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MARCH 1994

PROMOTION AND DEVELOPMENT OF
AGRO-RELATED METALWORKING INDUSTRIES (PHASE I)

US/RAS/92/072

LAO PEOPLE'S DEMOCRATIC REPUBLIC

Country Report*

Prepared for the Government of Lao People's Democratic Republic by UNIDO
in co-operation with RNAM/ESCAP

Based on the work of Reynaldo M. Lantin
UNIDO Expert

United Nations Industrial Development Organization
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SUMMARY

1. INTRODUCTION

The Special Programme for the Industrial Development of Asia and the Pacific, launched by the Third General Conference of UNIDO in 1989, has focused on two industrial subsectors supporting the vital agricultural sector of the least developed countries of the region: agro-related metalworking and food-processing industries. This approach has been endorsed by the policy making organs of UNIDO (GC.4/Res. 8 and 9, GC.5/Res.14) and funds have been allocated from various sources in support of preparatory activities in these fields. The priority areas to be addressed in the agro-related metalworking industries were identified in 1990 through a process of desk research and country consultations and a UNIDO/ESCAP Regional Workshop with representatives from most of the LDCs in the region. Subsequently a project was launched, in close cooperation with the ESCAP-executed Regional Network of Agricultural Machinery (RNAM) in Bangkok, with financial support from Italy and assisted by Associate Experts financed by Germany and the Netherlands, to achieve the following outputs by early 1994:

(a) National Focal Points in participating countries strengthened to be capable of providing a continuous flow of technical information and advice to enterprises in agro-related metalworking industries.

(b) Detailed proposals for **prototype exchanges** and assistance in the establishment of a **service for raw material procurement**, **concrete policy guidelines**, and concrete mechanisms for the **improvement of cottage-scale agro-related metalworking industries**.

(c) Detailed plan for the preparation of technical cooperation project documents in agro-related metalworking industries in areas requested by the concerned governments.

The countries participating in the process are Bangladesh, Bhutan, Cambodia, Lao PDR, Myanmar, Nepal, Solomon Islands and Western Samoa. The UNIDO expert visited all relevant production units, training and support institutions and ministries in these countries and, in addition to providing on-the-spot advisory services, prepared very detailed reports on the state of the industry in each country, constraints, potential areas of development and proposals for regional and national technical cooperation. As a result of this comprehensive analysis involving all relevant parties in the private and public sector, and bearing in mind ongoing and planned activities by the governments and the donor community in the participating countries, a thematic programme was formulated for the further promotion and development of these industries building on the successful implementation of the first phase and fruitful partnership with RNAM and the national focal points.

This report provides an account of the problems to be addressed, linkages with other programmes to reach the target groups, and a matrix of proposed responses by

UNIDO with donor support. The overall objective of this thematic programme is to promote rural development in the least developed countries of Asia and the Pacific through the promotion of indigenous manufacturing of agricultural tools, implements and post-harvest processing equipment thus, providing a subsectoral and technical dimension to national efforts to promote and develop cottage, small- and medium-scale industries.

2. DESCRIPTION OF THE SUBSECTOR

The agro-related metalworking industry subsector in the LDCs of Asia and the Pacific region has merited due attention and priority considerations for development in view of its impact on agriculture and the rural sector communities of these countries. Since agriculture is the mainstay of the LDCs, self-sufficiency in food for the increasing population which brings pressure to the constant land area and the environment, increased productivity of land and labour and hence, of agricultural production and income of farmers, are among the primary development objectives in these countries. The development of an agro-related metalworking industry for the manufacture of hand tools, single-animal-drawn implements and small mechanical powered machinery through developing capabilities of the private sector mainly through provision of institutional support from the public sector, provides a promising growth potential in and supportive role for agriculture and the agro-based processing industries. This is in view of the past neglect resulting from a state enterprise approach in agricultural mechanization which has proven to be unsustainable especially in the socialist countries. Most of the State-owned and large-scale enterprises declined in operation and viability with the collapse of the Council for Mutual Economic Assistance (CMEA). This situation is particularly prevalent in Cambodia, Lao PDR and Myanmar.

All the LDCs have now taken the new approach of letting the private sector take over the former government function of supplying tools and implements to farmers in the current efforts of privatisation of State-owned enterprises along with the adoption of the policy from centrally planned to liberalized market economy. The private sector is therefore, expected to take the initiative and to produce the required tools and implements on a commercial basis. However, due to their lack of experience and prior success cases in the private sector, the hesitation on the part of the private sector needs to be overcome by adequate infrastructure and institutional support with less of government intervention and restrictions but with due encouragement, such as allowing their products to develop a competitive edge over imports during the early stages of the enterprise.

In most of the LDCs the village blacksmiths are the primary suppliers of basic hand tools and animal-drawn implements being used by farmers. In general however, no institutional support has been given to blacksmithing which may be classified as a metalworking cottage industry but which performs an important role in agriculture and rural development. Small-scale entrepreneurs in the LDCs have so far been timid in investing in agro-related metalworking enterprises, that is, production of more modern, efficient and higher capacity machines than those which can be produced by blacksmiths. Thus, the small-scale enterprises need basic machine tools in their

fabrication or foundry workshops as well as technical assistance in product design, manufacturing, quality control and information on business management, including the financial and marketing aspects.

In LDCs where small-scale agro-related metalworking enterprises exist, typical owners are those who have had experience as former workers in other shops and started out to venture on their own. They simply train their own workers initially as apprentices, then given on-the-job training. Very few owners have engineering background and most workshop owners rely on their own creative and mechanical talents to produce machines which they perceive as having some market. Ideas usually come from existing prototypes or commercial machines which are copied or improved. Some medium-scale workshops may have engineers on the staff who would be assets in product development and improvement of machines being copied or adapted from sources abroad, normally as suggested or ordered by some international non-government organizations (NGO) for their projects in the country.

As the governments in the LDCs have adopted the open-market policy, any products to be marketed by the agro-related metalworking industry subsector has to compete with imported counterparts. The tariff structure, in the LDCs where it exists, often favours the imports in that finished goods are less taxed than raw materials.

In accordance with the Terms of Reference (Annex), the UNIDO Expert visited Lao PDR from 30 November to 14 December 1993. Meetings were held with the government officials concerned. Through the arrangements made by the Ministry of Industry and Handicrafts which is the national focal point and the UNDP in Vientiane, relevant institutions, organizations, factories, workshops and farming areas in Lao PDR were visited.

This report contains two project concepts, one regional for eight least developed countries in Asia and the Pacific and one country-specific for Lao PDR.

Based on the country reports of the UNIDO expert for each LDC during Phase I of the project US/RAS/92/072, Promotion and Development of Agro-related Metalworking Industries in Least Developed countries, the following status of the industry and the related agricultural mechanization in Lao PDR is given below:

There is only one public sector enterprise which produces agro-related machinery but at about one-third of the installed capacity of the factory. The machine tools are old and some are obsolete, but still usable. Repairs of some equipment would require imports of spare parts from the original manufacturers in Russia, China and other socialist countries. The foundry has a capacity of two tonnes per hour. Technicians are capable of casting 40-cm impeller diameter centrifugal pumps and possibly other products if pattern makers are trained or prototype patterns are obtained from other sources. An electric arc furnace is idle but can be made operational if spare parts from India could be imported. This foundry has other auxiliary equipment such as molding machine, sand processing and mechanized handling equipment which may be used for quality production of cast items.

There is no institutional support infrastructure for the promotion and development of agro-related metalworking industries. The Ministry of Industry and Handicrafts, which is supposed to provide such institutional support, lack the human resources to implement related programmes which would require direct intervention or field activities such as demonstration of machinery, organization of training and setting up of demonstration or pilot areas, among other activities which need to be done to promote the industry.

There is virtually no private sector manufacturing industry for agro-related machinery as historically this function had been provided mostly by the Agriculture Tools Making Factory (MMF) as described above under the Ministry of Industry, and Handicrafts and the now defunct Agricultural Machine Company under the Municipality of Vientiane. MMF has ceased to manufacture hand tools and blacksmiths have responded to taking up the slack in the supply of such tools. A village in Vientiane province has 14 blacksmiths whose total production of hand tools cannot satisfy the demand meaning that a large market potential for their products still remains untapped. There is a need to upgrade their skills and increase their productivity, especially in areas of providing anvils, blowers, grinders and tool-finishing equipment. If government industries and other agencies adopt a programme or policy to procure the hand tools for their workers from local blacksmiths, this micro or cottage industry will bring economic benefits to the community. If they master enough expertise to produce quality products it is possible that they could even export some of their specialty tools. This is an area which has not been tapped or deliberately promoted with comparative attention given to other cottage and handicraft industries.

There are indications that the private sector is responding to the demand for agricultural machinery, especially power tillers, rice thresher and rice mills which are mostly used for custom operations. Three entrepreneurs have immediate plans to produce the above machines initially but are trying to copy the Thai designs. Since one entrepreneur has fabricated about 220 units of rice mills, initially of Thai design and later his own design, indicating that given the proper climate like demand and less government restrictions, the private sector will respond.

3. CONCLUSIONS AND RECOMMENDATIONS

Supply and demand for agricultural machinery

The supply of agricultural hand tools, animal-drawn implements and mechanical powered machinery in 1993 came from the following sources:

(a) Hand tools consisting of machetes or knives, sickles, hoes, rakes, axes, diggers and special tools - blacksmiths (about 15,000 pieces/year produced by 14 blacksmiths in one village alone) and imports from Vietnam (Note: actual production by MMF in 1981 was 57,970 pieces including cast-iron plough shares and plough share-mouldboard units);

(b) Steel ploughs, cast-iron piough share-mouldboard units and cast-iron plough shares - MMF (2,800 pieces with US \$ value amounting to only one-third that produced in 1981) and imports from Vietnam;

(c) Power tiller sets, each consisting of power tiller unit, paddle wheels, mouldboard plough, disc plough, comb-tooth harrow, trailer and axial-flow pump - imports from Thailand (about 600 sets);

(d) Pedal threshers, Japanese design - MMF (250 units);

(e) Power threshers, Thai design - MMF (10 units) and imports from Thailand;

(f) Grain flour mills - MMF (5 units); and

(g) Rice mills - one private workshop in Vientiane (82 units of adapted design), Agricultural Machine Company Import-Export at Phontan Road, Vientiane (3 units) and imports from Thailand.

The demand for power tillers and threshers was being viewed by some private entrepreneurs as sufficiently high to justify competitive local manufacture as indicated by plans of three medium-sized ones to do so starting in 1994. Blacksmiths' products in one village, however, were so much in demand that production capacities were not meeting it. Traders who came to the village were ready to buy all the blacksmithing products of good quality. This showed that users preferred quality products as there was competition with imported ones. There was a need to increase the productivity and production capacity of blacksmiths through improved blacksmithing equipment, like electric or pedal-driven blower and grinder as well as anvil.

Through the national network which was proposed to be established with MIH as the focal point, the blacksmiths could be given information on new designs of hand tools which might be improvements of what they used to make in terms of effectiveness, ease of use and cost because of simplicity and lesser amount of material used. Blacksmiths in the remote and mountain areas need more assistance than those in the relatively more prosperous areas in the lowlands and irrigated areas, like Vientiane and the mid-southern provinces.

MMF would be one of the SOEs which may be privatized although no time-table has been set yet. One problem for the possible delay of such a scheme is that no investor might be interested in buying or leasing the facilities and equipment unless very attractive terms are offered. For example, if machine tools are sold by the piece or lot consisting of pieces of equipment which would support a complete workshop, small-scale entrepreneurs may be attracted and encouraged to establish their own workshops. Another alternative is to make the whole factory compound a mini-industrial estate where buildings are leased to different entrepreneurs but using common facilities like the machine shop and foundry. Each building may be occupied by two or more leaseholders for their own manufacturing specialization which would be agro-related. At the start, a building may be used as an industry incubator for a

new entrepreneur who wishes to go into manufacturing venture without investing on capital equipment.

A project on the promotion and development of agro-related metalworking industry (AMI) enterprises might give an additional role for MMF to perform the institutional support function and might even revitalize the agricultural machinery factory itself as human resources development, including training in areas of production management, quality control and marketing, would be a possible thrust. MMF could diversify its products to those which would not necessarily compete with the private sector industry it would be promoting. For example, it could produce agro-related products as water gates for irrigation canals on import substitution basis and could specialize on the production of micro-hydropower turbines the technology for which could be obtained from other countries like Nepal and China.

If privatized, MMF could perhaps sell its excess, idle or redundant equipment by the piece or lot consisting of pieces of machine tools which would support a small-scale workshop. Small-scale AMI entrepreneurs might be attracted and encouraged to establish their own workshops. Alternatively, the whole factory compound could be converted into a mini-industrial estate where initially, a large portion of one building might be leased to 2 to 4 small-scale entrepreneurs who could use common facilities, like the machine and foundry workshops. Each building may be occupied by two or more leaseholders for their own manufacturing specialization which would be agro-related. At the start, a building could be used as an industry incubator for a new entrepreneur who might wish to go into manufacturing venture with little or no investment on capital equipment.

To make the factory division more viable, it would also be possible to diversify MMF's products to include cast-iron water gates for irrigation canals and micro-hydropower turbines which were needed for the development of key areas and the production of which would unlikely be undertaken by the private sector. On the other hand, the present value of the MMF facilities is estimated to be so high that attracting a private entrepreneur or group to buy it will be difficult.

The gear box may be locally manufactured utilizing the foundry and gear-making and heat treatment facilities of MMF through suitable arrangements.

The role of the College should be given due importance as it is the only local source of developed human resources for agricultural development of the country which is the primary thrust of the government. Such human resources development should include the field of agricultural engineering and needs the reorientation of the current staff in farm machinery to develop capabilities in design and engineering activities rather than merely operation, repair and maintenance of tractors which at the present situation has somewhat become irrelevant and anachronistic. The fact that the farm machinery course has been discontinued due to lack of students is an indication of the lack of relevance of its current training format and the need to develop human resources for the planning and development of modern mechanization systems, including design, testing, manufacture and extension of agricultural machinery and other mechanical technologies. Other agricultural engineering areas,

such as for irrigation, soil and water resources development and management, crop processing and post-harvest technology, farm structures and environment should be developed in the staff to develop human resources for the line ministries, research, extension and the professional services field .

A subject which might be included in the curriculum for the last year of study is about business management with the view to introducing the students to the realities of small-scale entrepreneurship rather than employment of which there may be scarcity. Such a subject would create an interest among the students in setting up their own enterprises and therefore, would not have to rely on employment. In practice, such an establishment may be realized after perhaps one or two years after gaining experience and building up self-confidence. For this a credit programme may be arranged by the school with a credit institution to assist the graduates in starting their small business enterprises.

Ad-hoc technical advice

The following are suggestions to the various officials and heads of institutions indicated:

(a) MIH/MMF/NAC/PTS/LGTS/STENO Consider human resources development as priority and encourage the staff to build their capabilities in comprehending and absorbing new and relevant technologies by learning English which is getting popular. Since most of the accessible information from abroad are written in English, learning it through in-house service courses would widen opportunities of the staff for upgrading their capabilities in their respective fields. The base of selection of candidates for study fellowships would widen to include the talented and promising individuals.

