksmiths and animal traction equipment fabricators in each state where animal traction is common. These studies noted the existence of a blacksmith in nearly every village. One of the studies noted that the John Holt factory in Zaria sold 25,000 ridgers a year in the early 1990s, but employment at the plant dropped from 250 then to 50 in 1998 before the plant was shut down and moved to Lagos. Reduced government support and competition from local blacksmiths and rural artisans who were producing knock-off versions of the much desired ridger at half the price were the stated reasons. The same study mentioned a blacksmith near Kano who was producing 30 ridgers and 500 shears per week. The 1996 NCAM list includes only one fabricator of animal traction equipment for Sokoto, and that only if it is covered under "agricultural machinery and equipment", eight for Kano (of which seven list only agricultural machinery and equipment), four in Bauchi, none in Borno and ten in Kaduna (seven listed only as agricultural machinery and equipment). These numbers are clearly incorrect, as anyone driving through the area during land preparation season will attest. It appears that farm implements were not a focus of the 1996 NCAM survey, or it only included firms located in urban or peri-urban areas. This may partly explain why so few fabricators were found in some of those states with the highest concentration of animal traction.

A more recent list prepared by the Raw Materials Research and Development Council (RMRDC, 2002) shows only 250 fabricators in all of Nigeria. That study is even more incomplete than the NCAM listing. In Enugu town alone, only one of the twelve fabricators we found were on the list. Moreover, the list uses terms regarding the description of the firms that are not defined in the document. It appears that it is little more than a list of the better known firms.

Apart from the expected dropping out of some firms on the NCAM 1996 listing, and the start-up of others over the past ten years, and the likely failure of that listing to capture all of the firms producing animal traction equipment, we have evidence from our own work that the overall level of activity has increased since then. Anecdotal evidence from Kano indicates that prices of certain types of equipment have been falling as former apprentices go out on their own and provide increased competition. Moreover, the current list does not include some very dynamic firms and individuals that are incorporating critical feedback from end-users to improve their machines and expand their markets that were around ten years ago and should have been on the list. Finally, there is the number of firms listed for certain states that is simply inconsistent with numbers found in other states. Some of the lowest numbers, with six or fewer fabricators, are a bit hard to believe. These include Baylesa, Borno, Ebonyi, Gombe, Jigawa, Kebbi, Tabara and FCT Abuja. Compare those with numbers found in other states: 80 in Lagos state, followed by Abia, Anambra and Edo at 40-45 each, then Osun, Kwara, Imo, Kaduna, Oyo, Enugu at 25-35 each and 10-20 in the rest. Can these others be so different? So overall, it is very likely that the number of private businesses fabricating agricultural mechanization equipment and machinery is close to, if not well over, 1,000 firms. Whatever the real number now, the conclusion is the same: there is already a critical mass of fabricators such that identification of profitable technologies could provide the basis for sharply increased production and a rapid diffusion of such technologies throughout the areas they are designed to serve, if the system were better organized.

5.2 Description and Structure of Private Sector Fabricators/Designers

Private sector firms vary from quite sophisticated operations like John Holt in Lagos, who is no longer very active in production of agricultural machinery and equipment, to single man

operations that are not even on the NCAM list of fabricators. In terms of the types of equipment being fabricated in Nigeria by these fabricators, using the NCAM list as a basis, the largest concentration is in processing, with over 40% of fabricators producing milling machines, nearly 40 % producing cassava graters or processing plants, and nearly 30% producing palm kernel crackers, palm fruit digesters and related equipment. Dryers, grinding machines, threshers, shelling machines, hullers, expellers are produced by 10-15% of fabricators each.

The content of equipment being manufactured and sold lurches between commodities, according to shifts in government policies that favour one commodity over another. Evidence the sharp decline in rice mills in Abakaliki over the past 10 years, from over 1000 mills around 1995 to around 150 today, as import duties on rice were reduced to zero for a period of time. Also note the sharp rise in demand for gari processing plants in light of the current policy requiring a minimum level of cassava flour in all bakery products within three years. The very high import duty on rice is once again stimulating rice production and processing directed at higher quality rice that can substitute for imported rice. So the fortunes for rice are changing.

Typically local fabricators use materials available in local markets and locally available used parts. Often they simplify the design so as to be able to produce and sell their products cheaper than their more sophisticated competitors and imports. This type of knock-off production appears to serve a genuine public need. It enables potential users with limited means to enter the industry more easily by substituting higher maintenance-cost machines which can be financed from profits, for lower maintenance-cost machines that require more investment capital. Often, investment capital is scarce or unavailable. These are not always ignorant buyers who do not realize they are getting an inferior product. Many of them find technologically inferior products to be economically superior under their particular circumstances.

It is difficult to divide fabricators between formal and informal sector operators. The NCAM study seems to have focused on formal sector operators, evidenced by the large number of firms with limited or company in their name. Unfortunately those fabricators we encountered in the informal sector had begun operations within the past ten years and would not have been included in the NCAM list in any case. In addition, we did not always ask if they were registered or not. The distinction is really not very important at this juncture anyway. It will become important when financing becomes available and forward contracting becomes more prevalent, At that time one can expect that if access to services is predicated on a formal business structure, and those services are clearly beneficial to fabricators, they will register. Until then, they have a major role to play in providing lower cost equipment and machinery to users with more limited means. Should better quality machinery become widely available at a competitive price, one can also expect that such fabricators will be forced to upgrade their products and services in order to remain competitive, perhaps registering in order to do so more effectively.

A more useful distinction between different types of fabricators than formal and informal would be one of the classification systems used by UNIDO (NCAM, 2001). One is by size of operation and method of production, which tend to be closely correlated with each other. These include:

1) Family type: this is a worker owner enterprise employing 1-5 persons. This group might also be called a micro-enterprise and contains the large majority of informal operators.

2) Small scale or cottage industry enterprises employing 5-15 persons

3) Medium and large scale enterprises employing more than 15 persons

The first group has a strong presence in rural areas and small towns. The last two, apart from public and semi-public research and technology centres, are mostly located in urban and peri-urban areas. The first group uses less electricity in the fabrication process, making a non-urban location more feasible and economic than it would be for the other two with their much higher energy demands.

The NCAM list provides the best listing we have found of the types of equipment the various firms included on it actually produce, or at least are able to produce. There are no indications of the quantities which they produce, but our limited survey can provide some general impressions on both these counts since the variability we observed between the various types of fabricators in the six states we visited was not all that great. Annex II provides the details for most of the firms we visited which provide the basis for the conclusions in the following section.

Fabricators producing agricultural mechanization technologies for end users include black smiths, artisans, micro, small and some medium scale entrepreneurs and are widely distributed throughout the country. They usually have five or less permanent employees, and have relatively poor technical and management skills. They produce a wide range of machines including hand tools, draft animal implements, ridgers, shears, milling machines, cassava processing machines, oil palm processing machines, grinding machines, threshers, shellers, hullers, expellers etc.

In general, we found that fabricators of lower cost machinery sold more units than fabricators of higher priced, usually higher quality machinery. Among the higher volumes of sales we found a gari processing line which included a well designed (in appearance, at least), wood hopper, cassava grater that sold for 15,000N in Enugu. A cluster of about 10 fabricators sold about 500 such units in the past 12 months. A unit of one grater, 3-4 presses (35,000N each) and a 6.5 HP Lister type engine (95,000N) could process five tonnes of tubers a day. These fabricators are small, at the upper end of family type and lower end of cottage industry type. They outsource the heavier metal bending and turning work to larger industrial concerns with the necessary larger equipment, and had the most uniform manually punched grater screen that we saw anywhere. The fit and finish of the grater is exceptional. The one firm that was open when we got there had a couple of processing machines and several engines on display in his sales shop, which carried a full range of spare parts for the equipment he sold. We saw very few fabricators of this type selling more than 50 units of any piece of equipment in the last year. That seems to be a practical capacity for this type of operation.

At the other end we visited another fabricator in Enugu, Kobis, who is an engineer and a collaborator with SEDI, who reportedly produces high quality machines. We did not see his production facility. His cassava grater sold for 80,000N as compared to 100,000K when the same design is produced by SEDI. He also produces a screw press that sells for 45,000N. The line can process 10 tonnes of tuber a day. He sold only five such units in the past year. He supplied mostly larger institutional clients but did indicate people would buy machines if they were available in stores. He said there are not les than 25 fabricators of agricultural machinery in Enugu. (This compares to about 30 non-institutional fabricators reported for all of Enugu State in the NCAM list) Other products he manufactured and sold included palm kernel and fruit processing equipment (3-7 units of each type sold last year), He was capable of fabricating hammer mills, sieving machines, bagging systems, rice threshers, rice dryers and parboilers, but had not sold any in the past year. Like most other fabricators, he fabricates against orders for want of capital to produce for inventory. He attributed his relatively low volume of his sales to the presence of the lower cost machines available in the local market.

In general, the products of the largest number of local fabricators are relatively low in quality partly because they are made from cheaper materials, such as mild steel instead of stainless steel, and use less effective production technologies. Their products are mostly cheaper than imported machines of the same type. They are, therefore, widely patronized by end users who are mostly resource poor. These fabricators are able to sell many more products in their area than importers of the same types of machines. They produce a variety of machines, selling around 50 units of their most produced machine, and 5 to 10 units per year of the other machines they are capable of producing. They concentrate on producing for end users in their localities but some of the larger fabricators produce for a wider base of farmers and processors with a few already producing for the export market.

Most local fabricators use local scrap metal, local wood, second hand or sealed bearings, steel sheet and iron rods purchased in the local market for producing their machines. Most reported having no problems sourcing raw materials. They do not generally buy in bulk since they produce to order and do not, in general, collaborate in order to lower the cost of raw materials and transportation. The raw materials they use are mostly locally available except for some foundry inputs that are sometimes not easy to find. They use simple equipment like welding machines in their shops. Most of them do not have lathe machines and other equipment for advanced levels of fabrication work. They usually outsource more complicated functions like turning, bending, milling, casting etc. to bigger institutions, both public and private, with facilities for such operations. They have however been able to serve multiple markets (higher quality and lower cost) because of the existence of some fabricators that are able to produce for the higher quality market.