(b) NAC/LGTS/PTS - Corollary to (a) above, Nabong Agricultural College might develop programmes based on the concept of twinning with one or more developed universities in Asia for exchange of staff and students to upgrade its teaching faculty. Similarly, the Lao-German Technical School and the Pakpassak Technical School may develop their own programmes under TCDC arrangements.

(c) MIH/MVDIH - To accelerate privatisation of SOEs, especially those which were not attractive to foreign or local investors, MiH might consider apportioning the factory complex, building or equipment into small manageable and affordable lots or sub-divisions and renting them out or selling them to small-scale entrepreneurs on easy terms (perhaps an adaptation of the condominium concept). This widens the mass base of ownership or participation in industry, utilizes to the maximum otherwise idle or under-operated SOEs (e.g., the Agricultural Machinery Company at Km 5 - idle since 1991, and the Equipment and Repair Workshop at Thongpong - very few clients), reduces further deterioration of facilities through occupancy and usage and promote the development of small-scale industries. The SOE compound may grow from micro to mini industrial estate and perhaps expand to a full-scale one.

(d) MMF/MIH - They might prepare a programme to rehabilitate some facilities of the MMF to provide facilities and services to AMI incubators as well as training of farmers in operation, repair and maintenance of agricultural machinery. Organize an Agricultural Machinery Development and Extension Centre (AMDEC) at MMF with a view to providing institutional support for AMI and agricultural mechanization. Maximize utilization of foundry facilities by diversifying its products to serve the needs of other agriculture and rural development programmes by import substitution. For example, the Department of Irrigation needs cast-iron watergate sets for irrigation canals. MMF was also an SOE with the 1993 production value of agricultural machinery of only about 33 per cent compared to 1981 production value but had high income in calcium carbide, oxygen and acetylene production and in services which had probably made its operations viable.

(e) MIH/MMF - Encourage formation of village associations of blacksmiths to increase efficiency of raw materials procurement and to market their products directly and avoiding middlemen. Affiliate such associations with the Lao National Chamber of Commerce and Industry (LNCCI).

(f) LNCCI - Promote the agricultural machinery custom-hire operation services as a small-scale enterprise among the "wealthier" members of LNCCI to help farmers avail themselves of the benefits of agricultural mechanization.

(g) MIH - Maintain the contacts with the offices and institutions visited during the mission so that a "national network for agricultural machinery" could start operating informally. Follow up on the potential entrepreneurs for establishing workshops for AMI enterprises.

(h) MMF - Try to regain the market for hand tools lost to competition with imports from Vietnam by producing quality products, improving productivity and developing an effective marketing strategy.

(i) MIH/CPC - One way to promote the blacksmithing industry, a type of cottage handicraft or micro-scale enterprise, is to encourage ministries and provincial offices to purchase hand tools issued to their field workers from local blacksmiths instead of importing them. Such tools could be made according to specifications.

(j) DI/DAE - The use of pump irrigation for rice in areas which cannot be served by gravity irrigation systems but which have groundwater and surface water resources should be promoted. The following activities should be undertaken to complement those of on-going ones for implementing irrigation projects.

(i) Promote the use of low-lift pump irrigation from shallow tubewells or surface water resources during the dry season by establishing demonstration sites in key provinces like Vientiane, Luang Prabang, Saravane, Savannakhet and Champassak where rice is grown. The collaboration of the Lao-IRRI Project as well as should be sought as well as small-scale AMI entrepreneurs and the provincial offices concerned

(ii) Conduct hydrologic surveys of intended demonstration sites for installing shallow tubewells and low-lift pumps driven by electric motors or diesel engines. Among other activities, gather data on water depth, drawdown and water recharge rate and their crop yields, cooperative attitude of farmers and support from village leaders and other data needed for feasibility of conducting demonstrations.

(iii) Organize farmer groups as cooperators in selected demonstration areas by motivating them to raise dry season rice or other crops.

(iv) Establish pilot demonstration areas for the growing of high-yielding varieties of rice or other cash crops during the dry season in rainfed or non-irrigated areas in Vientiane municipality and in the provinces using low-lift pump irrigation from shallow tubewells of water courses and reservoirs or ponds.

(v) Install shallow tubewells using portable drilling rig developed from IRRI design and locally made low-lift pumps (initially to be made at MMF foundry shop using suitable designs from other countries) in the fields of farmer group cooperators.

(vi) Provide technical advice on the agronomic and cultural requirements of rice or other crops and, if necessary, assist farmers in obtaining credit for other inputs, like fertilizers and hand tools such as weeder.

(vii) Provide technical advice in the proper operation and maintenance of shallow tubewells and electric motor or engine-driven pump sets as well as in their economical operation and in water management through efficient water use and prevention of water wastage or losses.

(viii) Demonstrate other machines and agricultural technologies at the critical stages of crop production for maximum impact on yield and timeliness. Examples are power tiller or hydrotiller during land preparation, "dapog" system of raising seedlings, check-row marker, hand-pushed row weeders, improved sickle and the IRRI portable thresher.

(ix) Monitor the production areas and gather data on all expenses and income from the operation and make a cost and income analysis.

(x) Document all significant events using still and video cameras and prepare a promotion video, a slide show and an illustrated brochure as extension material for other areas remote from the demonstration sites.

(xi) Promote the use of shallow tubewells and low-lift pumps in other areas using video tapes, slide shows and leaflets and organizing study tours among farmer groups to the demonstration sites.

(xii) Prepare brochures and leaflets showing profitable business investments in renting out small-scale shallow tubewell and low-lift pump irrigation systems.

(xiii) Promote among members of the LNCCI and other wealthier persons, investments in installing shallow tubewells in farmers' fields and renting out low-lift irrigation pumps in rainfed rice-growing areas to enable farmers to grow rice crops during the dry season; include in the promotion package other recommended tools and equipment as well as agricultural technologies needed to increase crop yields and productivity of land and labour.

(xiv) Present investment proposals in meetings and seminars of business and other groups, utilizing video and slide presentations if actual visits to demonstration sites are not feasible.

(xv) Promote the manufacture of standard low-lift pumps among the small-scale AMI entrepreneurs.

This Country Report on Lao PDR is one of the outputs of the UNIDO-assisted Project, US/RAS/92/072, Promotion and Development of Agro-related Metalworking Industries in Least Developed Countries (Phase I). The other LDCs which have endorsed the project are Bhutan, Bangladesh, Cambodia, Myanmar, Nepal, Solomon Islands and Western Samoa on which separate country reports have been prepared.

In accordance with the Terms of Reference (Annex), the UNIDO Expert visited the Lao People's Democratic Republic from 30 November to 14 December 1993. He met with the Government officials concerned and visited relevant institutions, organizations, workshops and farming areas.

The purposes of such visits were to get information about agro-related metalworking industries and agricultural mechanization, identify problems and constraints of their development, provide ad-hoc technical advice, get the views of the all parties who might be involved in the development of the subsector and gather data which would be used to prepare project concepts for further formulation by UNIDO.

The Government of Lao PDR has been in the process of reorganization and undertaking economic reforms since the adoption of the New Economic Mechanism in 1988. Rapid changes due to the restructuring process during the transition from a centrally planned to a market-oriented economy have been encountered. Privatisation of the state-owned enterprises is one of the areas where policies and strategies have been restructured by the economic reform programme. The Agricultural Tools Making Factory and Oxygen-Acetylene or MMF, the only operating state-owned agro-related metalworking enterprise, may be affected by such reform but no plans have been set towards its privatisation.

Except for blacksmiths and one small-scale workshop fabricating rice mills adapting a design from Thailand, there are no other private agro-related metalworking industries.

The demand for power tillers and threshers was being viewed by some private entrepreneurs as high enough to justify competitive local manufacture. One group of

investors who have leased a state-owned agricultural machinery repair factory and two traders of power tillers, rice mills and threshers from Thailand have indicated plans to engage in local production of agricultural machinery starting in 1994. Blacksmiths' products in one village are so much in demand that total production capacity of the 14 blacksmiths are not meeting orders from traders who come to the village.

Major problems relevant to the promotion and development of agro-related metalworking industries in Lao PDR comprise the following: (a)
Inadequate government revenues has resulted in severe limitations for undertaking direct government execution of programmes;

(b) There is need for massive human resources development at all levels;

(c) There is lack of institutional support infrastructure and undeveloped physical infrastructure especially roads to facilitate communication;

(d) Access to information and capacity to absorb new technologies are limited and

(e) Limited resources and savings in the private sector also limited investment capacities;

Lao PDR has large potentials for development. Among them are the following:

(a) Plenty of forest, mineral and water resources;

(b) Possibilities of shallow tubewell and low-lift irrigation pump system as the water table was high and

(c) Abundance of water courses especially in the mountainous areas where micro-hydropower could be developed.

LIST OF ABBREVIATIONS

AMC	Agricultural Machine Company
AMCIE	Agricultural Machine Company, Import-Export
AMDEC	Agricultural Machinery Development and Extension Centre
AMI	Agro-related metalworking industry
CMEA	Council for Mutual Economic Assistance
CCI	Chamber of Commerce and Industry
CPC	Committee for Planning and Co-operation
DAE	Department of Agriculture and Extension
DI	Department of Irrigation
DIH	Department of Industry and Handicrafts
ECDC	Economic Co-operation Among Developing Countries
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization
GDP	Gross National Product
GOL	Government of Lao PDR
GTZ	German Technical Co-operation Agency
IDRC	International Development Research Cooperation
ILO	International Labour Organization
IRRI	International Rice Research Institute
ITC	Industrial Training Centre
KN	Kip (US\$ 1 = about KN 720)
Lao PDR	Lao People's Democratic Republic
LDC	Least Developed Country
LGTS	Lao-German Technical School
LNCC	Lao National Chamber of Commerce and Industry
MAF	Ministry of Agriculture and Forests
MHI	Myanma Heavy Industries
MIH	Ministry of Industry and Handicrafts
MMF	Agricultural Tools Making Factory and Oxygen-Acetylene
NEM	New Economic Mechanism
NGO	Non-government Organization
NFP	National Focal Point
NI	National Institute
NN	National Network
PDF	Pilot and Demonstration Foundry
PDR	People's Democratic Republic
PTS	Papassak Technical School
R&D	Research and development
RNAM	Regional Network for Agricultural Machinery
SBDP	Small Business Development Programme
SEARCA	Southeast Asia Research Centre for Agriculture and
SOE	State-owned enterprise
STENO	Science, Technology and Environment Organization
TCDC	Technical Co-operation Among Developing Countries
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization

LIST OF FIGURES

Figure 1. Some equipment and activities at the MMF workshop. Top: A used water pump being rebuilt at the MMF workshop. Bottom: Idle electric arc furnace at MMF due to lack of spare parts for its repair.

Figure 2. Some equipment and activities at the MMF workshop - preparation for casting of a centrifugal pump body and impeller. Clockwise from top left: Workers finishing the mould; semi-prepared moulds; and wooden pattern of the pump body.

Figure 3. Threshers being produced at MMF. Clockwise from top left: Newly assembled pedal threshers adapted from a Japanese model; painted pedal rice threshers ready for delivery; and engine-powered rice thresher adapted from a Thai model.

Figure 4. Two types of agricultural machinery being imported by AMCIE on display at Photan Road, Vientiane. Top: Power tillers and rice mills; Bottom: Rice mills of capacity 3 tonnes rice per day (two units at foreground) and one tonne rice per day (one unit at background).

Figure 5. The idle factory building of the defunct Agricultural Machine Company (AMC) of the Municipality of Vientiane. The factory is under privatisation process. Shown is the Manager of AMC which has gone into importing power tillers from Thailand under the name AMC Import-Export. He is leasing the factory himself to manufacture power tillers and rice mills along with barbed wires and nails.

Figure 6. Thai-built rice thresher mounted on a Lao-built trailer truck for use in custom threshing services.

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Figure 8. One of 14 blacksmiths at Phonemi Village, Province of Vientiane. Clockwise from top left: Blacksmith at work with assistant operating the dual-piston type blower for the forge (background) and with finished tools displayed (foreground); blacksmith using a metal shaver on a knife he has just finished working; and blacksmith's shed.

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INTRODUCTION

A. General

Geography and population

The Lao People's Democratic Republic (Lao PDR) is a landlocked country bordered by China and Myanmar in the north, Vietnam in the East, Cambodia in the south and Thailand in the west. About 70 per cent of the country's 236,800 square kilometres consists of mountain ranges with the highest peak of 2,300 meters, highlands and plateaus. The fertile plain areas are in the central and southern parts of the country. The Mekong River which originates from China and enters Lao PDR at elevation 600 metres above sea level through the border with Myanmar, generally flows southeastward mostly along the border with Thailand until it finally exits at 80 metres elevation into Cambodia. Its major stretches and tributaries are navigable.

The river and its tributaries have structured the life of the people, most of whom live alongside waterways and provide rich water resource potentials for irrigation and hydropower. Nomadic hilltribes live in the mountain areas. The 4.2 million Lao population which has been growing at 2.9% annually comprises 69 ethnic groups and classified into three major groups. The Lao-Loum (low Lao) represent about 65% or the majority, live along the Mekong River and are considered better-off than the other groups. The Lao Theung who occupy the mountain slopes comprise about 27% of the population and the Lao Soung who occupy the mountain tops and constitute about 18% of the population. About 85 per cent of the population are engaged in agriculture which is mostly done on subsistence type using family labour.

Population density is only 17 persons per square kilometre. Vientiane, the capital, has a population of 442,000 and the density is 118 persons per square kilometre. Other major cities are Luang Prabang (population, 44,000) in the north and Pakse (population, 45,000) and Savannakhet (population 51,000) in the south. The 16 provinces include about 112 districts (muong), 950 sub-districts (tasseng) and 11,424 villages (ban). Adult literacy is estimated at 50%.

Brief economic history

The French continued its colonial occupation of Laos after World War II but ended it in 1954 after a war for independence. However, Laos had yet to suffer the Second Indo-China War until 1975 when the Pathet Lao achieved victory. It initially pursued a programme of agricultural collectivization which was later abandoned. The emphasis then was central planning and state ownership. Self-sufficiency of the country and the provinces was the guiding principle and trade was in the form of barter agreements with other socialist countries under the Council for Mutual Economic Assistance (CMEA).

In 1986, the government started an economic reform programme called, "New Economic Mechanism" (NEM). The new system is still undergoing rapid transition resulting in a government reorganization from a centrally planned to a free-market

economy, where resources are allocated according to the maximum-profit principle while still embracing the socialist ideology. NEM policies involve deregulation of the price-control system, establishment of market prices, liberalization of internal and external trade, privatisation of state-owned enterprises (SOEs) and seeking of foreign investments.

Lao PDR has currently one of the most liberal foreign investment laws in the Asian region. The government has already privatized a number of SOEs through lease and sales contracts but would likely be retaining the strategic ones, like hydropower, telecommunications and airline enterprises.

To enhance foreign trade, one bridge across the Mekong River to Thailand is scheduled to open in April 1994. Main exports, which comprise 13 per cent of gross domestic product (GDP), are wood and wood products, electrical power, coffee and cardamom. Imports consist of all kinds of manufactured goods of all kinds, mostly from Thailand.

The economic reform programme had achieved an economic growth rate of 8 per cent per annum from 1989 to 1992 and a reduction of inflation rate from 75 percent in 1989 to only 7 per cent in 1993. However, Lao PDR is still listed as one of the world's least developed countries (LDCs) with per capita income of US\$ 180 in 1991.