Most local fabricators appear to be unaware of new designs, do not have an in-house capacity to interpret design drawings and manufacturing plans, but are good at learning by doing and have developed some capacity for copying relatively simple machines. They have poor inter-firm linkages and no strong associations. They also tend to have poor linkages with ADPs, PHTCs, technology centres and financial service providers. They tend to produce on order and do not do much marketing. They do, however, tend to have good relationships with end users. That facilitates feed back for improving their products.

They are usually very dependent on good supply of electricity for their business and are seriously handicapped by poor infrastructure especially power. They are unable to acquire a big enough generator for the use of critical, less frequently used equipment in the shops. Moreover, manufacturing with generator power significantly increases production costs and makes their production processes less profitable.

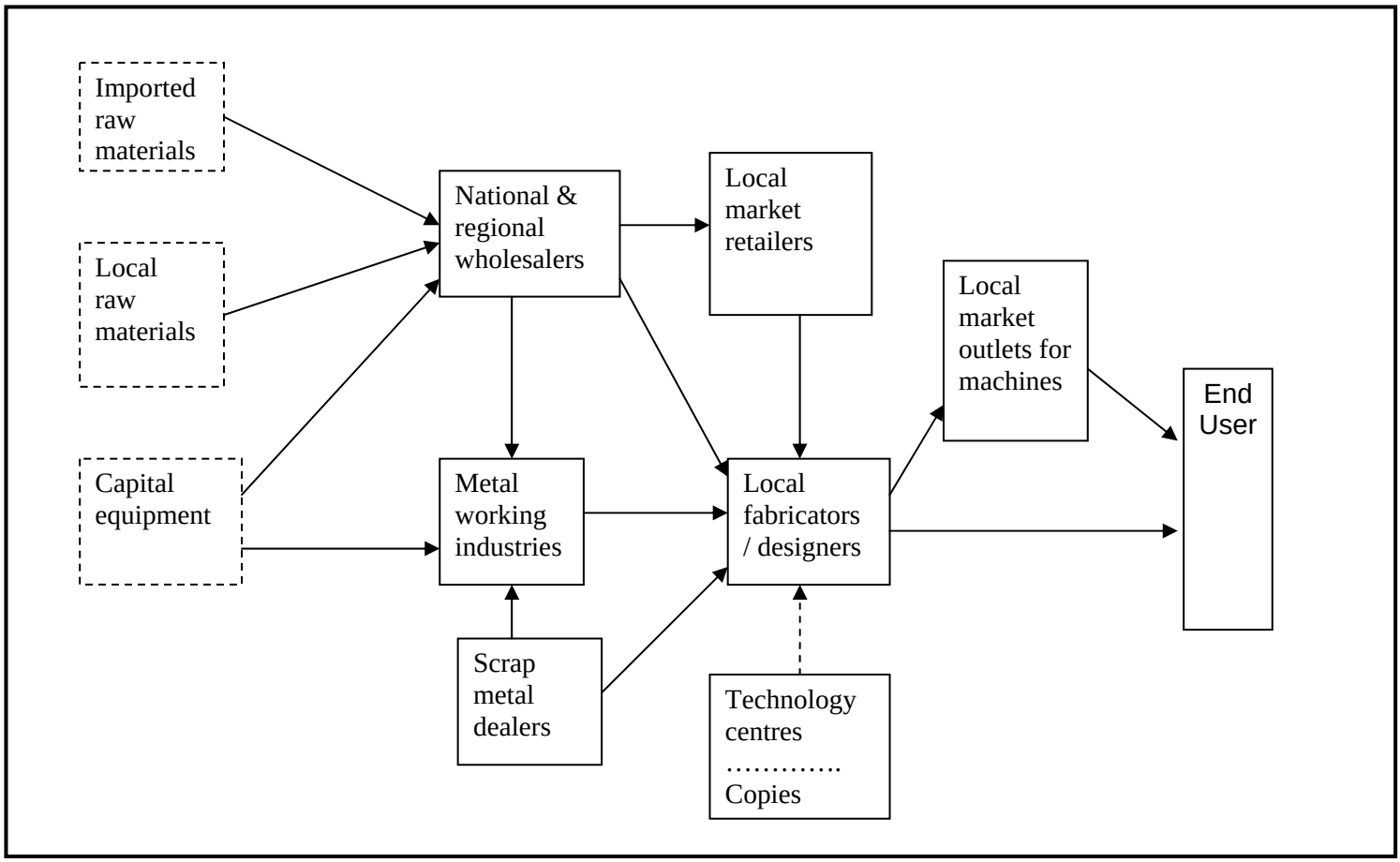
Financing and banking services are a big issue across the board for fabricators. Most cannot access bank credit for short-term financing. We asked several fabricators about their willingness to give up equity in return for financing, such as through SMEIS. All those we asked said, without hesitation, that they would, Financial issues are discussed in a later section on problems and constraints.

5.3 Local Fabrication Value Chain

Chart 1 on the next page describes the agricultural mechanization value chain as it pertains to local fabrication of agricultural machinery. Imported raw materials, local raw materials and capital equipment flow through national and regional wholesalers, and some go directly to fabricators, which is the more rare case according to our visits. Metal working industries that provide outsourced parts to the local fabricators, as well as the local fabricators themselves, purchase from these intermediaries, according to their proximity and quantity of material purchased. In addition, there is an active scrap metal industry that supplies scrap and used parts such as recycled bearings, shafts, transmissions etc. to both metal working intermediaries and to the local fabricators themselves. The fabricators also get designs and

other support from the technology centres, including machines to copy. The local fabricators then sell their output either at the factory directly to end users, to wholesalers, or through their own retail shop in the market, typically a local market only. A few fabricators export their machines.

Local fabrication value chain



6.0 Importers and Dealers

The bulk of Nigeria's imports of agricultural machinery come from India, China, Japan, Brazil, Pakistan and the UK. We do not have a good idea of which is the largest source because we were only able to interview a small number of importers out of what increasingly appears to be quite a large number. We asked each dealer we talked to where he obtained imported goods. Most gave multiple sources and very few gave the same name for their importers.

6.1 Importers

Only Wandell came up more than once. This suggests there are many more importers than we found; otherwise we would have found more duplication in sources of imported material by dealers and distributors. We interviewed Tonilla Nigeria (Wandell), Pillars, Tractor and Equipment and John Holt in Lagos, Star Agro and El Hadji Harouna in Kano, AMIL Solid

Minerals & Agro Allied Company in Kaduna and Dizengoff Agric Division in Ibadan. We identified 11 others that we did not interview, and heard there are still others in Port Harcourt and Calabar. Wandell describes itself as the largest importer of agricultural machinery in Nigeria and said Tonilla is second. Tonilla said it does not know if it is in the top three or not. The information in this section is based on interviews with these eight importers.

Tonilla and Pillars together imported about 5,200 cereal grinding mills with capacities between 250-350 kg/hr., 1,800 rice hullers/polishers with 300-500 kg/hr. capacity and 15,000 2"-4" water pumps, the largest portion being petrol driven because of their smaller size and the ease of carrying them home at night. Not all of the pumps are for agriculture, however, and about 10% is re-exported to neighbouring countries. Both companies import from China and India, with the larger sizes typically coming from India and the smaller ones from China.

Tonilla sells Simba brand equipment through its Simba subsidiary. Both companies brand their products at the source (i.e., by the manufacturer) but 85-90% are open source products, so other importers can do the same. Both companies maintain inventories of equipment and spare parts. Tonilla says it tends to sell better quality products in the market. Both sell through distributors throughout Nigeria. Equipment is imported in containers, completely knocked down (CKD). The distributors normally are the ones who assemble the equipment prior to sale.

John Holt is sole distributor for Yahama, which only means water pumps as far as agriculture is concerned. Anything else would be on special order.

Tractor & Equipment is the Nigerian dealer for Caterpillar equipment, and has the distributorship for the Challenger line of farm equipment from the UK. These include 65-400HP tractors. Their business is geared to institutional clients: sugar cane, international groups and Zimbabwe farmers in Kwara state. The company has branches in Port Harcourt, Kaduna, Kano, Wari, and Abuja and has a service outlet in Ekati; it always sends its own technicians to do service and has service contracts with most clients. This company reported having difficulty getting good skilled labour because of demand for skilled labour in the oil industry.

Star Agro International Nig. Ltd. imports directly from Pakistan, on order only, mostly small tractors CKD, but also ox ridgers, ploughs and harrows for the tractors. It imports in 40' and 20' container lots. All equipment is cleared in Lagos and shipped by truck to Kano.

AMIL Solid Minerals & Agro Allied Company imports only Chinese equipment and is also a direct seller. At the present time he has much more individual than government patronage. In the last two months has sold five rice mills and five grinding machines. Now he is seeing a lot of interest in destoners and has a lot of bookings for destoners. He imports spare parts for his machines and has no problems; he actually brings in Chinese technicians to train locals on the use of the machines he sells.

6.2 Dealers

The dealer network in Nigeria is really quite good. Most of the importers of small equipment we spoke with distribute through independent dealers that buy from multiple importers. None reported any difficulty getting what they need. Many also sell locally fabricated equipment and, indeed, fabricate equipment themselves. Not all stock spare parts, but those that don't say generic spares are available in the local market and they cannot sell OEM parts because of their high cost.

Dealers were as likely to report commercial credit problems as fabricators. The issues were the same, high non-interest charges, high required turnover of funds in order to generate

higher commissions on turnover (COT), and strange charges on statements. Most seem to get the bulk of their financing from advance payments required of buyers of imported equipment that is not in stock.

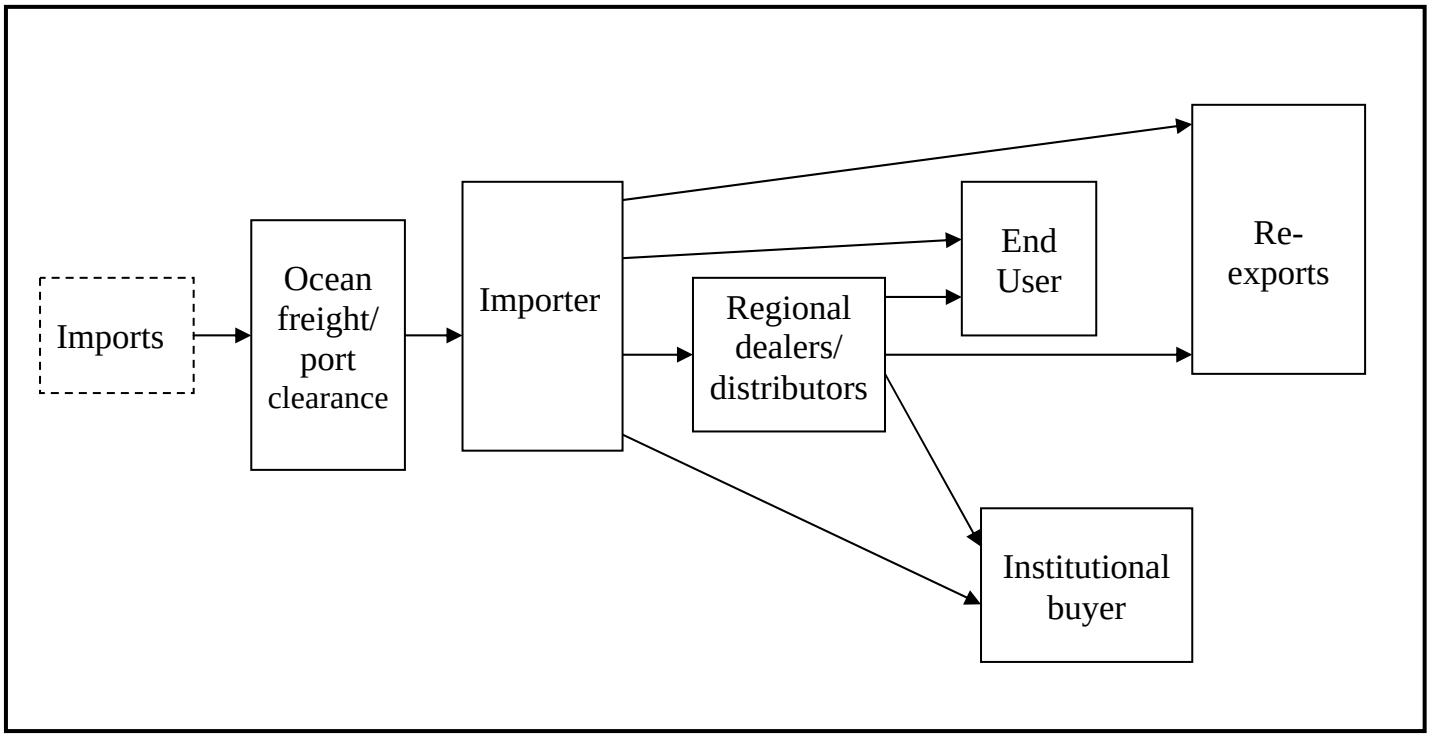
Most dealers have a staff of service technicians to assemble the equipment and to assist with installation and service. They typically provide a warranty of some kind for the equipment they sell.

6.3 Imported Agricultural Machinery Value Chain

The chart on the next page shows the value chain for imported agricultural machinery. Imports are ordered against a letter of credit opened in favour of the exporter by the importer when he places the order. It takes 4-6 weeks to build the order. Ocean freight takes another 6-12 weeks, depending on the origin and the size of the order, and costs around 4% of the FOB value of the equipment. Once the goods get into the port what happens seems to differ depending on the size of the importer. Tonilla says it costs about 2% to clear their goods and it takes 10 days. Pillars says it takes 2-3 weeks. Star Agro says it costs 10-20% to clear goods and takes 10-20 days.

The process for clearing goods through the port begins with the bank issuing the letter of credit requesting, on behalf of the importer, an inspection by the inspection agency in order to obtain the risk assessment report (RAR). After inspection, the inspection agency will issue the RAR, which will indicate the tariff heading and the custom duty payable for the imports. After settling the custom duty charges, through the Bank, the importer engages the services of a clearing agency and submits to it the RAR, together with the importer's proforma invoice and its bill of lading, which altogether will be used in clearing the imports.

Imported agricultural machinery value chain



The importer, through the clearing agency, will pay additional fees and charges before receiving the imports. These total costs, fees and charges are paid by the importer and include container handling charges and demurrage charges (5,000N/Day) paid to the shipping agency by the clearing agency, an “endorsement” (30,000N for a 20’ container and 60,000N for a 40’ container) paid to other port agencies through the clearing agency, the clearing agency fee (40,000N for a 20’ container and 80,000N for a 40’ container), and the transportation fee to the importer, paid to the transporter through the clearing agency (200,000-240,000N per container to Kano). The importer will also pay bank fees and charges which are negotiated as a percentage of the imports.

The fee paid for destination inspection and the time taken to finish the inspection are uncertain, and are, currently, the main bottleneck to timely clearance of imported goods. Inspection of imports could take weeks or months, thus making demurrage payment a foregone certainly on all types of imports. According to El Hadji Harouna, a Kano importer, in some cases importers abandon their imports because the heavy demurrage makes it unprofitable to take them.

The “endorsement” is plainly a bribe and is paid through the clearing agent to the various security units operating at the port. Both Star-Agro and Tractor and Equipment report having to pay VAT as well, the latter said sometimes even twice on the same shipment, even though there is no VAT for CKD agricultural machinery. Neither one receives a receipt either for endorsements or for VAT paid. The imports will never be cleared to leave the port if the bribes are not settled. For containers duly and officially cleared from the ports, police harassment along the road is virtually absent.

Once the goods clear the port they are transported to the importers warehouse for storage and internal distribution. The larger Importers sell through their dealer network while the smaller ones sell directly to end-users or institutional intermediaries. Items shipped to dealers and distributors are typically assembled by the receiving dealer or distributor. Re-exports can move directly from importer to the next importer or from dealers to buyers in other countries.

7.0 Donors and Government

When it comes to government it is clear that its effect on the agricultural mechanization value chain is enormous and is enormously complex. Virtually every government policy has an impact, as do its budgetary allocations to technology centres, universities and implementing ministries. For the purpose of this section we consider only its direct role in developing technology and/or distributing it to end-users. We include it with donors in the value chain because, with respect to direct fabrication and imports of agricultural machinery, the two operate in similar ways and have similar effects.

Massive government investment has already been made in technology centres and universities. Government also has responsibility to fund ongoing research on technology development. Extension is still the responsibility of government, although that is beginning to change in Nigeria. Government also tried to direct the flow of credit to SMEs by using the commercial banks, through a credit allocation system that required banks to allocate a set proportion of their credit portfolio to SMEs. The programme was only partially successful and was abolished in 1996, but it was followed by other programmes, some of which are discussed elsewhere in this report.

There have been numerous direct intervention programs by government in the agricultural mechanization value chain over the years. On our trip to Ibadan we saw part of 750 tractors purchased by the federal government from India for sale to end users through the ADPs.

The federal government has established guidelines for these sales and ADPs have four options from which to choose in undertaking such sales. Sales are subsidized, but we were not able to get the amount of subsidy for the overall program. This activity, to the extent it is subsidized, is probably not sustainable, although the size and price of the tractors may be low enough to be financially profitable on an unsubsidized basis for intensive use. We were not able to find out whether the purchase decision was based on any type of financial analysis of the cost effectiveness of the machines.

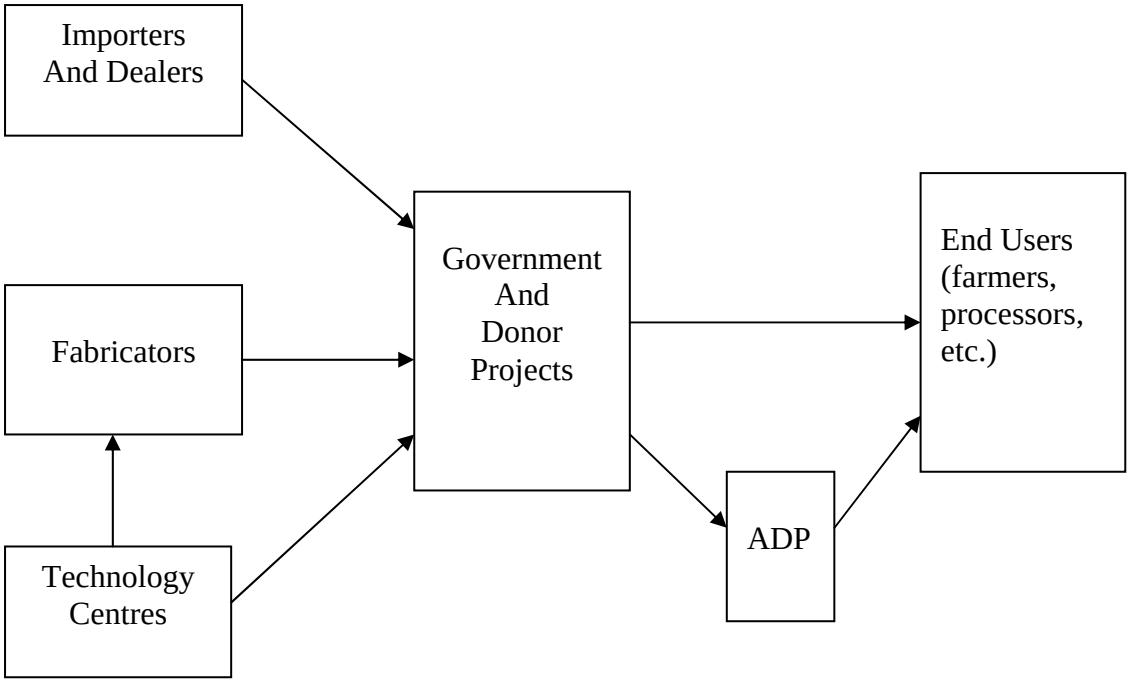
Under the Root and Tuber Expansion Programme the Federal Government has joined with the state governments to purchase and distribute one cassava micro-processing centre per local government area, of which there are over 700 in Nigeria, and one cassava factory per senatorial district, of which there are 109. Each micro-processing centre will have a large grater, a grater/chipper, two hydraulic presses, two tray fryers, a motorized sieve, one 8 HP diesel engine and two 5HP petrol engines. The centres each cost about 1,500,000N. Each cassava factory will have a flash and a rotary drier, three presses and a hammer mill, with a total cost of 9,000,000N each, including buildings and infrastructure. The equipment is being produced and installed under supervision from IITA.