Agriculture

About 85% of the population is engaged in agriculture, of which rice production is a major activity. About 70% of the country's rice crop is grown in the lowlands and 30% in the uplands. About 60% of the upland population do not produce enough rice to meet their needs and have to supplement their diet with maize, cassava, taro and other rice substitutes for about three months of the year.

Other major crops include coffee, sweet potatoes, soybeans, peanuts, tobacco, cotton, sugarcane and tea. There are sizable livestock holdings of buffalo and cattle which are sources of animal draft power.

Industry

About 40% of the Gross Domestic Product (GDP) is accounted for by the industrial and service sectors of the economy which have been growing steadily since 1986 under the incentives of NEM. Manufacturing is the leading component of the industrial sector. Wholesale and retail trading are the leading components of the service sector.

Potentials

Lao PDR is rich in mineral, forest, water and land resources. Forests cover about 47% of the country. Labour is relatively cheaper than in other countries. While agriculture is the backbone of the economy, the manufacturing and service

industries are where employment is being created. Establishment of such industries is needed to absorb the more than 10,000 new graduates expected yearly in the next 10 years.

The wood exports however, cause a severe environmental impact. The harvested timber from about 300,000 hectares of forest area far exceeds the replanting or reproduction capacity. Environmental degradation in the form of soil erosion is being exacerbated by the rampant slash and burn or shifting cultivation.

In 1980, more than 80 percent of the country's total land area was covered with forests. At present, it is only about 45 per cent and environmental degradation could be a reason for the occurrence of flash floods in some parts of the country. Unless further forest denudation is checked by systematic forest harvesting or banning of logging activities, afforestation and replacement of the swidden farming with soil conservation farming systems, the rich water resource potentials will also be threatened and more and destructive floods will occur.

The development of the country's potentials are hampered by the following:

(a) Scarcity of capable human resources. The country is still recovering from the massive brain drain which occurred during the mid 70s and earlier. However, through a modest human resources development majority of about 1,500 students sent abroad for further studies are beginning to return to render government services and to provide professional technical and management services to the private sector. The educational attainment and standards of the labour force are low which result in low productivity;

(b) Inadequate institutional infrastructure. Being in the transition stage from a centrally planned to a market-oriented economy, Lao PDR human resources are undergoing through a period of "birth pains" and semi-confusion arising from lack of understanding of the new concepts of a market economy, especially by the civil servants at the low levels in the ministries and public institutions. In the private sector, entrepreneurs lack business experience;

(c) Geographic location as a land-locked country. The Mekong River, however, is navigable and

(d) Inadequate physical infrastructure. Roads and road networks linking the provinces are essentially undeveloped. There is no railway system; land and river transport facilities as well as telecommunications are poor and inadequate;

B. Policies and strategies

The National Assembly, elected by the people, is a legislative body which endorses government policies, passes decrees, laws and regulations as well as approves government nominations. As a socialist country and having a sole political party, Lao PDR formulates development policies once every five years and hence, the five-year plans correspond to the Lao People's Party Congress. The overall policies

are normally issued by the Politburo with contributions from the central committee. The draft policies are then distributed to the ministries, provinces and other political and social organizations for study and comments before passing through parliament and being adopted at a later stage.

The Committee for Planning and Co-operation (CPC) and the Ministry of Finance were recently organized from the Ministry of Economy, Planning and Finance. CPC is responsible for indicative macro-economic planning and policy co-ordination, public investment programming, aid co-ordination and foreign investment promotion.

Third Five-year Plan (1991-1995)

The Third Five-Year Plan (1991-1995) has an overall goal of raising the people's standard of living and providing a foundation for the provision of basic needs. Guided by the NEM principles, the plan's thrusts are market orientation and pricing, including trade liberalization and export promotion, flexible exchange rate, restructuring the finance and banking system and granting autonomy to the SOEs.

A second planning instrument is the medium-term policy framework and public investment programme (PIP), issued later than the Third Five-year Plan. It provides for development of a regulatory framework for managing the emergent market economy and reorientating of public expenditure in order to strengthen public institutions and to provide the necessary infrastructure to the economy. Therefore, resources will be allocated to support institutional building, infrastructure construction and provision of health and education services. The strategy for realizing the plan objectives is the streamlining of the financial system at all levels, from the centre to the provinces and the districts.

Industry policies

The Ministry of Industry and Handicrafts (MIH) is responsible for the development of the small-scale enterprises for the industry and the Ministry of Commerce for that of trade. The objectives of the industrial policies are improvement of quality of products, increase in production for export and growth of income and rise in standard of living for entrepreneurs in the small-and medium-scale industry sector. There is a need to elaborate the in-depth overall strategy with sub-sectoral strategies like those for the agro-related metalworking industry.

The strategies are as follows:

(a) Strategy 1.

- (i) Ameliorate regulations and laws regarding the sector;
- (ii) Resolve the ownership issue according to the need of the small-and medium enterprise sector as landholders need to register the land they used as property in order to be able to provide collateral;

- (iii) Provide a better marketing service;
- (iv) Provide guidelines for an insurance policy;
- (v) Provide services in terms of credit availability for the sector;
- (vi) Negotiate with the government on tariffs, customs and taxes;
- (vii) Try to get finance for the small- and medium enterprise sector;
- (viii) Facilitate services;
- (ix) Develop a factory law and
- (x) Set up regulations (prices) for the use of electricity and other resources.

(b) Strategy 2.

This strategy aims at regulating the division of responsibilities between the MIH and the provincial authorities. At issue is the definition of responsibilities between these two parties.

(c) Strategy 3.

This strategy refers to privatisation of SOEs.

(d) Strategy 4.

This strategy stresses the importance of finding foreign assistance for both financial and technical assistance. It is also mentioned that the MIH is looking for advice on how to draw up policies and regulations for the small- and medium enterprise sector.

(e) Strategy 5.

This strategy refers to institution-building and human resource development within the ministry which wants its staff to be trained.

There is still confusion as to which policies are to be implemented by the MIH itself, that is, whether MIH should only facilitate the functioning of the private business by supervising the implementation of rules and regulations or should it get involved directly in implementation, such as putting up marketing facilities.

Agriculture policies

The agriculture sector remains as the focus of development. Irrigation facilities will be developed primarily for rice production and the extent depends upon

the available funds. Budget for operations can have a deficit of 30 % to 50 %. The Department of Irrigation (DI) is responsible for the development of water resources and the priority is the plain areas and along the Mekong River as the farmers are more receptive to new and modern technologies in rice production and therefore, will have more impact than those in other areas.

As strategy, considering the shortage of development funds, the small-scale irrigation scheme will be promoted. Here, farmers can develop their own irrigation systems covering up to 100 hectares with little or no government intervention except for technical advice where needed. In the medium-scale system which irrigates up to 1000 hectares, farmers' participation through their supply of labour and locally available construction materials, such as sand and soil, is encouraged.

I. GENERAL STATUS OF THE AGRO-RELATED METALWORKING INDUSTRY SECTOR

A. Public sector industries

The following are brief profiles of SOEs which either produce or have activities related to agricultural machinery.

The Agricultural Tools Making Factory and Oxygen-Acetylene or MMF

This factory, located at Km 8, Thadeua Road, Vientiane, is operated under MIH. It has reduced its production of agricultural tools and implements due to competition from the imported products from Thailand and Vietnam. It has totally stopped the production of hand tools since 1991.

MMF has four main buildings consisting of the following:

(a) Administration and machine shop building with a total covered floor area of 3,600 sq m and containing equipment mostly from Russia, China and Japan. The machine shop supplies machinery components for assembly and fabricated spare and special parts for machines brought for repair or rebuilding, like the second-hand centrifugal pumps from Thailand. A section of the building is allocated for assembly of agricultural machines, like the pedal rice thresher and the engine-powered thresher of which 920 and 51 units, respectively, have been produced since 1990. The other half of the building is for administrative use and for engineering design. One room, with a floor area of 25 m x 24 m is vacant.

(b) Foundry shop with a total covered floor area of about 2,000 sq m and which has a cupola furnace with capacity of two tonnes per hour. The foundry shop is able to cast centrifugal pumps with 30-cm diameter impeller, among its various cast products;

(c) Multi-purpose building with a total covered floor area of 2,200 which houses two active nail making and one barbed-wire making machines, a calcium carbide making equipment, vertical lathes and an inactive foundry section with a 500 kg capacity electric arc furnace capable of casting ferrous silicon and ferrous manganese. The foundry has been designed to be fully mechanized and contained moulding machines, sand processing machines, sandblasting equipment, overhead tracks for moving materials as well as, heat treatment facility and an analytic laboratory. However, it has been idle since 1991. The electric arc furnace which has been imported from India through an assistance project in 1987 needs spare parts to be operational.

(d) Two stock room buildings, one with floor area of 700 sq m and the other, 70 sq m.

In 1993, MMF fabricated 250 pedal rice threshers based on a design from Japan and 10 units of the power thresher based on the Thai design. Its production of tools and implements has dropped in quantity since 1989 due to competition from imported ones. Each power thresher is produced on order basis from private individuals and costs KN 1.8 million (about US\$ 2,500) each. The imported Thai thresher costs about KN 2.22 million (about US\$ 3,080).

There are 12 engineers, 41 technicians and 48 workers. Among the engineers, 6 have had training abroad of whom 3 were in the former East Germany and one each in Hungary, Russia and Vietnam. Three engineers have specialization in agro-mechanical engineering. They have limited experiences in adaptive design and fabrication, particularly those for the power thresher, pedal rice thresher, grain flour mill and maize sheller.

Should MMF provide institutional support to AMIs and to the emerging agricultural mechanization technology system, its engineers and staff will have to be re-oriented towards activities in training as well as in design, development, testing and extension of agricultural machinery. MMF's production is down to one-third its capacity and the engineers and technicians can be utilized for institutional support for promotion and development of AMI enterprises as well as agricultural mechanization.

Figures 1 to 3 illustrate some of the agro-related metalworking activities at MMF.

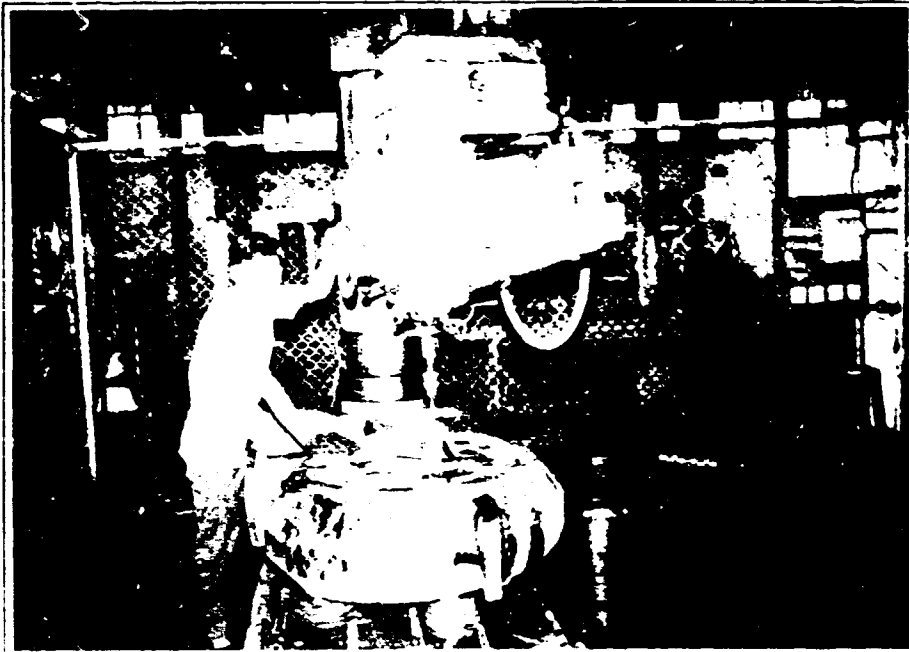


Figure 1. Some equipment and activities at the MMF workshop. Top: A used water pump being rebuilt at the MMF workshop. Bottom: Idle electric arc furnace for the foundry due to lack of spare parts.



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Figure 2. Some equipment and activities at the MMF workshop - preparation for casting of a centrifugal pump body and impeller. Clockwise from top left: Workers finishing the mould; semi-prepared moulds; and wooden pattern of the pump body.

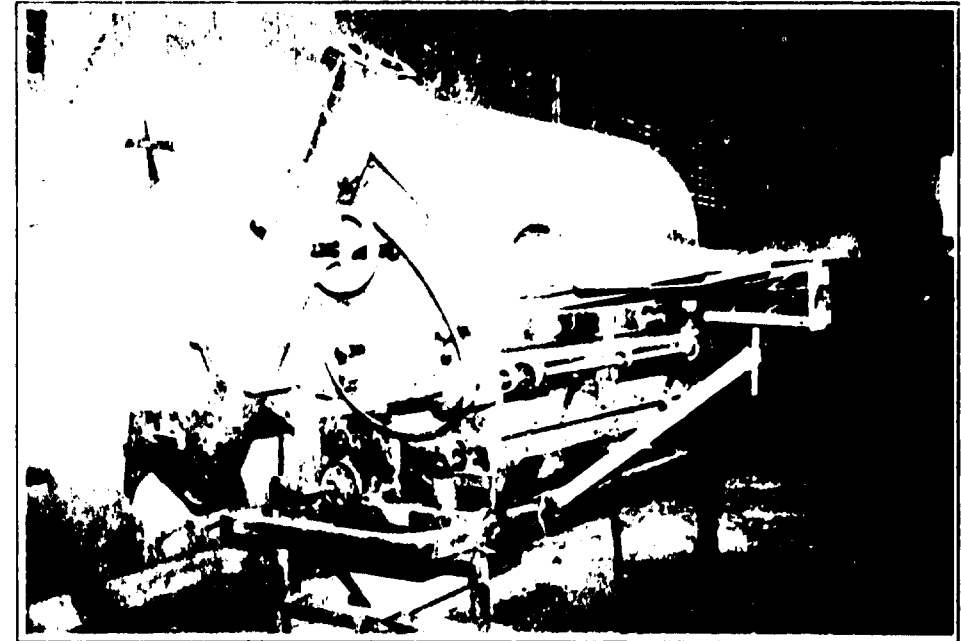
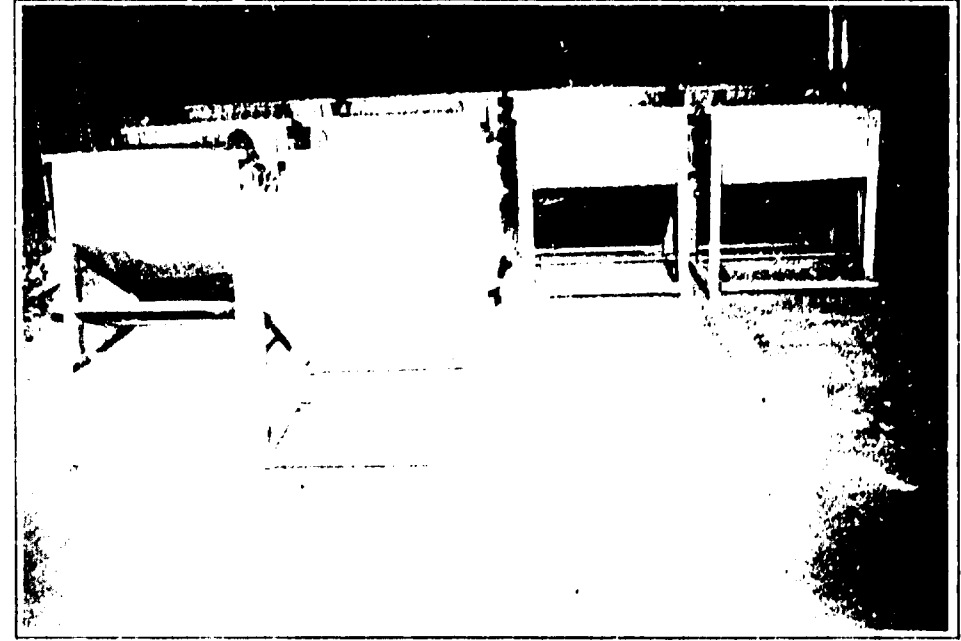
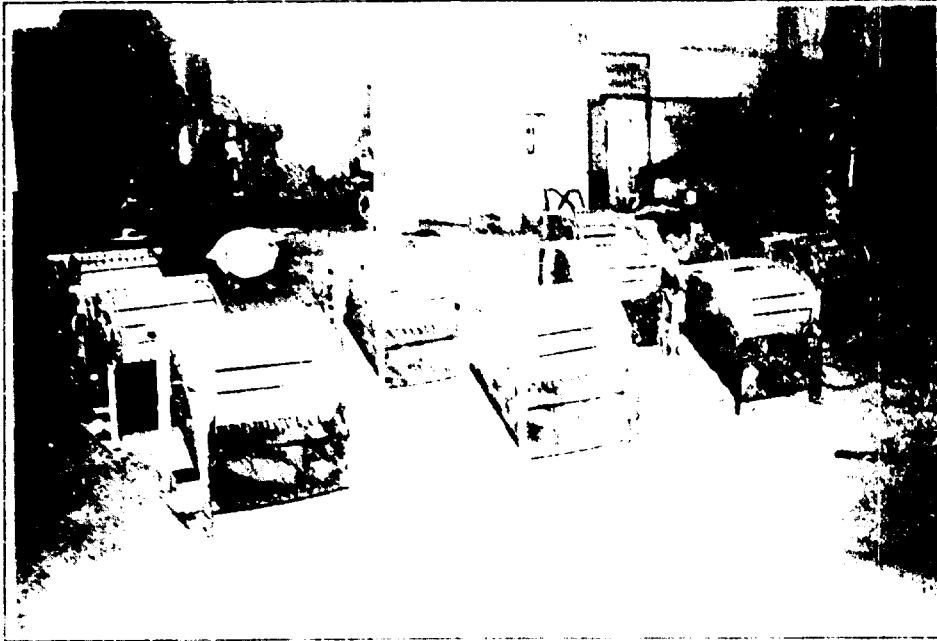