In Kwara state, the only one where we saw a factory already operating, the factory was leased to a private firm. The micro-processing centres were being turned over to women's' groups to see what they can do with them. Only viable groups that are registered are candidates for the centres. The women's' groups do not have to pay for them at this time. What they will be charged will be determined after the ADP evaluates their performance.

The really interesting implication of the cassava processing centres and factories, even though they are probably going to be leased at preferential rates, is that they create turnkey models which can be replicated elsewhere if they prove to be financially sustainable. Moreover, they provide a rich base for demonstration, as well as for financial and economic analysis, that can be used to educate government officials on financial viability issues. Most importantly, if the financial analysis of the prototypes confirms their financial viability, it would provide a sound base for SMEIS financing. One can easily conceive of a state based association of cassava processors that has legal status that can be partly owned by a venture capital firm such as Unic Ventures. Through the VC firm it can access financial management support and additional capital for adding new centres. The key, as always, is demonstrating that such ventures are profitable under field operating conditions. Unlike subsidized tractor hire services, such ventures could be quite sustainable and rapidly taken up by the private sector.

The chart below describes the distribution components of the government and donor value chain for agricultural equipment. The source of the equipment is either imports or locally fabricated machinery; both are used. The technology centres feed prototypes and some technical support to local fabricators who, in turn, supply the equipment. Sometimes they supply directly to government. Government and donors both distribute their equipment through the ADPs as well as directly to end users. This is especially true for larger agricultural processing machinery such as parboilers and other equipment produced by some of the technology centres. The non-ADP mechanisms are more political and do not always follow an identifiable pattern.

Government and Donor Equipment Value Chain



The main difference between government and donor distribution systems and the private fabricator systems is that they focus more on moving money and materials than on sustainability. One only has to note the sharp increase in such activities near election times to conclude this. For donors, the precipitating event may be different, it may not even be in Nigeria, but the operating principal is too often the same. Such interventions are usually justified in terms of some perceived need on the part of end-users, rather than on development of effective demand so that the market can take over and make the intervention sustainable. Identifying potential effective demand would require a financial analysis of the machinery under typical field operating conditions.
Such analyses are rarely done.

Government and donor delivery systems also typically give little attention to ongoing servicing and other post-delivery issues, apart from importing a set of spare parts to keep it operating for the first year. Often the material arrives too late to be used as intended in its initial year of operation, further compromising its financial viability. Historically, it was often complicated and little regard was given to standardization and brand uniformity so as to facilitate development of local parts replacement and servicing industries. With the advent of South-South cooperation this criticism may become less valid. Then there is the nearly impossible-to-change aspect of subsidized input programs, be they government or donor, a tendency to be diverted from their presumably “intended” beneficiaries.

Without a doubt, the most significant drawback of the government/donor value chain is the tendency to rely on imports rather than locally fabricated machinery. This essentially prevents any adaptation or improvement in the technology through feed-back from end-users. In the current state of development of Nigeria’s agricultural mechanization technology there is an excellent ability to modify designs to meet more location or condition specific circumstances. This is the real benefit of developing a local technology manufacturing capacity – gaining control over technology development itself.

8.0 Spare Parts, Maintenance and Repairs

Within Nigeria there is a widespread ability to make spare parts for machinery. Whether it is done or not is a question of cost effectiveness. It is commonly done for large manufacturing equipment where the cost of the locally manufactured part is very small in relation to the cost of the machine itself, even when the part is produced in very small quantities. There is also local fabrication of parts commonly used in most pieces of equipment for which many units are made: castings, shafts, grills, graters, etc. (Standardization of equipment designs would encourage the parts fabrication industry even more). For less frequently used parts, the first choice is to find a part from used parts and scrap dealers. The last choice is to get it from an importer who may have to special order it with, in the case of rarely ordered parts, a resulting long delay in receiving it.

From our somewhat limited travels we can say that there is a widespread availability of commonly needed spare parts throughout the country. Original Equipment Manufacturer (OEM) parts may be less available, not because the dealers do not want to import them, but because when they do, they do not sell because of the availability of after-market or knock-off versions in local markets. Still, most importers stock and distribute OEM parts for the machines they currently sell. Parts for older equipment may be a problem, especially OEM parts, as they are all over the world. But this appears to be less of a problem in Nigeria where 40 year old rice mills are still operating, as at Abakaliki. We did hear some lament about the poor quality of locally available spare parts, especially from government tractor hire services who tend to be the ones with the brand name equipment.

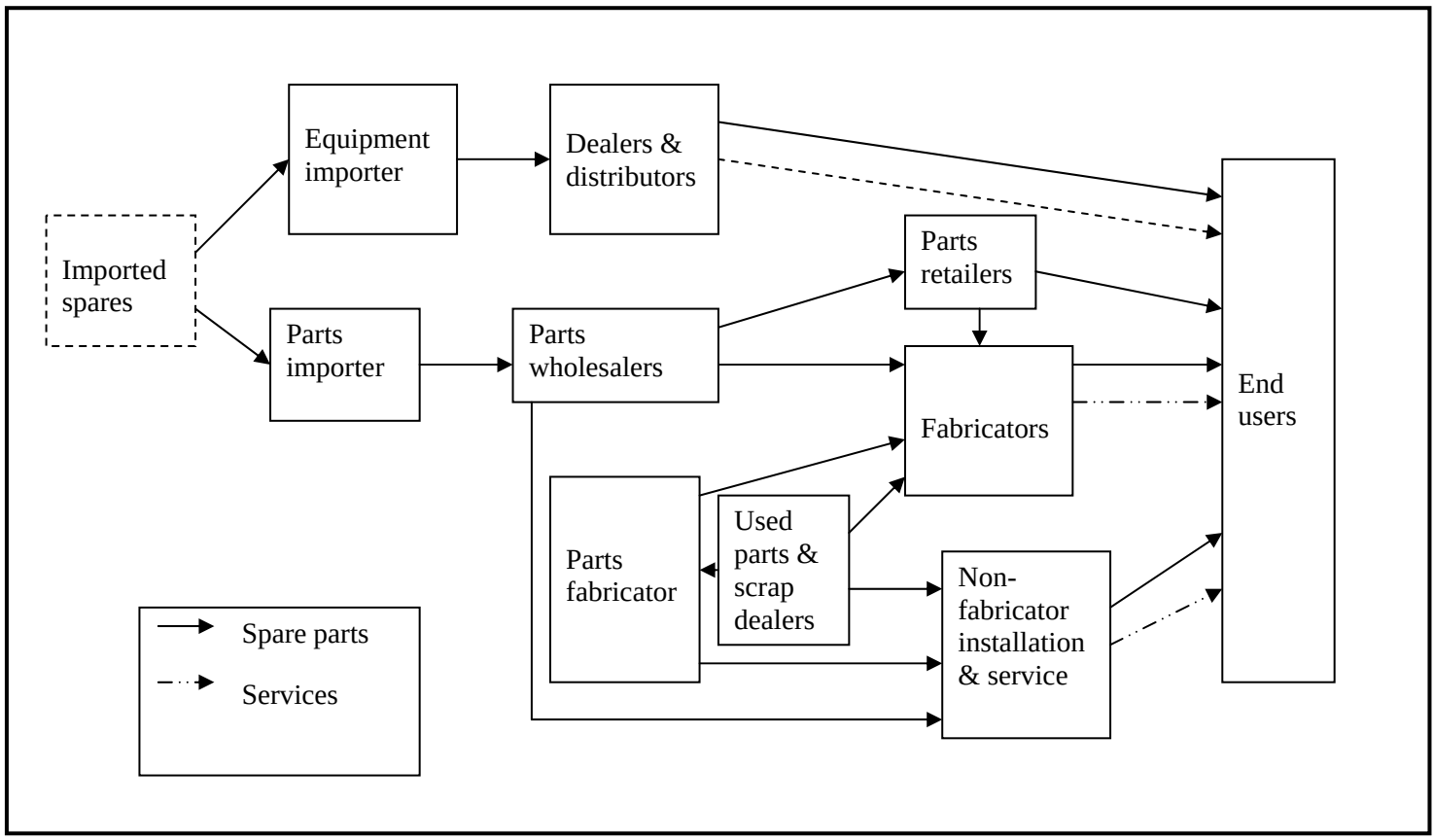
Maintenance of agricultural machinery outside of government services also does not seem to be a problem. Nearly every distributor and dealer we talked to services the machines it sells and usually installs them as well. This is also true for local fabricators. Still, there is a large installation and servicing industry separate from the dealers, distributors and fabricators. This is not surprising when you consider that each piece of equipment usually comes with a motor, and most fabricators do not repair machines. But there are even after-market equipment installation and repair services that do not sell the equipment. These are utilized by those who buy from sellers who do not provide service themselves, but who either outsource it or simply refer a buyer to it.

Maintenance of equipment within government services, and on some farms is a problem, especially for older equipment. But there is an entire and substantial industry that has developed around buying, cannibalizing and rebuilding such equipment. Green Fingers in Kaduna has about 50 such machines on its storage lot at the present time. It sells a refurbished tractor for around 3 million naira, versus 4.5 million for a new one. The company has also trained over 600 mechanics in the 20 years it has been operating. Sankara Nigeria in Kano does the same thing, though not on the same scale as Green Fingers. We also heard of others in the south.

The servicing agricultural equipment value chain is described in the chart on page 21. Spare parts are imported directly by equipment importers and by spare parts importers. Both distribute through their respective networks, with the dealers tending to be the terminal point for their parts, and local market retailers being the end point for after-market parts. Fabricators buy from both wholesalers and retailers, depending on the volume of their purchase and the skill of the manager. Fabricators also purchase from spare part and scrap vendors, as well as from parts fabricators. Parts fabricators may also buy material and parts from scrap and used part dealers, but they also buy a lot from raw material vendors in the local market. For example, some use scrap aluminium or old engine blocks for casting parts, while other buy aluminium ingot and new mild or stainless steel, depending on the part

and the fabricator. Some companies even have a capacity for electroplating (Addis in Lagos).

Servicing of agricultural equipment and machinery



Non- fabricator service providers buy both from parts fabricators and from the local parts market. One can assume that they also buy from fabricators, but that was not mentioned to us in our interviews. They also buy steel, cement and other materials necessary for installing the machinery. Our value chain chart focuses on equipment and spares so it does not show that.