Figure 3. Threshers being produced at MMF. Clockwise from top left: Newly assembled pedal threshers adapted from a Japanese model; painted pedal rice threshers ready for delivery; and engine-powered rice thresher adapted from a Thai model.

Agricultural Machine Company

This factory, located at Km 5, Thadeua Road, Vientiane and which is under the Municipality of Vientiane has been idle since 1991. It has taken the new form as a trading company which imports power tillers for sale to farmers. The name has become Agricultural Machinery Company Import-Export (AMCIE). It is housed in a commercial location in the city together with a private company trading in light cargo trucks and spare parts.

AMCIE has already fabricated three units of rice mills copied from the design in Thailand. Two of the units have a capacity of 3 tonnes rice per day each while one has a capacity of one tonne rice per day. The large model costs KN 3 million and the small model costs KN 1.2 million. The imported models cost KN 4 million and KN 1.6 million, respectively. The two types of machines are shown in Figure 4.

The closed factory building still contains obsolete manufacturing equipment which originated from the former USSR and were installed in 1975. Although some equipment are still serviceable, repair or rehabilitation of most of them appears to be uneconomical as spare parts would be difficult and expensive to procure.

The factory building is divided into five sections, each having a floor area of about 15 metres x 40 metres. It has been reasonably well-designed as a factory with consideration of good ventilation and natural lighting. The building which is shown in Figure 5 looks neglected after about four years of being idle. However, it is intact and only needs cleaning and face-lifting to make it look like a new factory.

Some second-hand equipment have been brought from outside sources for a planned start of operations in early 1994 when the manager expects the Municipality of Vientiane to lease the factory to him for KN 6 million (about US\$8,300) per year. For this, he has applied for a loan from the Bank of Vientiane in the amount of KN 50 million (about US\$69,450) at 20 per cent interest per year.

He has already installed some second-hand equipment for the manufacture of nails, barbed wires and mosquito coils in two of the five sections of the factory and plans to use the other three sections for the production of power tiller sets and rice mills. AMCIE is engaged in the assembly of power tiller sets, each set consisting of one each power tiller, disc plough, mouldboard plough, comb-tooth harrow, pair of paddle wheels and axial-flow pump (127 mm diameter x 5- or 6-metre length pipe with propeller shaft and blade) which are imported from Thailand. Each set costs KN 1.5 million. AMCIE has a temporary assembly space of about 7 m x 20 m behind its display area. It sold about 100 sets in 1992 and about 130 sets in 1993.

AMCIE plans to locally manufacture the power tiller and its complement equipment except for the transmission gear box and the engine which will continue to be imported from Thailand. The manager estimated that the whole set could be sold at only KN 1 million because of the comparative advantage of Lao PDR in lower labour costs and cheaper electricity rates over Thailand.



Figure 4. Two types of agricultural machinery being imported by AMCIE on display at Photan Road, Vientiane. Top: Power tillers and rice mills; Bottom: Rice mills of capacity 3 tonnes rice per day (two units at foreground) and one tonne rice per day (one unit at background).



Figure 5. The idle factory building of the defunct Agricultural Machine Company (AMC) of the Municipality of Vientiane. The factory is under privatisation process. Shown is the Manager of AMC which has gone into importing power tillers from Thailand under the name AMC Import-Export. He is leasing the factory himself to manufacture power tillers and rice mills along with barbed wires and nails.

B. Private sector industries

KSTG Co. Ltd.

This company, located at Photan Road, Vientiane, is owned by the manager of AMCIE and managed by his wife. It deals with the distribution of light trucks and supply of steel materials for construction or shop requirements. It also sells spare parts and machine elements some of which will be locally manufactured once the idle AMC factory being leased from the Municipality of Vientiane gets operational.

KSTG has a unit of the Thai thresher mounted on a locally built trailer truck powered by a second-hand automotive diesel engine (Figure 6). The power from the engine can be transferred to the thresher by switching the power-take-off splined shaft. The thresher is being used for custom threshing services.

KSTG plans to start manufacturing operations in early 1994 or as soon as operational funds of about US\$100,000 become available. Aside from financing the start-up operations, KSTG would need at least one engineer for production. Since there is scarcity of the right kind of human resources, short-term training of the engineering staff would be a priority. In this case, the engineer should have training also in production management. KSTG would also need about 20 technicians in addition to the present 10 shop technicians already employed under AMCIE.

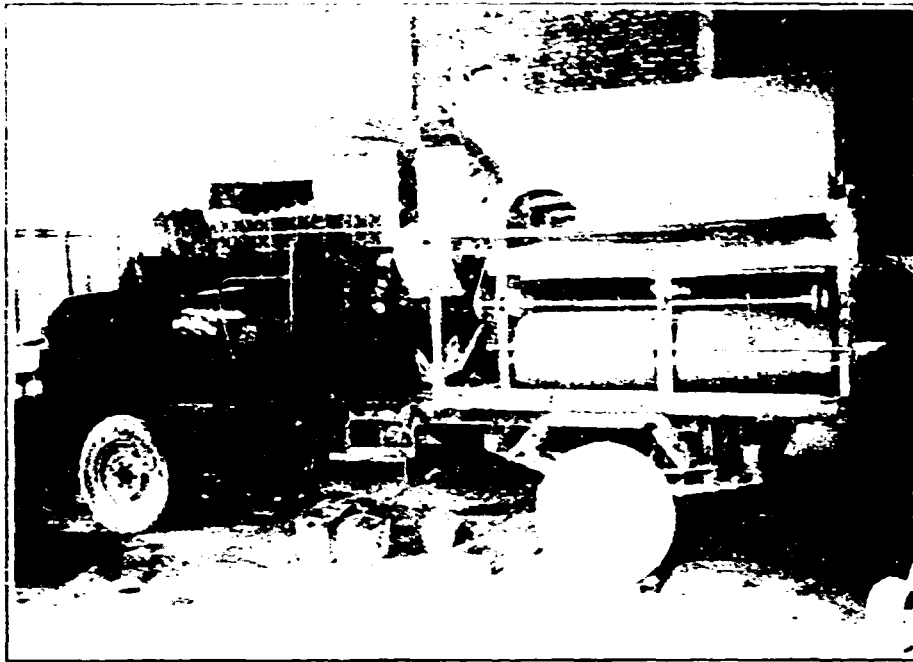


Figure 6. Thai-built rice thresher mounted on a Lao-built trailer truck for use in custom threshing services by KSTG Co. Ltd.

Rice mill manufacturer, Viengchalon village, Vientiane

This small-scale workshop is located at the ground floor of the yet incomplete building. The owner is an entrepreneur who had a rice mill and obtained a five-year milling contract with the military. He used the savings from the rice mill business to start a workshop in 1988. He also used to work in the fabrication of rice mills in Thailand for nine years. With this experience, he trained his 16 permanent workers and two casual workers in fabricating rice mills. The initial units were copies of the Thai design but later on the design was modified to suit workshop capabilities to reduce costs and to improve performance.

The following are the sales figures of the rice mill workshop:

Year	Number of Units Fabricated and Sold
1988	16
1989	23
1990	26
1991	30
1992	40
1993	82
Total	217

Since the owner lacks capital, all rice mill units had been fabricated on order basis. He does fabrication work with the client advancing 50 % of the total cost. If he had enough capital he could purchase raw materials in bulk and perhaps not lose opportunities of buyers who could not wait for the machines and had to order them from Thailand.

The shop has 5 welders, 2 hacksaws, 1 bench drill, 6 portable drills, 1 wood plane and 1 set of equipment for spray painting. The prices of machines are as follows:

(a) Large-size model with capacity of 600 to 750 kg rice per hour and powered by a 30 hp electric motor - US\$ 1,000;

(B) Medium-size model with capacity of 400 to 550 kg rice per hour - US\$ 700 and

Small-size model with capacity of 300 to 375 kg rice per hour - US\$ 600.

The rice mills are mostly sold in Vientiane Municipality, Vientiane Province and Champassak Province, taking up three-fourths of the total sales and in Xiangabhourri and Pakse provinces, taking up the remaining one-fourth of the total sales.

Imported ready-made components are the pulleys, belts, bearings and pillow blocks which are available locally. The raw materials are also available from local traders.

In his programme for expansion, the owner wants to make power tillers but would need technical assistance. Although he recognizes the need for training, time away for training by the workers would be opportunities lost in production. He estimates about KN 50 million as needed capital to complete the workshop and diversify his production. He indicated interest in receiving designs and technical information regarding new machines.

Pam Inter Group Co., Ltd.

This is a Thai-owned machinery dealer, located at, 86 Ban Papo, Thadeua Road, Vientiane. It is selling power tillers, rice threshers, rice mills, diesel engines and centrifugal water pumps. Every unit is imported from Thailand except for the diesel engine which is imported from China. The Siam Kubota in Thailand makes the power tiller with the Thai-made Kubota engine. Figure 7 shows part of the company's display area in downtown Vientiane.

Each power tiller with 8-hp engine is sold at Baht 60,000 while the thresher costs Baht 70,000 (1US\$ = Baht 25.30). Apart from AMCIE and Pam Intergroup Co. Ltd., there is no other power tiller dealer in Vientiane. Some general stores however, sell other brands of Thai-made power tiller as one of their product offerings.



Figure 7. Display of two power tillers, a rice thresher and a rice mill at the frontage of the Pam Inter Group Co. Ltd., an importer of such machines from Thailand. Other products on sale and not shown are pumps and diesel engines imported from China.

The trading company started in February 1993 and since then, has sold 600 power tiller sets, 20 rice threshers and 5 rice mills.

It has plans to manufacture power tillers in 1994 at a location about 5 km from Vientiane. The factory will be medium size and establishment will be partly supported by Japanese investors from Siam Kubota.

Novatech International Ltd.

This metalworkshop is engaged in fabrication and adaptation of equipment for road building and maintenance. However, the director general has indicated plans to have activities in AMI. He has ample experience in related work in Africa, particularly the development of the hand-operated oil expeller and the hydro-turbine.

Blacksmiths

There are 14 blacksmithing enterprises in the small Phonemi Village, Phone Houng District, Province of Vientiane which is about 70 km north of Vientiane. Apparently, the village has gained good reputation for the accepted quality of the hand tools, such as sickles, knives, diggers, axes, weeders and rakes being produced in the village. The demand for the products is so large that the blacksmiths cannot fill it.

One blacksmith pointed out that electricity was needed as the double-piston type blower for the forge needs an assistant to operate it. An electric blower would speed up the heating of the work and increase productivity. Grinding and finishing a piece of work by hand using a shaver, then a hand file and finally a whetstone, take so much of his time that only 5 pieces of knife, for example could be made per day. The total production of the village is about 5,000 pieces of each hand tool per year.

Raw materials are obtained in the municipality of Vientiane which is about 80 kilometres away. A blacksmith can only buy 20 kg of vehicle leaf springs at a time which he does 3 times a month. Leaf springs cost KN 300/kg.

The blacksmithing equipment is crude and productivity is low. The anvil is a section of a rail, about 15 cm long and anchored on a piece of wood buried in the ground. The blacksmith works in a sitting position which limits the amount of force exerted in hammering the workpiece.

Figure 8 shows the blacksmith and his assistant at work, the equipment and blacksmithing tools used and some of the products.

Custom threshing and rice milling services

Rice threshing and milling are two operations which have become popular among custom work operators. In Tha-Ngon, a custom service operator has a mobile rice thresher and a stationary rice mill both of which had been imported from Thailand. Figure 9 shows the two money-making equipment for custom operators yet offer affordable services to farmers.



Figure 8. One of 14 blacksmiths at Phonemi Village, Province of Vientiane. Clockwise from top left: Blacksmith at work with assistant operating the dual-piston type blower for the forge (background) and with finished tools displayed (foreground); blacksmith using a metal shaver on a knife for finishing it; and blacksmith's shed.

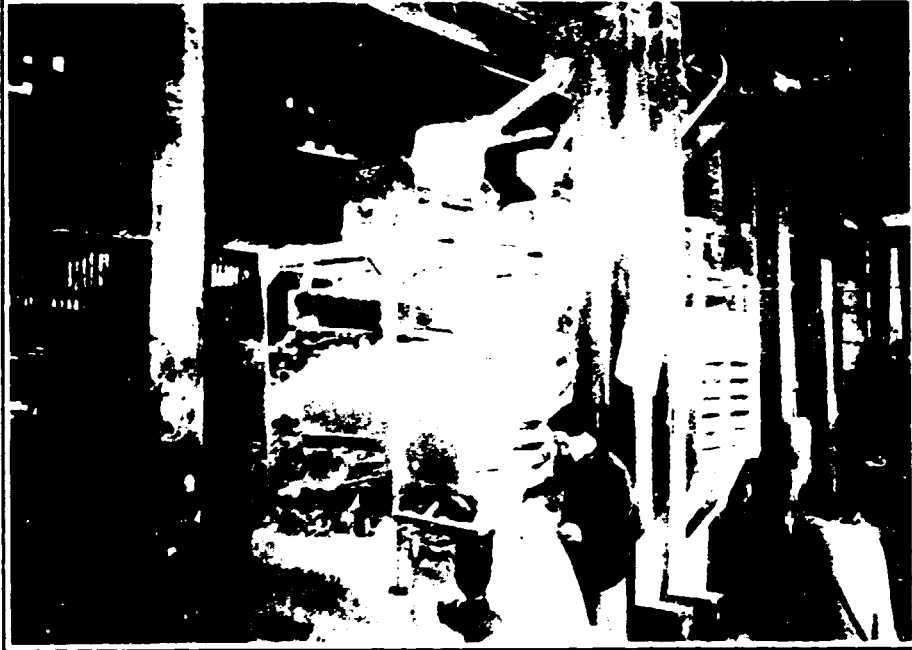


Figure 9. Popular machines used for custom operation. Top: Mobile rice thresher mounted on a truck. Bottom: Rice mill.

C. Institutional support

There is virtually no existing institutional support services, such as credit, technical and market advice for the small- and micro-scale entrepreneurs to obtain credit. Enterprises are required to be registered if the fixed capital is US\$ 1,400 or more. There are still stiff restrictions on the movement of people and goods between provinces. The needs of small- and medium-scale enterprises are access to market and technical information as well as a clear regulatory framework from the Government.

Steps however, are being taken to correct the above deficiencies during the current transition period from a centrally planned to a market-oriented economy. A Farmers Promotion Bank has been established and restrictions on inter-provincial travel appears to be getting relaxed.

There is no incentive for the bank to lend to industry because the interest rate is low at 15 % and even lower to the agricultural sector while the inflation rate is officially at 7 % officially. About 57 % of the loans are extended to the trade and services sector where the interest rate is 20 %. Application for loan is both tedious and cumbersome. There are four Thai banks and one Thai-Lao bank in Vientiane, but there is still no Lao private bank.

The small- and micro-scale entrepreneurs have to rely on the informal money lending system where interest rates are between 10 and 20% per month. It is possible to get access to credit for up to US\$7,000 without formalities. Micro-entrepreneurs are reluctant to go to the bank because they are sure not to be given credit at all. They would be wasting time and opportunities for earning if they do all the required paperwork without an assurance of obtaining credit. They prefer to go to informal money lenders.

There is need for training by small-scale entrepreneurs mainly to compete with Thai products. The training needs are those related to business and those for upgrading the skills of workers. The medium- and large-scale industries need assistance in increasing capabilities financial management, including accounting, costing and general management.

There is need to improve the quality of the existing training institutions. Training in administrative and management skills provided by institutions is perceived as not meeting the needs of the employers. There is lack of short-term training for entrepreneurs or skill upgrading for workers regarding new technologies. Thus, most businesses send their staff for training in Thailand.

Small Business Development Programme (SBDP)

There had been no effort of comparative seriousness for promoting and developing the micro- and small-scale enterprises as for encouraging foreign investments. However, with the advocacy of UNDP and UNIDO, some attention had lately been focused on that apparently neglected sector of the industry which

constituted over 90 per cent of all Lao enterprises, employed a large part of the labour force and was the mainstay of the urban population.

A programme formulation framework had been devised by UNDP for the SBDP. Four programme components had already been formulated by, so far, three collaborating organizations, namely, UNIDO (for component I - policy, promotion and coordination as well as for component II - technical training in priority sub-sectors, including metalworking), GTZ (for component III - business management training and entrepreneurship development/multipurpose institution) and The Asia Foundation (for component IV - product development, market development and data collection for cottage industries and handicrafts). GOL had, in principle, accepted the proposed programme and the components.

The Department of Agriculture and Extension (DAE), Ministry of Agriculture and Forests (MAF)

Agricultural extension for agricultural machinery is virtually non-existent. DAE has no mechanization plan, although before 1988 it had an agricultural mechanization office which handled the custom land preparation using Russian-made four-wheel tractors. However, DAE recognizes that modern agricultural machinery must be introduced to farmers but there is no mechanism in the department or Ministry of Agriculture and Forestry for undertaking such an activity. A section at DAE might be established to link and collaborate with MIH regarding the supply, promotion, training and extension of agricultural machinery, particularly power tillers and irrigation engine-pump sets.

No machinery whatsoever, has been introduced by DAE in the northern provinces, although some agricultural tools and implements had been distributed by MMF.

The Department of Irrigation (DI)

This department under the MAF used to be responsible also for micro hydropower development. In late-1993, that responsibility was transferred to the Department of Energy under MIH. The main function of DI is to develop the irrigation system which is only some 3 per cent of the total cultivable area. Lack of funds hinder such development, although an irrigation project is being constructed with assistance from Japan. A water-pumping station has been completed to pump water from the Nam Ngum River in Tha Ngon, Vientiane and another construction is being bided to pump water from Nam Phoun River. Short-term development is to be concentrated in the plain areas and those near the Mekong River, the rationale being that people in those areas tend to adopt modern farming technologies faster than those remote from the populated areas and therefore, greater impact will be achieved.

The development of small-scale irrigation systems (under 100 hectares) is mostly left to the private sector as government funds for these will be minimal. The small-scale irrigation system is mostly of the pump irrigation type with some farmers investing in axial-flow pumps which come as part of the power tiller set imported

from Thailand. However, they are used only for pumping from surface water sources.

The installation of shallow tubewells is being encouraged. Some well-to-do individuals have tubewells and pumps but use them only for domestic water supply. DI has a plan to encourage the use of shallow tubewells for pump irrigation. Some areas in Vientiane however, have high calcium and potassium salt concentrations. Groundwater might not be useful or its massive extraction by pumping might cause local environmental damage. Precautions through studies of ground water quality being undertaken by the Mekong River Committee are to be taken by DI which should be consulted regarding any wide-scale projects for the development of shallow tubewell pump irrigation systems.

The Department of Industry and Handicrafts

This department has a division of industrial development. However, the function is not that of giving industrial extension services. A new industrial entrepreneur, must on his own, seek for information on technology, designs, quality control and other requirements for production.

Lack of awareness of the importance of maintenance and repair of production equipment at the factory is a common problem. There is a need to develop this awareness at both the management and the worker's levels. As engine-powered agricultural machinery become increasingly used by farmers and custom hire operators, there will be an increasing need for training in operation, repair and maintenance of power tillers, small engines and pumps. Some four-wheel tractors are still in service but many tractors have been junked or cannibalized to sustain the spare part requirements of the other units.

The Ministry of Trade

The Ministry of Trade has the policy of developing the agriculture and forestry sectors to meet the growing domestic demand. It aims for export by improving efficiency and productivity. In 1993, GOL pushed the trade policy through greater production to promote exports taking advantage of the natural potentials, like hydropower, mines and agricultural products. Appropriate marketing strategies for China, Thailand and Vietnam, including improvement of quality of products will be enhanced.

The trade policy also provides for encouraging increased domestic trade especially in the mountainous areas. Services will be extended to link with farmers and their production information. Trade agreements with neighbouring countries will be implemented. The transit regulations across neighbouring countries for export and import of products will be studied. The transit experiences in Savannakhet Province with Vietnam may also be adapted in other provinces regarding other neighbouring countries.

LAO-IRRI Project

This research and extension project on rice is being undertaken in collaboration with the International Rice Research Institute (IRRI). It has no agricultural machinery research programme. The three staff members who are assigned in the agricultural engineering section in the National Agricultural Crop Research Centre are responsible for maintaining equipment for research and seed multiplication. They are not committed to any form of engineering research in national cropping programmes.

Aware of the fact that rice farmers are practicing subsistence level farming with low input and low output, the project management does not plan any research and development of agricultural machinery. Even the machines developed by IRRI in the Philippines are viewed as not appropriate for the farming conditions in Laos. For example, the hydrotiller which has gained popularity in the soft soil areas in the Philippines was assessed after limited field trials, as having little potential in the Lao environment on account of its cost. Moreover, its use would be limited only to areas which have irrigation systems. An example of the much needed machine is a hand-pushed weeder for inter-row cultivation in upland rice (Figure 10). The Lao-IRRI has proposed that a wheeled weeder developed by a farmer in Thailand be tested under Lao PDR conditions.

Unless the tool or implement is very low cost, affordable and badly needed, there is no possibility that a subsistence farmer can own a modern agricultural machine. However, this does not mean that such farmer cannot avail himself of such technologies. An appropriate system, like custom hiring of machinery, may be encouraged among entrepreneurs in the provinces.

Since the area normally farmed by a Lao farmer is about 2.5 hectares on the average, his production capability is limited by the amount of farm power that he has. One or even two animals are not sufficient to undertake intensive farming to increase production and productivity. His access to mechanical power sources could improve his family income.

Agricultural mechanization, at a very limited degree, has so far been confined in the irrigated areas which constitute only 3 per cent of the total cultivated rice area. Vientiane municipality and Vientiane province have 50 per cent of the total irrigated area. For rice production, land preparation using power tillers and four-wheel tractors and threshing using the Thai model thresher have become popular. Rice milling is mechanized in irrigated areas and in rainfed areas along the Mekong River. However, in most areas of upland production and areas of rainfed lowland production in the mountainous areas, the milling of rice is still being done manually.

IRRI's current and future mandate aims to increase the research emphasis in the more marginal environments, in particular the rainfed lowland production environment. One of the critical needs for research in Laos is on mice and rodent control but IRRI is reluctant to do any research in this area. The rice-husk stove adapted by IRRI from a Vietnamese design is assessed to have potential in Laos.



Figure 10. A hand-pushed dryland weeder developed by a farmer in Thailand near the Thailand-Lao border. This device was observed by the Lao-IRRI Project as an effective weeder and may be adopted by Lao farmers if tested under Lao conditions and fabricated by local metal workshops. (Photos courtesy of Lao-IRRI Project).

Training has been identified as the role that Agricultural Engineering Division at IRRI can play in the development of the national rice research programme in Laos. The equipment developed in Thailand is viewed as applicable to the environment existing in Laos.

The Nabong Agriculture College (NAC)

This college, located at Ban Paksap May, Xaythani District, Vientiane, is under the administration of MAF. It started in 1969 as the Ecole Royale Agro-Silvo Pastorale located at Dongdok, Vientiane. After 1975, it was moved to its present site at Nabong Plain first as the Nabong Agriculture School. It was then upgraded to a college in November 1992.

The college has 114 hectares of which 17 hectares are designated for buildings and premises while the rest are for field practice. There are 77 staff members of whom 51 are teachers. Two have PhD, 11 have MSc and 12 have BSc degrees while 26 have Certificate levels. They all have obtained their education from the socialist countries.

NAC has about 275 students and graduates about 100 mid-level agriculture technicians annually. The total number of graduates is 1,343 of whom 234 are women and their specialized training fields included agronomy, animal husbandry and veterinary, farm machinery and forestry and irrigation. At present only agronomy and animal husbandry course specializations in both the mid-level certificate and the high-level diploma are being offered. Interest in farm machinery has gone down with the end of tractor supply assistance from the former USSR while the forestry and irrigation course specializations have been transferred to another location in Tha Ngon, some 15 km from Nabong. Figure 11 shows the farm machinery shed and workshop which are still used for rendering mechanization services to some 95 hectares of field production practice land of the college as well as for mechanization subjects in the agronomy curriculum.

NAC is currently being assisted by UNDP for the upgrading of facilities. The French Comite de Cooperation Avec Laos is assisting in establishing a chemistry and a soils laboratory. The Australian Overseas Service Bureau conducts an English course. Two of the staff are pursuing MSc degrees in soil science and agricultural engineering at the University of the Philippines at Los Banos under the SEARCA programme.

NAC has still a long way to go in terms of development towards one which would offer high-quality education in agriculture and related fields, such as agricultural engineering. Library and laboratory facilities have to be built up. About 75 per cent of the faculty have only BSc and Certificate levels. There is a need to upgrade the technical knowledge of the teaching staff through a massive human resources development programme possibly in cooperation with some of the more developed universities in Asia which offer excellent and high level education in agriculture and related fields.



Figure 11. The Nabong Agricultural College tractor and machinery sheds and workshop.

The Lao-German Technical School

This school, located at Km. 3, Thadeua Road, Vientiane, was established in 1964. Since then, both the quality and the facilities had deteriorated. The educational level of instructors is not high and their assistants are usually workers. The level of the courses is not advanced and appear too academic with little emphasis on practical work. The school has enough shop facilities, but is not used much and equipment is poorly maintained. Very few graduates go to industry. They prefer to pursue studies abroad, to join the school as instructors and to enter government service in the ministries which at present is very limited in view of the retrenchment programme in government service.

A two-year rehabilitation period with a DM 3 million assistance from the German GTZ was started. The machine shop has already been restored through repair of the machine tools, but the other three shops still need rehabilitation. The buildings are getting new coats of paint. Figure 12 shows the status of rehabilitation of the school and some instruction activities being undertaken related to metalworking industries.

The curriculum is being revised under technical assistance from GTZ. The school has a staff of 49 in teaching and 15 in administrative services. There is a general increase in the morale of the staff who look forward to getting their knowledge upgraded under the new technical assistance programme. About four German advisers will be fielded to assist in the rehabilitation programme.

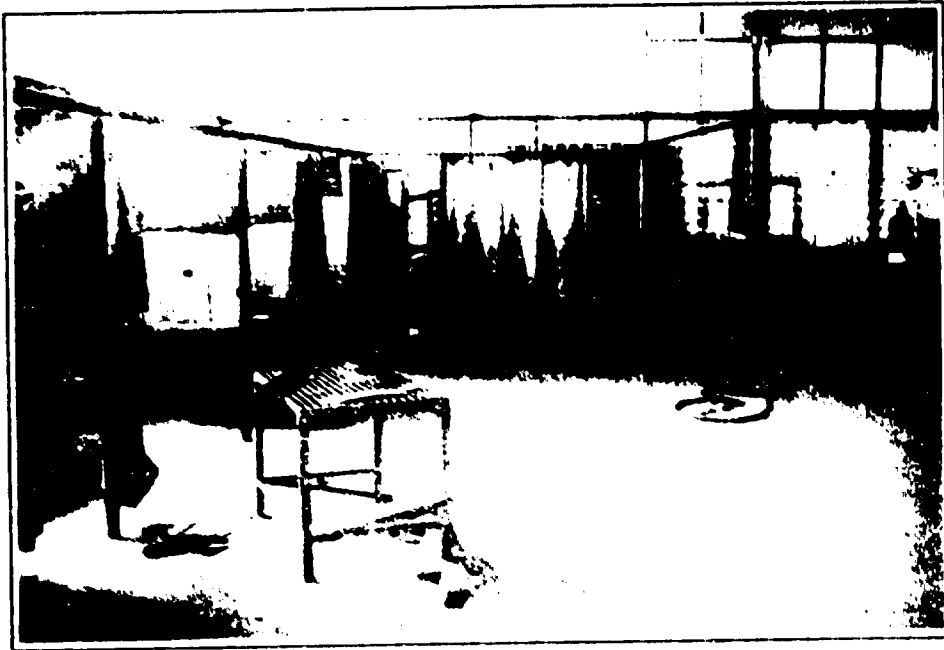


Figure 12. The Lao-German Technical School facilities are being upgraded. Clockwise from top left: Welding section, still to be improved; Rehabilitated machine shop; and Students working on a blacksmithing project.