End users get their parts and service from all four sources; parts dealers, parts retailers, fabricators and non-fabricator service providers. Fabricators usually service the equipment they sell and will sometimes service equipment fabricated by someone else. They provide both on-site and in-house service, though not all fabricators provide both. Non-fabricator service providers service a much wider range of products. Sometimes end users must order parts from abroad, though usually they can get less common spare parts through the importer in 7-10 days.

9.0 Governance Structure of the Value Chain

There are two aspects to the governance structure in the value chain: how it is supposed to function and how it actually functions. Below, we discuss these in turn.

9.1 Intended Structure

NCAM has been mandated to coordinate research and development activities of technology centres in agricultural mechanization. This mandate includes adaptive and innovative research towards development of indigenous machines for farming and processing, including the design of simple machines which can be manufactured locally. NCAM is also mandated to standardize and certify, in collaboration with SON, agricultural machines, equipment and engineering practices in use in Nigeria. In addition, it is supposed to bring to focus mechanical technologies and equipment developed by various institutions, agencies or bodies, and evaluate their suitability for adoption. It should assist in the commercialisation of proven machines, tools and techniques, disseminate information on methods and programmes for achieving speedy agricultural mechanization, and promote cooperation in agricultural mechanization with similar institutions in and outside Nigeria.

Agricultural mechanization technologies are to be developed in the first instance by universities, polytechnics and research institutes. PCU and the ADPs are to provide extension of mechanisation inputs to farmers. Post Harvest Technology Centres (PHTCs) are to provide training and extension to farmers, processors and fabricators in their domain. AMMOTRACs in Misau and Akure are to provide short, medium and long term training to agricultural machinery operators and mechanics. RATSU in Ilorin is to provide training for blacksmiths and rural artisans, while the IDCs and TICs are to provide extension, training and facilities for MSMEs in general.

In 2003, the Federal Government established the Small & Medium Enterprises Development Agency of Nigeria (SMEDAN) as an agency devoted to promoting policies and programs for the development of the MSME sector of the Nigerian economy. The mission of SMEDAN is to facilitate the access of micro, small and medium entrepreneurs/investors to all resources required for their development. The Agency is expected to be a “One Stop Shop” for Micro, Small and Medium Enterprises Development. The functions of SMEDAN include stimulating, monitoring and coordinating the development of the MSMEs sector; initiating and articulating policy ideas for micro, small and medium enterprises growth and development; promoting and facilitating development programmes, instruments and support services to accelerate the development and modernization of MSME operations; linking SMEs to internal and external sources of finance, appropriate technology, technical skills as well as to large enterprises; promoting information and providing access to industrial infrastructure such as layouts, incubators, industrial parks; and intermediating between MSMEs and the Government. SMEDAN is the voice of the MSMEs. It is to work in concert with other institutions in both public and private sectors to create a good enabling environment of businesses in general, and MSME activities in particular.

SMEDAN presented a draft National Policy on Micro, Small and Medium Enterprises (MSME) to the public on the 25th of Jan 2007. This document is currently under public review.

NOTAP is concerned with the inflow of technology. It reviews agreements between national companies and foreign partners. Government recently expanded its role to include encouraging inventors to get patents. It will be transferred from the Ministry of Science and Technology to the Ministry of Commerce under a newly created Nigerian Intellectual Property Organization (NIPO). NIPO will have responsibility for patents and will also contain the Copyright Commission.

The President recently approved formation of a National Committee on Innovation and Inventions. It is not clear what the outcome of this committee’s efforts will be, but some stakeholders suspect it presages a new oversight structure for all of the technology development institutions in the country.

The Bank of Industry Limited (BOI), which is largely owned by the Federal Government of Nigeria, was set up to provide financial assistance for the establishment of large, medium and small industrial projects; as well as expansion, diversification and modernisation of existing enterprises. It is also responsible for rehabilitating ailing industries. BOI has zonal offices in Aba, Abuja, Akure, Asaba, Bauchi, Kaduna, and Lagos.

A second bank, The National Agricultural Credit and Rural Development Bank (NACRBD), targets about 70 percent of its banking transactions toward micro loans. These loans are directed at rural and urban low income earners, small holder farmers, artisans, petty traders as well as formal and informal groups.

These two banks have adopted a new approach in financing SMEs by adopting low interest rates, minimal collateral requirements and offering diversified products. The Federal Government has directed them to bring down the interest rates on loans to below 10 percent.

The government has also introduced the Small and Medium Enterprise Investment Scheme (SMEIS) which represents a tool of long term resources for funding MSMEs in Nigeria. The objective of the scheme was to stimulate increased availability of capital to MSMEs while reducing their debt-service burden, and also help in the restructuring of the capital of MSMEs to stimulate their revitalization and growth. The scheme requires all commercial and merchant banks to commit 10 per cent of their annual pre-tax profit to the funding of equity investments in small and medium scale industries. The banks are permitted to take up to 40% of the equity in a company and may be bought out after four years by the other shareholders.

9.2 Real Structure

NCAM does not at the moment coordinate the activities in the agricultural mechanization value chain as expected in the decree that established it, nor does it coordinate research activities of the technology centres with regards to agricultural mechanization. It has worked with SON is establishing some standards, but what has been done is very small compared to what needs to be done. It has not been effective in testing and standardizing agricultural equipment in the country. Given the large numbers of technology centres developing agricultural machinery in Nigeria, and a certainly larger number of private firms doing the same, it is probably unrealistic to expect a public institution like NCAM to be able to achieve the objectives listed for it in its enabling decree.

The technology centres have developed many prototypes but there is little proper evaluation of these technologies with respect to their financial, economic, and sometimes even technical, effectiveness. The activities of the centres are not coordinated or shared, with the result that most appear to know very little about advances in sister institutions. NCAM does little or no coordination of research and development activities in agricultural mechanization,

The ADPs have well trained staff but are unable to fulfil their obligation of promoting agricultural mechanization technologies because of lack operational funds and because mechanization is not part of the Research, Extension and Farmer Input Linkage System (REFILS) for linking extension and research. They also have very weak links to technology centres and therefore have limited knowledge of advances in agricultural mechanization technologies.

There are practically no technology, resource or policy rents, or barriers of entry for those who want to be involved in importation, fabrication, sale or servicing of farm and agriculture related equipment. The rules and regulation regime is not well developed, nor is it

pervasive, There is evidence of some illegal taxes (e.g. VAT, 'endorsements') on machinery imported by selected vendors, and there are chronic delays in obtaining the risk assessment reports (RAR) required for clearing goods through the ports, sometimes resulting in demurrage charges.

The major rents in the agricultural equipment value chain are extracted by banks. Problems are not uniform, but they appear to be pervasive. The upper extreme of what we found included one well established champion fabricator who borrowed 500,000N to get working capital for meeting a government order (advance payments are typically not made for orders under 10 million naira), He used the funds over a 4-5 month period and repaid 140,000N in interest, fixed charges, application and other fees over the five month period. I visually verified them from his bank statements. That comes to an effective annual interest rate of 90%. The only explanation appears to be that he does not own his production facility, he rents it. But he has a large volume of business, quite a large fabrication facility and a long business history. The other extreme was an importer/refurbisher/dealer in Zaria who was paying nothing more than the COT on his loans, plus an annual interest rate of 30% on his last working capital facility of 300,000N. However, when his loan officer of five years was replaced, he could not get another loan. There was no looking back at his banking history or anything. The new loan officer did not know him. In this instance if the loan officer was looking for a bribe he was looking in the wrong place. Whatever the reason, a business with a good banking record and a regular need for working capital was now locked out of the credit market. Changing banks scarcely provides a solution is such situations as one's banking history must then start anew.

The major costs with bank credit are not the relatively high interest rates that prevail throughout Nigeria, but the other charges that come with it. They appear to be much less predictable and arbitrary. Many of these businesses would be ideal candidates for Small and Medium Enterprise Investment Scheme (SMEIS) financing. What is missing, or as yet is poorly developed, are the structures for bringing them together.

Stakeholder associations are mostly non-existent and those that exist are weak. Kano State Agric Input Dealers Association (KASAIDA) appears to be one of the stronger ones and has been in business since the 1990s, formed under the impetus of a USAID project. The more recently formed Kano Agric Equipment and Engineering Services Association is an offshoot of this association.

The Kano Agric Equipment and Engineering Services Association registered in October, 2006 in order to empower its members and organize the agric machinery market for the benefit of its members and their customers. The association facilitates training opportunities for its members and provides sales and service of agric machinery and spare parts, including servicing broken-down agric machinery for the farm and industry. In the last 12 months the members of the association have collectively sold 150 tractors, 100 each of ridgers, slashers, threshers and water tanks, 60 rice mills and planters, 50 disc ploughs, maize mills and lesser numbers of several other implements. There is an active business in purchasing and refurbishing old and broken down equipment for resale. Their clients come from all over northern Nigeria and from neighbouring countries such as Niger, Cameroon, Mali, Chad and Burkina Faso.

There are very few informal rules we were able to identify; activities in the agricultural mechanization chain are very limited because demand for agricultural equipment is relatively low. There are very weak relationships between actors (e.g. between technology centres, centres & fabricators, centres and ADPs, etc.). There has been no significant improvement in the access of fabricators or small scale processors to funds and credit; uptake of the SMEIS fund has been very low to non existant.

Patent rules are not enforced in the sub-sector but this does not seem to be a problem at the moment. The public institutions charged with patent enforcement do not seem to be alarmed at the high incidence of copying of machines and many of the designers do not seem to be seriously bothered by the high level of disregard for intellectual rights in the sub sector either. Most designers feel that the activities of small fabricators copying their designs would not seriously affect their sales as they often target a higher quality segment of the market. There are, however, instances of big companies losing market share to artisans producing lower cost, lower quality knock-offs that are in high demand in local markets (John Holt in Zaria). There does seem to be some desire to protect designs and prototypes at the level of technology centres, but the cost of acquiring and defending patents limits what they can do. Nova Technologies, which holds some patents of its own, says that patents are hardly worth the effort as they are not enforced. Moreover, the patent process itself may result in your technology being hijacked.

The Ministry of Commerce is mandated to regulate the activities of importers of agricultural equipment based on current tariffs and import laws. We were not able to determine which ministry or service is responsible for overseeing the inspection agencies issuing the RAR at the ports, but there is clear need for reform in this area. Port clearance needs to be expedited and more sophisticated inspections of imported goods known to be objects of adulteration are needed.