The subjects offered in the three-year course are general mechanics, welding and plumbing, automotive mechanics and electricity. Each is a three-year course with the curriculum containing 40 % practical work, 35 % technology and 25 % general knowledge of mathematics, physics, German and English languages and other subjects.

Schooling is free. Candidates for admission must finish the primary (5 years), lower secondary (3 years) and upper secondary (3 years) levels and pass an entrance examination. Scholarships are given by the Ministry of Education and all the provinces have representative students to distribute the technical talents throughout the country. The 1993 schoolyear student population is 369. Between 80 and 100 students graduate per year.

The Pakpassak Technical School

This school is the oldest of its kind in Lao PDR. It was built in 1936 during the French colonial period. It started as a training place for workers sent by factories for one- to two-month training in general mechanics, electricity and building construction. It was only in the 1960s that the school started to offer technical courses in a more formal way similar to the one at present. Since 1975, it has been offering courses in motorcycle mechanics, automotive mechanics, general mechanics (lathe operator-fitter), general electricity, welding and blacksmithing, carpentry, masonry, plumbing, radio and TV set repairing, accounting and cooking and sewing (home economics). There are about 1,000 students of which about 400 are new entrants per year.

There are two levels of education. One level is for the diploma of qualified workers for those entering the school after the eighth grade and finish after two years. The other is for the diploma for technicians for those who enter the school after the eleventh grade and finish after three years. The technician courses are in construction, woodworking/carpentry and accounting. One-half of the students taking the technician level courses are in accounting. Metalworking courses are the least popular with only 25 students graduating per year.

There are 110 teachers and their qualifications are low, being at the technician level themselves and not having bachelor's degrees. Some of them have undergone training in socialist countries, like the former Czechoslovakia, Hungary and Russia. The workshops in general mechanics are mostly old while those in the woodworking are relatively new. In general, the courses tend to be more academic than practical. There is a trend towards learning English.

The Science, Technology and Environment Organization (STENO)

This organization which was formed in April 1993 from the Ministry of Science and Technology and combined with the function of MAF is under the Office of the Prime Minister. It is the focal point for coordinating science, technology and environment-related activities in the ministries. It has also the task of formulating policies and strategies on science, technology and environment. For these functions,

it has a working group consisting of representatives from the ministries of agriculture and forests, commerce, industry, public health and education.

Its functional organization consists of the departments of environment, intellectual property and standards, centre for science services, library and the institute of research in science and technology which focuses on the transfer of technology to handicraft industries and to farmers.

STENO takes charge of human resources development in various ministries by allocating the available fellowships for study abroad to the appropriate ministries. It aims at strengthening institutions in environmental technology through fellowship grants from the World Bank, UNDP/FAO (for sustainable agriculture), IDRC and Asia Foundation. It also builds up capabilities in agriculture, forestry and public health.

Among the 40 engineers in the staff three are in the mechanical engineering field. There are 10-15 fellowships grants available per year from the Asia Foundation, IDRC and UNDP.

STENO has laboratory facilities although they are still being developed. It is willing to collaborate with MIH regarding the development of machinery technologies coming from other countries for testing and adaptation to the environment prevailing in Lao PDR.

D. Non-government organizations

Very few international non-government organizations (NGOs) are present in Laos. Activities of those which exist bear no relevance to the promotion of agro-related metalworking industries in the country.

The Lao National Chamber of Commerce and Industry (LNCCI)

LNCCI used to have government members of its board. It is now an autonomous body which can be said as truly representing the private sector industry. It elected a new set of board members in June 1993 and the government is only represented by a non-voting adviser from the Ministry of Trade in contrast to the previous membership in which five members were appointees by the government. It has about 600 members of whom only 70 are small-scale entrepreneurs. The membership fee is US\$30 per year. One of its plans is to form associations among small-scale industry entrepreneurs and among farmers throughout the country.

II. STATUS OF AGRICULTURAL MECHANIZATION

A. Locally made machinery being used by farmers

Farming is essentially at the subsistence level. A family normally has about 2.5 hectares. Single-animal ploughs and harrows are used for land preparation. Buffaloes provide the motive power in such operations. Oxen are used for pulling

carts. A farming family usually has two animals not only for draught purposes but also for income and security in time of need.

Sickles are used for harvesting paddy which is usually cut high above the ground leaving about 20 to 30 cm tall stubbles. Animals feed on the stubbles at least until the end of January when green grass and other animal feed become scarce due to the dry season which usually lasts until the end of April. Thus, animal feed has become a serious and recurring problem which affects the health and performance of animals. Sometimes, due to their poor health caused by scarcity of animal feed, land preparation is delayed to allow the animals to recover their health after the onset of the rains usually in the beginning of May.

Tools and implements have been largely supplied by MMF. These consisted of cast-iron mouldboards and shares, spades, hay forks, sickles and other hand tools.

B. Machinery developed/adapted by workshops

Before the open market policy went into effect, the government was engaged in custom land preparation using four-wheel tractors with complement disc plough-harrows obtained from the former Soviet Union. With the collapse of CMEA, the source of tractors became a problem and the government privatized the custom work operation by selling the tractors to private entrepreneurs.

In Vientiane suburbs where there are still rice farming activities, mechanical power is mostly used for tillage and threshing of paddy. Four-wheel tractors which have been bought by private individuals from the government, are normally used for ploughing and harrowing under hire basis. Some of the tractors are also used for non-agricultural purposes, like earthmoving and hauling. Figure 13 shows the adaptations made on tractors for earthmoving and the use of tractors for operating threshers in custom services.

Around Vientiane, power tillers, particularly those made in Thailand, have increasingly been used since 1978. One distributor sold about 100 units in 1992 and about 130 units in 1993.

There are no available data on population of power tillers and their complement equipment, including mouldboard plough, disc plough, comb-tooth harrow, paddle wheels, trailer and axial-flow pump, which together are sold as a set. Purchasers of these power tiller sets hire their equipment to other farmers.

Pedal threshers, adapted from a Japanese design by MMF have been introduced and are getting popular. About 220 units have been sold by MMF and production is on-going due to demand.

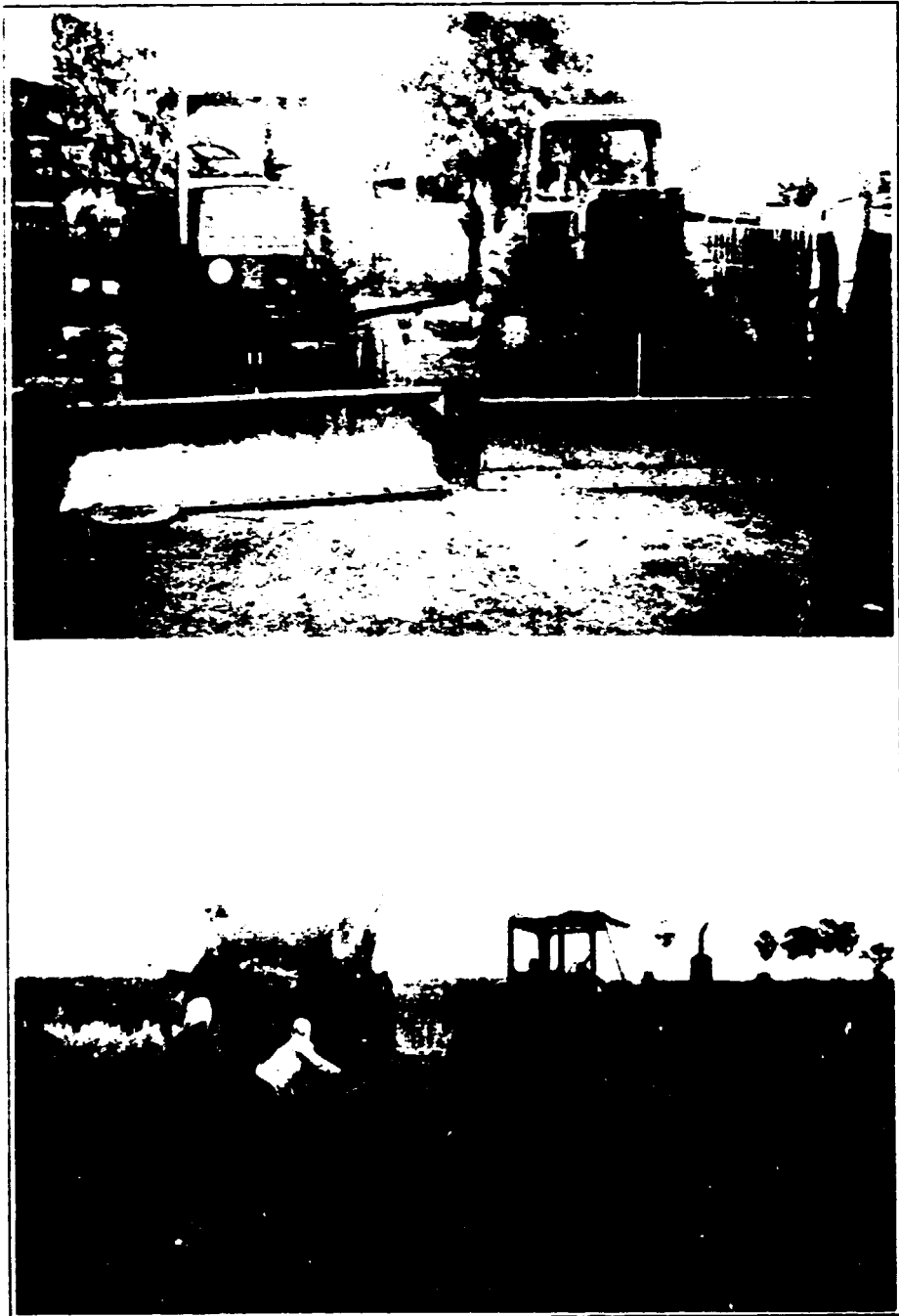


Figure 13. Tractors used for custom work operation. Top: Earth-moving services using a bulldozer adapted on the tractor; Bottom: Threshing of rice using the Thai-built thresher.

Rice mills, imported from Thailand and of one to three tonne rice per day capacities are getting popular among entrepreneurs. One importer intends to locally fabricate the same rice mill model and in fact has already fabricated three units. In spite of using imported components such as pulleys, augers, belts, bearings etc. which could not be fabricated as yet, the selling price was reduced by 25 percent. Another small-scale workshop fabricates rice mills of its own adapted design and sells them at very much reduced prices than the imported ones.

C. Demand for agricultural machinery

There is no information available on the demand for agricultural machinery. However, dealers of imported power tillers, rice threshers and rice mills have been set up in Vientiane, indicating the increasing popularity of these types of machinery. In one district of Vientiane province, about 70 km north of Vientiane, the power tiller has been in popular use since 1991. Practically no farmer uses the buffalo any more for lowland rice cultivation as farmers have access to hiring services by farmers who own them. The estimated number of power tiller sets in Vientiane province is 600. Less than 30 per cent of the land is tilled with use of animal-drawn ploughs and the use of the buffalo is confined mostly in the uplands. Likewise, manual threshing is almost no longer practiced in the province as farmers have access to hiring services by thresher owners.

Farmers in Vientiane province purchase power tiller sets either by cash savings from sales of agricultural products, such as fruits and vegetables or by credit from the state-owned bank. Credit repayment rate however, is only about 50 per cent. The use of power tillers enables farmers to save time and to plant a second or dry season crop of rice as the axial-flow pump is one of the equipment in the power tiller set purchased.

One small-scale workshop has been fabricating rice mills of its own design on orders from private entrepreneurs planning to go into rice milling business. Another one which has fabricated three units of the Thai rice mill model plans to start manufacturing it or perhaps other models with larger local content to reduce the price.

Hand tools such as sickles, hoes, rakes, axes, field knives, hole diggers and long-handled weeders are made by blacksmiths. At least in one village in Vientiane province, there are 14 blacksmith sheds located near one another. The hand tools that they make from spent vehicle leaf springs are so much in demand by traders that they cannot produce enough pieces. The reason for the demand is the cessation of manufacture of such items by MMF since 1988.

DAE lists the following as the important criteria for selecting machinery for introduction to farmers:

(a) Machinery should be small-scale, of simple design, appropriate for small fields and not expensive;

(b) Machinery should be easy to maintain and repair by the farmer himself and

(c) Machinery should be light and easy to move in the field; examples are thresher, power tiller and water pump.

A state-owned enterprise for the construction of an irrigation canal from the Nam Ngum Dam uses a fleet of 7 four-wheel drive tractors for transporting water at the construction sites. The tractors originated from Japan. The tractors were lent by MAF which has obtained the machinery from a village development project assisted by the government of Japan. The project was discontinued after its period due to lack of funds to sustain it.

Imports of agricultural machinery

The import of farm machinery and equipment in 1992 was valued at US\$25 million. Non-agricultural equipment comprised bulldozers, graders, rollers and cement mixers for construction of roads and communication infrastructure. Agricultural equipment comprised power tillers, rice threshers, pumps and diesel engines most of which were used in Vientiane, Savannakhet and Champassak provinces and Vientiane municipality.

Table 1 shows the values and origins of imports of machinery and equipment by Lao PDR in 1992. The data are not classified agricultural machinery from other equipment. Since most of the agricultural machinery importation comes from Thailand and to some extent, Vietnam and China, it may be assumed that about 80% of the total value of such imports amounting to US\$11,203,300 is for agricultural machinery. It may also be assumed, quite conservatively that 20% of the values of imports from Japan which amount to about US\$4.25 million is also for agricultural machinery. The total agricultural machinery imports amount to about US\$9 million, which is a conservative estimate and represents only about 36% of all total machinery and equipment imports from all sources. Other unofficial sources place the value of imports of agricultural machinery as US\$15 million.

The magnitude of imports indicates that there is potential for import substitution through local manufacture of agricultural machinery. There is a demand for machinery. Through promotional efforts, both in industry and in agriculture, the demand could increase in the next few years.

Demonstrations of new agricultural machines along with agricultural projects will cause awareness among farmers. Private sector initiatives in agro-related metalworking industries will be stimulated if they are invited by the project management of such projects to be involved in the demonstrations.

Table 1. Imports of machinery and equipment by Lao PDR in 1992

Origin	Value in US\$	Origin	Value in US\$
Australia	637.811	Korea	143.179
China	439.692	Macao	351.134
Denmark	394.362	Malaysia	39.509
England	43.080	Pakistan	6.579
France	1,120.859	Russia	40.736
Germany	559.205	Singapore	976.175
Holland	8.554	Taiwan	2,029.573
Hongkong	942.775	Thailand	10,522.583
Indonesia	66.914	USA	1,944,449
Italy	5.250	Vietnam	241,025
Japan	4,524,786		
Total		25,038,220	

Source: Ministry of Trade, 1993.

Major agricultural crops

The demand for agricultural machinery may be indicated by the extent of production of crops which can change according to the success of the government in promoting a certain type of crop. Table 2 shows the extent of production of various crops in terms of hectareage and tonnage of production. The crops that showed increased area and production trends are season and irrigated rice, mungbeans, peanut, tobacco, sugarcane and tea during the period 1991 to 1992. However the areas devoted to rice, maize and starchy root production account for about 90% of the total cultivated area for annual crops.

Therefore, the demand for machines will be for rice production and processing, maize shellers and root crop chippers. Peanuts have almost doubled both in area planted and production during the period 1991 to 1992 perhaps displacing some areas for maize and starch roots. Peanut planters or hand jabbers and peanut shellers will be needed as more farmers go into peanut production.

Table 2. Area and production of major crops in Lao PDR.

Crop	1991		1992	
	Area (^{'000} Ha.)	Production (^{'000} Tonnes)	Area (^{'000} Ha.)	Production (^{'000} Tonnes)
Cereals	607.67	1,424.04	639.13	1,665.15
Rice	556.87	1,223.38	592.55	1502.36
Season rice	322.78	842.14	392.9*	1153.43
Irrigated rice	13.32	43.71	15.50	55.30
Raise	234.09	337.53	200.07	293.63
Maize	34.18	68.58	32.13	57.71
Starchy roots	16.62	132.08	14.45	105.08
Vegetable and beans	6.81	51.22	1.66	18.35
Annual industrial crops	35.95	143.83	50.23	169.98
Mungbean	3.22	2.11	7.63	5.46
Soybean	6.10	5.51	6.11	5.38
Peanut	5.55	5.63	14.91	11.16
Tobacco	10.21	45.33	10.47	48.27
Cotton	8.03	4.75	7.82	5.30
Sugarcane	2.84	80.50	3.29	94.41
Long-life industrial	18.33	8.48	18.40	9.86
Coffee	17.93	6.77	17.79	7.41
Tea	0.40	1.71	0.61	2.45
Total area of annual crops	673.67	-	709.36	-

Source: Ministry of Agriculture and Forests

Animal draft power resources

Since 1985, there has been an increasing trend in the number of head of both buffaloes and cattle. There is potential for wider use of animal draft power, especially for farmers who cannot afford to buy power tillers or have access to custom operation or hire services of mechanical equipment for land preparation. Table 4 shows the extent of livestock production.

Table 4. Population of buffaloes and cattle in Lao PDR, thousand head.

Year	Buffaloes	Cattle
1985	939.4	626.5
1986	980.1	646.4
1987	1027.6	702.6
1988	1040.7	764.1
1989	1026.1	816.5
1990	1071.8	841.9
1991	1099.5	899.1
1992	1130.7	992.9

Source: Ministry of Agriculture and Forests

D. Production of agricultural machinery

Agricultural hand tools, animal-drawn plough mouldboards and shares as well as a few engine-powered rice threshers have been produced by MMF. The Agricultural Machine Company of the Municipality of Vientiane used to produce tools and implements from 1975 to 1988. Hand tools are mainly produced by blacksmiths. Some hand tools are imported but the import figures are not available.

Production by MMF

Table 3 shows the production figures of MMF for agricultural machinery and implements from 1990 to 1993.

Table 3. Production (number of units) and value (million Kips) of products by MMF.

Type of Product	1990		1991		1992		1993	
	Qty	Value	Qty	Value	Qty	Value	Qty	Value
Ploughshare	148	0.08	493	0.3	43	0.02	1000	0.6
Ploughshare & mouldboard	1096	0.9	1439	1.5	0	0	1000	0.9
Plough	550	1.0	3422	10.4	704	2.3	800	2.6
Machete	318	0.2	30	0.3	0	0	0	0
Pedal thresher	304	11.6	181	8.2	184	8.6	250	11.8
Power thresher	20	11.2	11	14.6	10	14.8	10	15.8
Grain mill	5	0.3	2	0.2	3	0.2	5	0.4
Maize sheller	1	0.5	0	0	0	0	0	0
Total	2442	25.78	5578	35.5	944	25.92	3065	32.1

Source: MMF, 1993

MMF has stopped its blacksmithing production of hand tools, particularly machetes or knives, since 1992. Production of ploughshares and mouldboards was temporarily stopped during 1992 and revived during 1993, apparently because of demand as there is no other local source. This is in spite of the growing popularity of power tillers in the Vientiane area.

It is notable that only one mechanical power-operated maize sheller has been produced due to lack of demand. Either there was no need for it or with its price of KN 500,000, it did not have comparative advantage over a power rice thresher which buyers usually use for custom threshing. The cost of a rice thresher could easily be recovered. A less costly design, such as the hand-operated maize sheller which is appropriate for a small-scale family production system, will probably have demand.

MMF has no marketing arm or active market promotion system. There are no fixed dealers. Traders or individual farmers come to the factory to purchase the type of machine they need.

The factory's large revenue is from the production of calcium carbide, oxygen and acetylene and from services rendered. The volume and value of production of agricultural machinery do not appear to be profitable against the high cost of overhead, operation and raw materials. In 1981, MMF produced a total of 57,970 pieces of machinery valued at KN 1,869 million.

Production of hand tools by blacksmiths

The stoppage of production of hand tools by MMF might have stimulated the blacksmithing industry. At least in a village in Vientiane province, production capacity of 14 blacksmithing enterprises located there cannot cope with demand. All together they produce 5,000 pieces each of sickles, machetes or knives and axes per year. They also produce rakes and small hoe heads for weeding. The rate of production of one blacksmith is 8 pieces of sickles per day, 5 pieces of machete per day, 5 pieces of ax per day and 2 pieces of rake head per day. Production is seasonal. For example sickles would be in demand during harvest season and hoe heads at the beginning of the the rain season. Machetes would be in demand almost all year round.

Traders go to the village to buy the blacksmithing products in bulk. Since they would buy all that the blacksmiths could produce, the demand is not satisfied. Some of the blacksmithing shops have been established within the past two or three years, indicating a recent demand creation. In spite of the proximity of the blacksmith sheds to each other, each blacksmith is independently operating. He purchases his own raw materials (used vehicle leaf springs) at 20 kg at a time in Vientiane which is about 70 km away. Charcoal for fuel is supplied in sacks by a trader. There is no existing association among themselves to take advantage of lesser cost by bulk purchases and perhaps getting new designs.

E. Tractor repair services

Approximately 300 tractors had been imported from Russia from 1985 to 1991. Most of these tractors are now in the private ownership mostly in the Vientiane Municipality and the Vientiane Province where they are being used for hire services in transport, ploughing and harrowing with disc harrow-ploughs and earthmoving with adapted bulldozers. Quite a few of such tractors are no longer functioning as repair costs have gone very high. Cannibalized tractors stand by the roadsides or front yards of their owners. Some micro-scale repair workshops exist but they would require spare parts which are procured from stores which used to owned by the government or from cannibalized tractors.

The Tha-Ngon Agricultural Machinery Repair Workshop

This workshop, located at Tha-Ngon, Vientiane, used to be owned by the Municipality of Vientiane. It was privatized in 1987 by lease a group of farmers and investors at the rate of KN 4 million per year. The lessee has acquired stocks of spare parts of tractors and components of disc ploughs and harrows and assembled them for sale. The stockyard contains about 100 pieces of agricultural equipment which appear to have no buyers as no new tractors have been imported since 1991. Only the discs and the bearings would be the items needing replacement in the equipment which are in the hands of the private sector.

The workshop has 11 engineers who had been educated in the former the Soviet Union. However, the activities in the workshop are minimal. The workshop repairs pumps used in irrigation systems. Charges for labour only in the overhaul of tractor engine are between KN 130,000 and KN 150,000.

In July 1993, the lessee obtained a bank loan of KN 20 million for five years at 14 % interest per year. The workshop has plans to have a joint venture with a Thai company to manufacture threshers and power tillers. It has purchased a light-weight thresher from Vietnam which is mounted on a frame with two wheels for portability in the field. Figure 14 shows the disassembled thresher for study and adaptation for production.

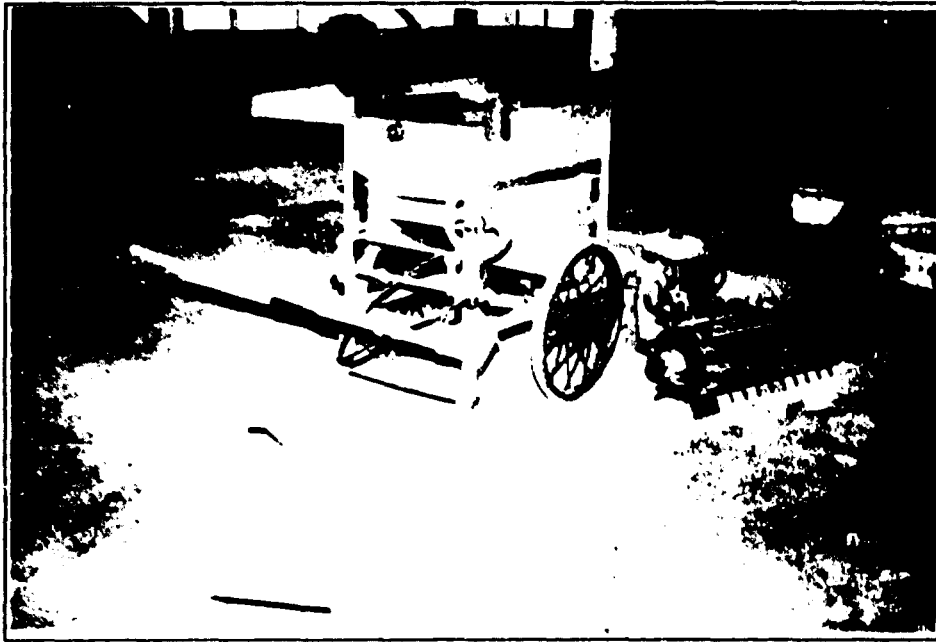


Figure 14. The Thangon Agricultural Machinery Repair Workshop is now privatised and starting to have agro-related metalworking activities. Clockwise from top left: Disassembled thresher from Vietnam under study for local manufacture; view of the inside of the workshop with water valves under repair; and workshop yard with a large inventory of unsold disc harrows.

III. ECDC/TCDC POTENTIALS

There is a wide scope for technical cooperation between Lao PDR and the more developed developing countries in terms of human resources development. Development of education capabilities at the higher level has been neglected. Students had to be sent to the other socialist countries to enable them to obtain professional or technical degrees. However, the focus of their training has apparently been too narrow to adapt to the present situation and NEM. There is therefore, a need for re-orientation of their background. For example, graduates of the farm machinery course have been trained for tractor mechanization and not in engineering principles which, if they had, would enable them to switch to design and development of machinery under the current needs of agriculture. This educational situation has left a vacuum of qualified engineers in almost all fields which requires an infusion of new and updated knowledge at an accelerated pace if the country is to catch up in development with neighbouring countries.

The only possible source of high-level human resources in agriculture and agricultural engineering is NAC. Yet more than half of the teaching staff has only the Certificate level of education from the socialist countries which have a different agriculture environment than that prevailing in Lao PDR.

A possible way to accelerate the development of human resources is to have an exchange programme between a fledgling high level institution like NAC and some of the more developed agricultural universities in Asia. These institutions exist in Thailand, Malaysia and the Philippines. There is no language barrier in case of Thailand unlike in the other countries where English or the local language must be learned. It is therefore, essential that as a first step towards human resources development an in-house programme of English language learning should be organized in the Lao institution. The language barrier should be overcome to have a two-way programme, that is, the institution's staff visiting another country for study and the other country institution's staff visiting the Lao institution. The same is true for promising students to serve the staff in the future.

There is a large interest in learning English among the students and the faculty of NAC.

The same scheme can be adapted for practical transfer of technology at a workshop like the MMF. Engineers of the National Institutes (NI) of the Regional Network for Agricultural Machinery (RNAM) may be seconded on short-term basis to MMF by their respective institutions to assist MMF engineers in the testing and modification of a particular machine brought from such institution. At the same time a counterpart engineer from MMF could be seconded to the same NI where the visiting engineer originated. The scheme would be mutually beneficial for Lao PDR and the cooperating country.

IV. PROBLEMS AND CONSTRAINTS

A. National network

There is as yet no national network (NN) nor a national institution in which the activities to support the promotion and development of AMI could be based. MAF has no programme for mechanization nor an office or section to look after the machinery requirements and their extension to farmers. Its DAE has dissolved its farm mechanization section after the privatisation of the tractors obtained from the former USSR. However, MIH has the MMF which operates at less than 30 per cent of its capacity. It has enough space and still usable workshop facilities as well as some engineers who have capabilities in design work but would need upgrading their capabilities and broadening of their horizons under the market-oriented economic system.

There is a need to form a national network (NN) even informally, the more so because the NI will be stationed with MIH which is not in contact with farmers. Being in the industry sector, the MIH staff is not as knowledgeable as those of the DAE and DI about agriculture or the rural sector which is the ultimate beneficiary of the agricultural mechanization programme or the promotion of the AMI enterprises.

Thus, a strong link between MMF and the DAE as well as with DI is imperative. Moreover, suitable linkages must be formed by MIH with relevant institutions, like private small- and medium-scale AMI enterprises, LNCCI, credit institutions, farmer's associations which LNCCI is trying to form, banks and technical training and educational institutions.

B. Public sector industries

The SOEs dealing with AMIs have suffered financial difficulties resulting from the NEM. Theoretically, there should be no cause and effect relationship between the downfall of such industries and the new policy. In fact, if the factories were performing well in the first place, they should be the first ones to benefit from the policy. Among the factors could be a deterioration of management not only from within the particular SOE but also from the external. Lack of financial autonomy in the past and the different orientation of management under the then centrally planned economy are also contributing factors.

A reorientation therefore, of the management staff as well as training in business management under a market-oriented economy is needed. Since there is no scheduled privatisation of MMF in the foreseeable future, there is a need to upgrade the capabilities of its managing staff, especially in the fields of financial management, accounting, efficient production planning and management, quality control, product development and marketing.

C. Private sector industries

The private sector would normally find difficulties in starting off a new AMI enterprise given the constraints of lack of credit facilities, institutional infrastructure and existing manufacturing enterprises on which to model new ones. MIH, the logical government agency to provide the needed institutional support, severely lacks the personnel to provide meaningful and comprehensive enough services. This has been brought about by the drastic reduction of personnel from the original 250 to only 50 persons. Such reduction scheme has affected all ministries and departments.

Any plans to provide the required institutional support are in themselves constrained by the above small-size staff in the ministries and departments. Naturally, the capabilities of the staff have to be upgraded to enable them to perform their functions more efficiently, otherwise, bottlenecks will occur. As institutional support is greatly needed in the promotion and development of AMI, a strategy to this effect is to tap the personnel of MMF. Its tool factory division is operating at about one-third below capacity, a situation which means that there is excess personnel, at least in the meantime. Development funds however, are needed and under a fiscal autonomy system for MMF, it has to increase its production rate and marketing achievements to finance the development.