There is also some fraud, extortion and uncertainty regarding local taxes faced by some fabricators and other stakeholders. One fabricator, a full time engineering student and fabricator, who is not registered, says people come by regularly who say they are from Revenue or local government to collect taxes due. He just asks them to provide some form of identification and they then leave him alone. The implication is that they are misrepresenting themselves in the first instance.

10.0 End Users, Champions and Value Chain Workshops

The end users of agricultural machines are farmers, processors and industrialists using agricultural raw materials. Most of the farmers are small holders using hand tools and animal draft technology for land preparation, planting, weeding, pest control, harvesting and primary processing activities. Processors are mostly micro and small scale enterprises using simple machines. There are some medium scale farmers and processors who are able to use relatively more sophisticated production and processing equipment and machines. They tend to produce better quality but higher priced products for the rapidly increasing urban market and, in some cases, exports. There is also a growing crop of industrialists operating medium scale factories producing food and industrial products such as starch, vegetable oil, etc.

End users run the gamut in terms of size and sophistication. They are widespread around the country, but their products are mostly of poor quality without much attention paid to standards. They generally have poor knowledge of the technologies that are available for their operations, relying mostly on what can be produced by local fabricators with whom they usually have a close relationship. Most of the time they opt for cheaper agricultural machines, at the expense of the quality of their products. This is a conscious choice on their part. They are mostly resource poor, have poor links with financial resources and, therefore, short payback horizon on their investments. They tend to operate at close to substance level, as do most of their customers. They do very little marketing of their products, and, generally, have poor managerial skills. They are poorly linked with the ADPs, PHTCs, IDCs and technology centres in their states. They are mostly risk averse, but have demonstrated willingness to adopt economically beneficial technologies when there is evidence of good financial performance by using such technologies.

There is now an emergence of champions all around the country, among fabricators and end users, people who are willing to take risks, use their resources for technology and product development, and who desire to operate in the higher value niche of the market. They use more advanced technologies that may be more expensive, but which offer some advantages in terms of quality and/or quantity of output. They desire, and have sought, increased cooperation with technology centres, government and donor programmes, with a view to improving on the quality and volume of their production. They are also willing to work with smaller end users individually, and in groups, with a view to improving the quality and quantity of products in the market generally. They are willing to serve as demonstration units for others to learn and copy. They desire to get their production to globally competitive levels and are willing to associate with others to undertake actions that will achieve this, including pressurizing government to improve the policy environment under which they operate.

We found these people all over in our work. They represent, perhaps, the single most important resource, apart from prudent government policy, for improving the agricultural machinery value chain. They include such people as Sheku Sagagi at the Technology Incubation Centre in Kano, Mullam Mohammed Umar Kura, Kano ADP Managing Director, Turadu Dantata of TADCO (Nigeria) Ltd. in Kano, Charles Frimpong of Hanigha Ltd. in Kaduna, Banloli Oyeniyi of Nova Technologies in Ibadan, Ayo Olubori of PEAK Products in Abeokuta, Anthony Monueke of Annes Agro Processing Industries Ltd. in Abakaliki and many others at all levels of the chain, including many in government, research and technology institutions.

The value chain workshop format we used for gathering information for this report proved to be an excellent mechanism for tapping the energy of these people, most of whom see clearly the need to put major emphasis on the private sector and greater interaction between technology centres as driving forces for improving agricultural mechanization. It provides an opportunity for everyone to see how interdependent they are, how the fortunes of one affect the fortunes of all. Most importantly, it provides an example of how to go about harnessing their collective energy for agricultural transformation.

11.0 Constraints and Opportunities

At the moment, farmers, processors and other end users of agricultural mechanization technologies do not use enough of these technologies for their farming and processing operations to have much impact on national productivity. Nigerian agriculture remains very labour intensive and uncompetitive. Most farmers use hand tools and most farming operations, ranging from bush clearing, planting, weeding pest control, harvesting and primary processing, are still largely carried out using hand tools. This results in very low productivity in agriculture. This low productivity has several causes, many of which relate to agricultural mechanization.

11.1 Lack of Information and Resources

These farmers and processors do not have adequate information about the machines and technologies that can be used effectively for their farming and processing operations. More importantly, they do not have much assurance that the machines they know to exist are, in fact, technically and financially efficient. Investing in agricultural mechanization inputs is, consequently, a fairly high risk undertaking for end users.

Like the farmers and end-users they serve, most small scale fabricators and artisans who supply the bulk of mechanization inputs to end users in Nigeria, are resource poor. For them

these risks are difficult to justify, especially when they do not have access to lower cost institutional financial resources. They produce only to order and suffer from inadequate working capital for prototype development. They do not have the means to employ the services of experts to develop machines and do not have access to and/or capabilities in the use of relatively advanced techniques like casting and heat treatment. Their products are generally of poor quality and not very durable. They also have limited knowledge of technologies that can improve different operations, but they do demonstrate an ability to copy simple machines.

Fabricators usually only make machines that are fully or partially paid for by clients, and the same is true for ordering from dealers and importers. There are, however, good trust relationships in the value chain and clients appear to believe that the risks in relation to failure to deliver the desired equipment by the fabricator or dealer are low. They however carry substantial risks with respect to performance (efficiency and effectiveness) of machines that are not of proven technical and financial soundness.

11.2 Poor Coordination and Feedback

There is poor coordination of the activities of technology centres with respect to agricultural mechanization activities. Most technology centres do not know in detail what the other centres have developed, and have little or no relationship with NCAM. Most of the centres focus on producing technically efficient machines that are sometimes too expensive for the ordinary end user and of questionable financial value to them. They also have little cooperation with fabricators in their localities, and do little outreach to improve or extend their products. They have limited relationships with the ADPs, PHTCs, etc. that can effectively extend the technologies they develop to farmers, processors and fabricators. Generally, there is poor dissemination of information on available technologies and their technical and financial benefits. There is therefore very little uptake of the technologies developed in the centres.

11.3 Poor Links to Finance

In order to improve access of SMEs to financing, including those involved with agricultural mechanization and processing, the Federal Government established the Nigerian Bank of Commerce and Industry (NBCI) in 1973, specifically for this purpose. In 1977, the government formulated the Rural Banking Policy which mandated commercial banks to establish branch offices in rural areas, with a view to bringing banking services, including micro-credit, to the rural population. Other programmes aimed at providing financing for rural businesses over the years, many of which were agriculturally related. In the 1980s these included the Family Support Programme (FSP), the national Directorate of Employment (NDE), the Peoples bank of Nigeria (PBN), the National Economic Reconstruction Fund (NERFUND) and the Community Banks. In the 1990s it was the Family Economic Advancement Programme (FEAP). There were also World Bank assisted schemes, SME I (1985) and SME II (1992), that were designed to enhance credit delivery to the SME sub-sector. These government and donor assisted schemes all failed. They were plagued with absence of accountability, crippling bureaucracy, high loan default and lack of commercial orientation. Government also tried to direct the flow of credit to SMEs through the commercial banks with a credit allocation system that required banks to allocate a set proportion of their credit portfolio to SMEs. The programme was only partially successful and was abolished in 1996.

In order to correct the problems of the past, the government has recently adopted new approaches that recognize the need for solutions and services that are unique to SMEs. These include the restructuring of its major development finance institutions, resulting in the

establishment of the Bank of Industry (BOI) in 2001 and the Nigerian Agricultural Cooperative and Rural development bank (NACRDB) in 2002. It also established the Small and Medium Industries Equity Investment Scheme (SMEIS) around that time. This program requires commercial banks to set aside 10% of their gross profit (profit before taxes) each year to be used for equity participation in SMEs in Nigeria. The banks can pick and choose who they link with, and can buy up to 40% of the equity of a firm. If an agreement is reached the entrepreneur must let them participate for up to four years, longer only if the owner agrees.

Unic Ventures is a two year old venture capital firm that manages SMEIS funds from Union Bank and Afribank. They will consider providing equity financing for companies with less than 1.5 billion Naira in assets, excluding land. They require a SME business plan before they inject funds. They can provide help in growing a business idea, and try to inject a CFO into the operation so as to help with financial management. This company says it is very interested in looking at investments in fabrication of agricultural equipment and processing of agricultural products. The trick is to find a suitable and cost-effective interface mechanism between the banks and VC firms like Unic Ventures, and the small fabricators which are the backbone of Nigeria's agricultural machinery fabrication and processing industry. Otherwise, banks will continue to resist partnering with small entrepreneurs. There may also be potential for linking fabricators and end-users to micro-credit funds, although these entities are typically very risk averse.

One way of solving this financing dilemma would be to create local agricultural mechanization promotion workgroups (AMPW) consisting of all stake holders in the agricultural mechanization value chain. How these informal workgroups might function is described later, but they could have associated legal entities that could raise capital from AMPW members and from venture capital outfits, and/or solicit loans from other sources. They then could funnel these funds to fabricators and end users via equity of debt financing.

In order to make this approach cost effective for the VC firms, this entity would take responsibility for supervising the companies and husbanding the funds. In collaboration with the VC firms, they could easily provide technical and financial management support to them to insure maximum profitability and/or repayment capability. They would receive interest on the loaned funds or dividends from the equity share, and could also receive licensing fees from new users who adopt the technologies developed and supported by the AMPW. A portion of this revenue could be funnelled back to the AMPW to cover its operating expenses. The idea requires a lot of flushing out but it could accomplish a lot of productivity enhancing/cost reducing goals. These would include:

- providing an incentive for standardizing designs that would facilitate specialization and more sophisticated metallurgy;
- making testing and evaluating technologies easier;
- facilitating development of private sector extension activities in support of mechanization – AMIL Solid Minerals & Agro. Allied Company is already doing this.
- facilitating application of sanctions for fabricators who violate sharing agreements
- providing more effective feedback from end-users to technology development centres
- reducing distrust in Nigerian made machines that have a cost effectiveness approval from the AMPW

11.4 Government policy

There is little doubt that the major constraint to more rapid development of small scale agricultural mechanization is unstable and unpredictable government policies and poor public sector infrastructure, especially electricity and energy, but also including the banking structure. We have mentioned some of these problems elsewhere in this report.

The disincentive effect of dumping subsidized inputs on the market cannot be over-emphasized, especially when the economic viability of the inputs at unsubsidized prices has not first been verified. If the economic feasibility on an unsubsidized basis is not good, there will be no adoption or demonstration effect to build effective demand in the absence of subsidies. The long history of subsidized fertilizer and tractor sales in Nigeria clearly shows this. Moreover, if adopters know there will be subsidized inputs coming, they will not purchase commercial inputs and will wait for the subsidized ones. They may even wait too long, until the late arrival reduces or removes the effectiveness of the input for the current production season, thereby losing production and income. In addition, there will be certain negative effects on local providers of those inputs when the inputs are imported or purchased from a single large supplier outside of the local economy into which they are being distributed. Never mind that subsidized inputs appear to have a tendency to not go to intended beneficiaries, or get dumped into the local marker at significantly higher prices immediately after receipt by selected individuals, or go to individuals who do not have a serious economic interest in seeing that they are used efficiently. It is the slogan of helping the poor farmers that provides the smoke screen for concentrating movements of inputs through a few hands so they can better be diverted to a select few, many of whom, no doubt, are far from poor.

An example of how disruptive sharp changes in policy can be comes from Abakaliki where 1000 rice mills operating in 1995 were reduced to only 150 today as the duty on rice was lowered to zero. Now that it has again increased, we are seeing substantial momentum in the opposite direction, throughout the country, coupled with substantial smuggling of rice. With the duty so high, we can see that much tax revenue is being diverted to neighbouring countries and many people will be drawn into processing rice, only to be driven back out when the duty drops to the ECOWAS level, as indeed it must. A more modest duty would still provide substantial incentive to local processing without drawing in high cost, unsustainable production, and would provide a stronger foundation for sustainable agricultural mechanization.

A counter example is provided by Enugu town where fabricators sold about 500 gari processing lines last year. Abakaliki has another large concentration of fabricators that is growing sharply in response to the current policy mandating a minimum percentage of cassava flour in bread. The problem is that the unattainable target is driving up prices unnecessarily high for consumers, whereas a more gradual policy would have most likely had the same impact on cassava flour production, but at a more sustainable pace and with less negative consequences for consumers of the primary product.

The case of electricity is a joke. A large portion of the country's production capacity is shut down every day because of power disruptions. In addition, huge costs are imposed on businesses which must build in redundant generating capacity so they can continue to operate, driving up costs and making Nigerian production even more uncompetitive in world markets. Some types of equipment even suffer operationally from such shutdowns, to say nothing of the amount of time wasted switching and restarting systems that shut down when the power goes out. Some types of processing machinery have to be completely broken down (c.f. Chinese groundnut oil extraction mills) and cleaned if they stop while in the process of extracting oil. Money used for indiscriminate subsidies on agricultural machinery would probably do a lot more good for small scale agricultural mechanization if it were used instead to eliminate problems with the supply of electricity to the sub-sector.

11.5 Opportunities

In spite of these constraints there are opportunities within the agricultural mechanization value chain that can be exploited for upgrading it. These opportunities include the following:

- There is proven willingness by end users across the country to adopt economically beneficial technologies and to pay for them.
- Local fabricators have good contacts and relationships with end users. This provides for wide distribution of technologies and maximum chance of feedback to improve designs.
- Fabricators are able to produce low cost equipment and are therefore good at lowering costs of entry for end users.
- Fabricators possess a dynamic response capability – they are very responsive to government policy / derived demand
- There is a willingness and capability among fabricators to copy machines that have a proven record of technical and financial success.
- In every major section of the country there are entrepreneurial champions involved in the development of machines and adopting efficient processing techniques in their operations. They are sometimes hindered by lack of access to advanced fabrication machines which are required for producing complicated parts. They are willing to cooperate with others, including technology centres, to ensure the promotion of agricultural mechanization and are ready to use their workshops and factories as training facilities for others.
- Technology centres have good and relatively sophisticated equipment base as well as qualified technical staff that are already paid
- Technology centres have produced prototypes for a wide range of equipment, some of which can be further developed to adoption levels.
- Technology centres do have some contacts with entrepreneurs, particularly some of the champions, providing some chance for relationship strengthening
- Technology centres are beginning to produce for the market in a bid to increase the resources available for their activities. This should make them more responsive to market forces

Even more encouraging to this process, is support being provided by NASENI. NASENI now has seven centres around the country and plans to form industrial clusters around these centres. These clusters will include small and medium scale enterprise. NSENI has 14 foundries and plans to increase the number to 76 in the next few months – two in each state. These facilities will be made available to local fabricators and, hopefully, will bring down the cost and increase the quality of their products.

12.0 Avenues for Upgrading the Value Chain

The small scale agricultural mechanization value chain can be upgraded by using process, product or functional mechanisms. The process mechanism would involve actions that increase the efficiency of performing activities within the chain, without changing roles of stakeholders within the chain. Product mechanisms refer to actions that would lead to the development of better products, products that are easier to build or are superior in one form or other to products currently available in the market. Function mechanisms refer to more fundamental shifts, such as the way that the products are put together, the roles of outsourcing, specialization within the value chain, and the development of clusters

The process mechanisms for upgrading the small scale agricultural mechanization value chain include the following:

- Improve management capacity of private sector fabricators and end users;
- Facilitate technical, financial and economic analysis of agricultural machinery prior to extension in order to reduce the risk of adopting new technologies;
- Develop mechanisms for improving outreach between the technology centres and end users;
- Develop mechanism for soliciting and publicizing best-of-breed technologies;

- Facilitate linkages between private sector fabricators, users and commercial financing structures;
- Advocate for a more stable agricultural policy environment.

The product mechanisms for upgrading the small scale agricultural mechanization value chain include the following:

- Promote linkages and information sharing:
    - among technology centres
    - among fabricators
    - between technology centres and fabricators
- Promote mechanisms for providing feedback between end users and fabricators and technology centres

The function mechanisms for upgrading the small scale agricultural mechanization value chain include the following:

- Work with champions (fabricators and end users) to become outreach outlets and a source of feedback into research
- Promote private sector - public sector partnerships in technology development and diffusion
- Promote specialization and development of clusters to utilise larger scale, cost reducing /quality improving technologies
- Promote contracting between commodity producers and end users to expand markets for production and processing
- Foster trade, investment and financing links with China, India and Brazil. These are countries that are currently producing technologies that are adaptable to Nigerian conditions

Bankole Oyeniyi, Director of Nova Technologies in Ibadan, won one of the first awards given by the Raw Materials Council for best of breed designs for one of his pieces of equipment. He has visited India on a technology exchange tour. He noted early in our field work that the real progress in technology in India began when the government linked state research and technology centres together. Before that they were working in isolation, much like Nigeria today. We believe that to be the key to transforming the small scale agricultural mechanization value chain today.

13.0 Recommended Next Steps

1. Promote formation of local and/or zonal agricultural mechanization promotion workgroups (AMPW) consisting of stakeholders all along the chain. These would include technology centres, input suppliers, importers, fabricators, dealers, farmers and other end-users, champions at all levels, and REFILS/ADP representatives. The first set of workgroups could be in Enugu, Zaria, Ilorin and Ibadan. PrOpCom needs to direct the process to ensure that it comes to a good end. The AMPW would look at all sources of equipment, including imported equipment, that promise to address critical problems with agricultural mechanization identified by end-users. The components of the activities would include:
    - Access of fabricators, at least the champions, to facilities of technology centres at a low cost.
    - Creation of capacity within the workgroups to undertake the following:
        - prioritize technologies to be identified/improved/promoted/tested/evaluated based on what is available, both locally and through imports, and the critical needs of local end-users,

- engage in further development of identified superior technologies to the point where they can be extended,
- establish processes for testing and evaluating these technologies under user level working conditions,
- evaluate the technical and financial feasibility of the technologies,
- based on favourable results, identify champion end users and others willing to adopt such technologies and undertake on-farm or in-factory technical and financial evaluation of the technologies,
- for technologies found appropriate, prepare written and graphic technical brochures and information aimed at both local fabricators and end users of the technologies
- provide outreach support for local fabricators interested in fabricating the machines, using champions and other fabricators as a peer support mechanism,
- prepare written financial evaluations of the technologies, including defining the circumstance under which the technology can be expected to perform as evaluated, for distribution to end users of the technologies and potential investors in the technologies,
- develop mechanisms for privatizing extension of properly evaluated and "approved ready" technologies to end users, possibly through a combination of marketing training for fabricators and dealers and sales commissions for extension agents and others in a position to recommend the technology
- Create a viable environment to register noble ideas
- Undertake advocacy roles as needed.
- Organise tours for champions to foreign countries

- Deal with all issues related to agricultural mechanization affecting stakeholders in the workgroup.

2. Support the development of modalities/structures for linking financing mechanisms, such as SMEIS, BOI, NBCRD, with fabricators and end users. This may involve supporting workshops that bring together the major players to discuss proposals from any of them, i.e., from venture capital firms, other sources of finance and the AMPW, for providing financing. Such proposals might include formation of zonal or local level legal operating companies for the purpose of:
   - raising capital from AMPW members and from venture capital outfits, and/or loans from other sources,
   - on-lending such funds to, or taking equity participation in, small mutual-guarantee groups of fabricators and end-users seeking financing,
   - collecting repayment of funds from fabricators and end users, and
   - providing technical and financial management support to them to insure maximum profitability and/or repayment capability.

3 Facilitate national level annual meetings of representatives of the local workgroups for the purpose of exchanging information and ideas, identifying best-of breed technologies through contests, exchanging technical and financial information on best-of-breed technologies, national publication of results, and for reviewing and harmonizing methodologies and for providing technical support for the technical and financial evaluation of these technologies.

4. Identify ways of making the local, zonal and national workgroups and activities self-supporting through user fees, membership dues, licensing fees and a share of profit of their associated legal operating companies.

Annex A: Report on PrOpCom's Agricultural Mechanization Workshop

Gubabi Hotel, Abuja, 7 February 2007

On Wednesday February 7, 2007, **PrOpCom** organized a workshop, which held at the Gubabi Royal Hotel, Abuja. The topic of the workshop was **Agricultural Mechanization Value Chain Analysis.**

Stakeholders in the agricultural sector such as fabricators, importers of agricultural equipment, representatives of agricultural research institutes and technology development centres, policy makers and implementers, donor agencies, state agricultural development projects and the academia, attended the workshop.

PrOpCom and its Mandate:

PrOpCom (Promoting Pro-Poor Opportunities Through Commodity and Service Markets), is a Programme funded by the United Kingdom's Department of International Development (DFID).Its main goal is to help reduce poverty by acting as motivator, facilitator or catalyst of change in the market place with a view to bringing greater benefits to the poor from market-based activities.

The broad aims of **PrOpCom'**s activities are to enable the poor to enhance their incomes, have greater opportunity for jobs, gain greater access to markets with better quality products, have more choice in the market and use the market to reduce the economic risks they face.

To achieve this, **PrOpCom** works with individuals, organizations and firms engaged in the agricultural sector. They include farmers, processors, marketers, and their associations in the rice and Soya commodity chain. PrOpCom is currently involved in three main catalytic activities: the *Ofada* rice, the Kura-Kano Corridor Rice and the Benue Soya beans project.

Background to the workshop:

In line with its mandate, **PrOpCom** sought to gather practical field intelligence about the equipment challenges and technology-related problems that militate against farmers, processors and marketers increasing their incomes, the things that make them remain poor.

Report of the field study undertaken by two consultants Professor Femi Ajibola and Dr. Tom Zalla entitled **Analysis of the Small Scale Agricultural Mechanization Value Chain** in Nigeria was presented at the one-day workshop. It formed the basis of discussion at the interactive forum.

Labour and equipment-related Problems besetting Nigeria's agriculture

The study sought to investigate four main problems besetting Nigeria's agriculture:

- The issue of low labour productivity in agriculture which accounts for the lack of global competitiveness of Nigeria's agricultural produce
- The issue of low quality of agricultural products which is responsible for low farmer\ processor income
- The absence of efficient mechanization of labour intensive operations, which is partly responsible for the high cost of production and
- The apparently high wage for agricultural labour, which also leads to high cost of production and low level of profitability.

Findings of field study:

The study revealed that:

- There are more than 60 technology centres working on agricultural mechanization technologies in Nigeria. These include federal and state universities, federal and state polytechnics; National Centre for Agricultural Mechanization (NECAM) Ilorin; research institutes such as the Project Development Agency (PRODA), Enugu; Federal Industrial Research Institute (FIIRO), Oshodi, Lagos; SEDI, NSPRI and many others.
  The report noted that although there is a fair distribution of technology centres across the country, there are poor linkages (cooperation, consultation and coordination) between these centres, fabricators and the end users. Most, if not all, of the centres have limited operating budgets, which hamper optimum performance on their part. Besides, the centres tend to focus on design and development of machines without much attention given to promoting their commercialization or reaching out to farmers who are the end users of those machines.
  The centres do not also pay much attention to conducting economic (financial cost and benefit) analysis of the machines they produce (in addition to the technical analysis of their products) to provide the end user with a range of choices of economically beneficial technologies he could adopt for maximum return on his investment.
- Local fabricators abound and are widely distributed through out the country. It pointed out that a 1996 study by NCAM, for instance, indicates that there are about 600 local fabricating firms in Nigeria. Forty per cent of them produce milling machines; 40 per cent cassava processing machines; 28 per cent oil palm processing machines and 10-13 per cent dryers, grinders, threshers, shellers, hullers and expellers. Today, ten years after that study, there are probably over a thousand local fabricators available producing a greater variety and quality of machines.
  Some of the local fabricators are producing some high quality machines and are exporting them; some local blacksmiths and rural artisans offer stiff competition to some foreign manufacturers in the area of ridgers production.
  The study noted that in spite of the fact that there is a large number of prototypes and production models available again, the perennial problem of poor to non-existent linkages between fabricators, end users and financial intermediaries tend to limit adoption
- There is a lack of information on best-of-breed technologies available and a financial analysis of them. This increases the risks of usage and significantly

reduces their rate of adoption. The study team however identified whom they call ‘champions’ among the local fabricators some of whom were invited to the workshop.

- The reality of Nigeria’s unstable political environment and erratic agricultural policy adversely affect the rate of adoption and effective utilization of agricultural technologies/machines and hence impacted on the country’s food security and the level of poverty of local farmers.

The report was very well received and generated robust comments and observations from the participants who commended the team for a good job. They also praised the organizers of the workshop for providing a forum for the various stakeholders in the agricultural sub sector to meet and exchange ideas and that effort be made to give wide publicity to the outcome of the workshop. Participants lamented that although agricultural mechanization is critical in Nigeria’s quest for food self-sufficiency and poverty reduction, it is unfortunately one sub-sector that has not received much attention from policy makers.

Comments and observations on the report:

The presentation generated a lively debate among the workshop participants, who raised questions or offered suggestions that could lead to a better mechanization of Nigeria’s agriculture.

Participants wanted to know what type and level of mechanization would lead to higher productivity and increased income for the poor farmer. They said it is not enough to talk about mechanization, desirable as that is, without thinking seriously about the issues of quality, cost and suitability or appropriateness of machines for specific agricultural use.

It was pointed out that a farmer who mechanizes using expensive but technically inefficient and ineffective machines could lose money heavily. It is only efficient and effective technologies that could lead to higher productivity, which would in turn account for higher profitability and increased income for the farmer or processor.

Participants observed that oftentimes among some local fabricators no one variety of machine produced by the same fabricator is an exact replica of the other. Similarly, spare parts produced by the same fabricator for his set of machines do not always fit the other. This, he said, raises the issue of lack of standardization of machines and spareparts by some of the local producers of machines. He suggested that to make locally fabricated technologies replicable, durable and effective, technology development centres should provide standard machines for fabricators some of whom are barely literate.

On this issue of standardization of machines and spares, which many participants stressed, it was observed that the National Centre for Agricultural Mechanization (NECAM), working in conjunction with the Standards Organization of Nigeria (SON), should be more alive to its mandate. NECAM was urged to not only standardize local and imported machines but carrying out as well financial analysis of them to guide the farmer’s choice of them.

Participants observed that many farmers and processors are often not aware of available technologies that are good, cheap, durable and appropriate for specific purposes. They underscored the urgent need for an agency to take it upon itself to publicize information about the existence of such machines so that the end user, who is key in the agricultural mechanization drive, can avail himself of those machines.

Some participants lamented the plight of most local fabricators who lack the capability to write feasibility studies to enable them to secure funds from banks and other lending institutions and urged that fabricators be assisted to access funds. They suggested encouragement of fabricators to form a pool to engage in the mass production of notable products that can sell.

Most contributors complained about the perennial and seemingly intractable epileptic power supply in the country, which is killing especially small and medium scale businesses. The use of alternative power supply, they noted, contributes to the high cost of products, which make it hard for some of the locally produced products to compete with foreign made ones.
From the concerns expressed, the queries raised and the suggestions offered during the comments and observation session, most participants seemed to have agreed on:

- Need for Government's agricultural policy to be on ground that will operate for at least 25 years;
- Need for technology centres to use their facilities to train local fabricators so they can produce high quality machines;
- Need to organize local fabricators to form co-operatives and assist them to write feasibility reports to enable them to access funds from agricultural funding agencies;
- Need to address the issue of the mistrust of local farmers of made-in-Nigeria machines by letting them know that some of the machines are of very high quality apart from being simple, appropriate (effective) and affordable;
- Need to encourage a pool of fabricators to standardize and mass produce products that have great sales potential;
- Need to advise farmers to avoid expensive and inefficient machines/ technologies as well as too much overhead costs.
- Need to encourage fabricators to specialize in the production of a few of the various components of machines rather than being a jack of all trades and master of none. Specialization is necessary in order to foster mass production of machines or their spareparts.

After the lively exchanges during the comments and observations of the plenary session, the workshop was broken into three work groups and tasked to brainstorm and provide practical and doable solutions to the following posers:

1. How can private sector fabricators and public sector technology centres work together to improve design and availability of production and processing technologies, equipment and

machinery? Is there a way to do this without additional government funding?

2. Is there potential for expanding everyone's business by drawing attention to best-of-breed technologies and providing users with a financial analysis of such technologies?
3. Is there a way of sharing of designs among fabricators and technology centres without putting those with the improved designs at a comparative disadvantage by sharing it?
4. What mechanisms can we use to introduce and facilitate the financial and economic analysis of improved technologies and offer this information to end users?
5. How can we generate revenue to help sustain this cooperation over the long-term?
6. others

The work groups had earlier been encouraged to seek solutions to the above listed problems by thinking less about what role Government could play and focusing more on what stakeholders themselves can do to achieve desired objectives. Each of the work groups presented its report to the plenary. The Workshop arrived at the following consensus:

- There is need for greater collaboration between private fabricators and technology centres. Private sector fabricators should be formally allowed access to the use of facilities of public technology centres for low fees. The fees are to be used for maintenance of operations of these centres as they are hardly given sufficient operating budgets by Government
- There is enormous potential for the expansion of everyone's business if technology centres provide facilities for the testing, standardization and certification of the products of the fabricators as well as their financial and technical analyses.
- To promote sharing of designs so that all parties can be equal gainers, there is need for zonal fora for regular meetings between fabricators and technology centres where issues of new designs and improvements of existing ones are discussed and mutually beneficial agreements reached
- Private-public sector Forum (PPF) should be used to introduce and facilitate the financial and economic analysis of improved technologies and this information made available for public consumption.
- Revenue to help sustain over the long-term the desired healthy relationship between the private and public sector could be generated through levies and annual dues imposed by stakeholders' unions or associations and through support from donors and investors
- Local fabricators should form groups to draw Government's attention to their needs as well as promote access to funds from funding agencies.

Conclusion:

The meeting, which began at 9.30am, ended at 6.45pm.

IDANG ALIBI
Rapporteur

Annex B: Sources Cited

National Centre for Agricultural Mechanization; 1997; Animal Traction for Agricultural Development in Nigeria, Proceeding of a National Training Workshop; UNDP/Nigeria Country Programme; Ilorin

National Centre for Agricultural Mechanization; 2001; Directory of Fabricators, Welders and Agricultural Machinery, Equipment and Tools in Nigeria; UNDP/Nigeria Country Programme; Ilorin

Raw Materials Research and Development Council; 2002; Directory of Equipment/Machinery Fabricators in Nigeria; Raw Materials Research and Development Council, Federal Ministry of Science and Technology; Abudja

Annex C: List of Contacts

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