Blacksmiths

One of the biggest constraints of blacksmiths in that village is the lack of electric power supply. They figure that their productivity could be increased tremendously if they use an electric grinder rather than a file or metal shaver and then a whetstone for finishing their tool products. However, no blacksmith uses a bicycle operated grinder or blower which may be operated simultaneously by his assistant who has very low productivity just operating the dual piston type blower for the furnace. Perhaps when a national institute is established, it could help blacksmiths located in remote areas to improve their equipment to increase their productivity and thus, their income.

D. Institutional support

Promotion and development of AMIs

The following is a more general appraisal of the major problems relevant to the promotion and development of AMIs in Lao PDR:

(a) Inadequate government revenues which barely supported the operational expenditures in spite of severe cost reduction measures, like reduction of staff (from 250 to 50 or 80 % decrease at MIH) and shying away from direct government execution of programmes. As guideline, only the provision of the correct environment and the enabling rules and regulations for the private sector initiatives were to be undertaken.

(b) Need for massive human resources development at all levels but more critically at the upper and middle levels to re-orient the staff to the market-oriented system and decentralized planning as well as execution of projects. Educational backgrounds of most of the staff were those from other socialist countries.

(c) Lack of institutional support infrastructure and undeveloped physical infrastructure especially roads to facilitate communication. This stems from the above two constraints and together, the three form a vicious cycle which needed to be broken, perhaps by external assistance.

(d) Limited access to information and capacity to absorb new technologies due to language barrier as the technological literature in the region was mostly written in English. Local or Thai language literature which could be understood was not readily available.

(e) Limited resources and savings in the private sector which limited investment capacities. However, there seems to be a run-away trend to aspire for imported luxury or consumption goods which are not contributing to income nor production.

Agricultural production support system

The small staff at DAE severely limits its capabilities to demonstrate machines and extend agricultural technologies to farmers. The Lao-IRRI Project practically handles the research and extension activities in rice production.

Some of the problems being met in the production of rice by farmers are as follows:

(a) Only one cropping can be done in most areas because of lack of irrigation water during the dry season. Sometimes the crop is also damaged due to some dry spells during the wet season. In this case, water pumps are essential for security of water availability;

(b) Large power requirements for land preparation and high labour requirement for planting and harvesting of paddy. There is an apparent shortage of labour, especially during peak land preparation and planting for rainfed rice as well as during the harvesting periods of rice in both the irrigated and rainfed areas. Rice machinery, if made affordable by or accessible to farmers by means of custom operation services and credit with loan guarantees, would increase production and productivity.

(c) Insect damage. Integrated pest management is one agricultural technology which has not been introduced to farmers as extensively as it should due to lack of human resources at DAE. This low-cost technology rather than wanton use of sprayers by farmers only to aggravate the situation is needed. Once farmers start using sprayers, it will be difficult to restrain them as required in the integrated pest management.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Potentials

Lao PDR has a lot of potential for development. The following are some of the general areas which can contribute to the promotion and development of agro-related metalworking industries:

(a) Plenty of forest, mineral and water resources. However, local exploiting capacities are limited. Proper management of the exploitation of such resources to avoid further environment degradation is necessary. A danger of over-exploitation and at a fast pace to earn foreign exchange is eminent. There is potential for growing essential oil plants and promote distillation among the people living in the hill and mountain areas. For this purpose they will need technical and financial assistance, but if successful the processing of aromatic and medicinal plants could substitute activities for production and primary processing of illegal drugs.

(b) Possibilities of shallow tubewell and low-lift irrigation pump system as the water table is high. Therefore, a demand for shallow tubewell pumps and axial-flow pumps can be created if dry season rice planting is promoted by the government. However, institutional support is needed for mapping of ground water resources and building of the capabilities for the local manufacture of low-lift pumps.

(c) Abundance of water courses especially in the mountainous areas where micro-hydropower could be developed. Abundance also of lowland water resources, including the Mekong River and its tributaries where aquaculture could be promoted together with axial-flow pumps.

B. Public sector industries

Supply and demand for agricultural machinery

The supply of agricultural hand tools, animal-drawn implements and mechanical powered machinery in 1993 came from the following sources:

(a) Hand tools consisting of machetes or knives, sickles, hoes, rakes, axes, diggers and special tools - blacksmiths (about 15,000 pieces/year produced by 14 blacksmiths in one village alone) and imports from Vietnam. The actual production by MMF in 1981 was 57,970 pieces including cast-iron plough shares and plough share-mouldboard units:

(b) Steel ploughs, cast-iron plough share-mouldboard units and cast-iron plough shares - MMF (2,800 pieces with US \$ value amounting to only one-third that produced in 1981) and imports from Vietnam:

(c) Power tiller sets, each consisting of power tiller unit, paddle wheels, mouldboard plough, disc plough, comb-tooth harrow, trailer and axial-flow pump

- imports from Thailand (about 600 sets):

(d) Pedal threshers, Japan design - MMF (250 units):

(e) Power threshers, Thailand design - MMF (10 units) and imports from Thailand:

(f) Grain flour mills - MMF (5 units) and

(g) Rice mills - one private workshop in Vientiane (82 units of adapted design), Agricultural Machine Company Import-Export at Photan Road, Vientiane (3 units) and imports from Thailand.

The demand for power tillers and threshers is being viewed by some private entrepreneurs as high enough to justify competitive local manufacture as indicated by plans of three medium-sized ones to do so starting in 1994. Blacksmiths' products in one village however, are so much in demand that production capacities are not meeting it. Traders who come to the village are ready to buy all the blacksmithing products of good quality. This shows that users preferred quality products as there is competition with imported ones. There is a need to increase the productivity and production capacity of blacksmiths through improved blacksmithing equipment, like electric or pedal-driven blower and grinder as well as anvil.

Through the national network which is proposed to be established with focal point at MIH, the blacksmiths may be given information on new designs of hand tools which might be improvements of what they usually make in terms of effectiveness, ease of use and cost because of simplicity and lesser amount of material used. Blacksmiths in the remote and mountain areas need more assistance than those in the relatively more prosperous areas in the lowlands and irrigated areas, like Vientiane and the mid-southern provinces.

Future status of MMF

MMF might be one of the SOEs which will be privatized although no time-table has been set yet. One reason for the possible delay of such scheme is that no investor might be interested in buying or leasing the facilities and equipment unless very attractive terms are offered. The cost could be formidable for an individual investor considering the large area occupied and value of the buildings and equipment. A possible way to overcome this problem is to sell the machine tools by the piece or lot consisting of pieces of equipment which would support a complete workshop. Small-scale entrepreneurs may be attracted and encouraged to establish their own workshops.

An alternative is to make the whole factory compound a mini-industrial estate where building subdivisions are leased to different entrepreneurs but facilities, like the machine shop and foundry would be common. Each building may be occupied by two or more leaseholders for their own manufacturing specialization which would be agro-related. At the start, one building may be used as an industry incubator for

a new entrepreneur who wishes to go into manufacturing venture without investing on capital equipment.

There is bias towards retaining MMF's status as SOE perhaps because of the strategic nature of its calcium carbide production which also was a money-making venture. However, that factory could be operated independently of the agricultural tools factory.

A project on the promotion and development of AMI enterprises might give an additional role for MMF to perform the institutional support function. It can revitalize the agricultural machinery factory itself as human resources development, including training in areas of production management, quality control and marketing, would be a thrust.

MMF can diversify its products to those which would not necessarily compete the private sector industry it would be promoting. For example, it may produce such agro-related products as water gates for irrigation canals on import-substitution basis. It can specialize on the production of micro-hydropower turbines the technology for which could be obtained from other countries, like Nepal and China.

The gear box may be locally manufactured utilizing the foundry and gear-making and heat treatment facilities of MMF through suitable arrangements.

Development of human resources in agro-related machinery engineering

The role of NAC should be given due importance as it is the only local source of developed human resources for agricultural development of the country which is the primary thrust of the government. Such human resources development should include the field of agricultural engineering and needs the re-orientation of the current staff in farm machinery to develop capabilities in design and engineering activities rather than merely operation, repair and maintenance of tractors which at the present situation has become of little relevance.

The fact that the farm machinery course has been discontinued due to lack of students is an indication of the lack of relevance of its current training format and the need to develop human resources for the planning and development of modern mechanization systems, including design, testing, manufacture and extension of agricultural machinery and other mechanical technologies. Other agricultural engineering areas, such as for irrigation, soil and water resources development and management, crop processing and post-harvest technology, farm structures and environment should be developed in the staff to develop human resources for the line ministries, research, extension and the professional services field.

A subject which might be included in the curriculum for the last year of study is about business management with the view to introducing the students to the realities of small-scale entrepreneurship rather than employment of which there may be scarcity. Such a subject would create an interest among the students in setting up their own enterprises and therefore, would not have to rely on employment. In

practice, such a establishment may be realized within one or two years after gaining experience and building up self-confidence. For this a credit programme or loan guarantee scheme may be arranged by MIH, in cooperation with NAC, with credit institutions to assist the graduates in starting their small business enterprises.

Ad-hoc technical advice

The following actions were proposed to the various officials and heads of institutions visited by the agro-related metalworking expert:

(a) MIH/MMF/NAC/PTS/LGTS/STENO - They might consider human resources development as priority and encourage the staff to build their capabilities in comprehending and absorbing new and relevant technologies by learning English which was getting popular. Since most of the accessible information from abroad were written in English, learning it through in-house service courses would widen opportunities of the staff for upgrading their capabilities in their respective fields. The base of selection of candidates for study fellowships would also widen to include the talented and promising individuals.

(b) NAC/LGTS/PTS - Corollary to (a) above, NAC might wish to develop programmes based on the concept of twinning with one or more developed universities in Asia for exchange of staff and students to upgrade its teaching faculty. Similarly, the Lao-German Technical School and the Pakpassak Technical School may develop their own programmes under TCDC arrangements.

(c) MIH/MVDIH - To accelerate privatisation of SOEs, especially those which were not attractive to foreign or local investors, MIH might consider apportioning the factory complex, building or equipment into small manageable and affordable lots or sub-divisions and renting them out or selling them to small-scale entrepreneurs on easy terms (perhaps an adaptation of the condominium concept). This widens the mass base of ownership or participation in industry, utilizes to the maximum otherwise idle or under-operated SOEs (e.g., the Agricultural Machinery Company at Km 5 - idle since 1991, and the Equipment and Repair Workshop at Thongpong - very few clients), reduces, through occupancy and usage, the further deterioration of facilities and promotes the development of small-scale industries. The SOE compound may grow from micro to mini industrial estate and perhaps expand to a full-scale one.

(d) MMF/MIH - They might prepare a programme to rehabilitate some facilities of the MMF to provide facilities and services to AMI incubators as well as training of farmers in operation, repair and maintenance of agricultural machinery. Organize a machinery development and promotion unit at MMF with a view to providing institutional support for AMI and agricultural mechanization. Maximize utilization of foundry facilities by diversifying its products to serve the needs of other agriculture and rural development programmes by import substitution. For example, DI needed cast-iron watergate sets for irrigation canals. MMF was also an SOE with the 1993 production value of agricultural machinery of only about 33 per cent compared to 1981 production value but had high income in calcium carbide, oxygen

and acetylene production and in services which had probably made the entire operations OF MMF viable.

(e) MIH/MMF - Encourage formation of village associations of blacksmiths to increase efficiency of raw materials procurement and to market their products directly and avoiding middlemen. Affiliate such associations with the Lao National Chamber of Commerce and Industry (LNCCI).

(f) MIH/MMF.- Assist the blacksmiths in increasing their competitive edge against the imported hand tools by encouraging the blacksmiths to produce quality products, improving productivity and developing an effective marketing strategy.

(g) LNCCI - Promote the agricultural machinery custom-hire operation services as a small-scale enterprise among the "wealthier " members of LNCCI to help farmers avail themselves of the benefits of agricultural mechanization.

(h) MIH - Maintain the contacts with the offices and institutions visited during the mission so that a "national network for agricultural machinery" could start operating informally. Follow up on the potential entrepreneurs for establishing workshops for AMI enterprises.

(i) MIH/CPC - One way to promote the blacksmithing industry, a type of cottage handicraft or micro-scale enterprise, is to encourage ministries and provincial offices to purchase hand tools issued to their field workers from local blacksmiths instead of importing them. Such tools could be made according to specifications.

(j) DI/DAE - The use of pump irrigation for rice in areas which cannot be served by gravity irrigation systems but which have groundwater and surface water resources should be promoted. The following activities should be undertaken to complement those of on-going irrigation projects.

(i) Promote the use of low-lift pump irrigation from shallow tubewells or surface water resources during the dry season by establishing demonstration sites in key provinces, like Vientiane, Luang Prabang, Saravane, Savannakhet and Champassak where rice is grown. The collaboration of the Lao-IRRI Project as well as small-scale AMI entrepreneurs and the provincial offices concerned should be sought.

(ii) Conduct hydrologic surveys of intended demonstration sites for installing shallow tubewells and low-lift pumps driven by electric motors or diesel engines. Among other activities, gather data on water depth, drawdown and water recharge rate and their crop yields, cooperative attitude of farmers and support from village leaders and other data needed for feasibility of conducting demonstrations.

(iii) Install shallow tubewells using portable drilling rig developed from IRRI design and locally made low-lift pumps (initially to be made at MMF foundry shop using suitable designs from other countries) in the fields of farmer group cooperators.

(iv) Demonstrate other machines and agricultural technologies at the critical stages of crop production for maximum impact on yield and timeliness. Examples are power tiller or hydrotiller during land preparation, "dapog" system of raising seedlings, check-row marker, hand-pushed row weeders, improved sickle and the IRRI portable thresher.

(v) Monitor the production areas and gather data on all expenses and income from the operation and make a cost and income analysis.

(vi) Document all significant events using still and video cameras and prepare a promotion video, a slide show and an illustrated brochure as extension material for other areas remote from the demonstration sites.

(vii) Promote the use of shallow tubewells and low-lift pumps in other areas using video tapes, slide shows and leaflets and organizing study tours among farmer groups to the demonstration sites.

(viii) Prepare brochures and leaflets showing profitable business investments in renting out small-scale shallow tubewell and low-lift pump irrigation systems.

(ix) Promote among members of the LNCCI and other wealthier persons, investments in installing shallow tubewells in farmers' fields and renting out low-lift irrigation pumps in rainfed rice-growing areas to enable farmers to grow rice crops during the dry season; include in the promotion package other recommended tools and equipment as well as agricultural technologies needed to increase crop yields and productivity of land and labour.

(x) Promote the manufacture of standard low-lift pumps among the small-scale AMI entrepreneurs.

C. Machinery prototypes and drawings needed

The agricultural machines listed below may be introduced to Lao PDR but only with accompanying technical assistance regarding their fabrication, perhaps initially at MMF. Actual commercial units, in addition to drawings, will have to be provided for easier replication.

(a) Hand tools

(i) Manually operated maize sheller from the Philippines. This low-cost and simple machine can be fabricated from wood and metal (nail) materials. The device will increase the productivity of the family labour.

(ii) Hand-pushed wheeled weeder from Thailand upland rice. According to LAO-IRRI Project, this simple but effective tool was designed by a farmer in Thailand and a metalworkshop should be able to fabricate one with the aid of a photograph of the tool. Similar designs however, are also available from India.

The Oil Crop Research Division of the Central Agricultural Research Institute at Yezin, Pyinmana in Myanmar hand-pushed wheeled weeders from the USA in cultivating sesame, groundnut and other oilseed crops.

(iii) Improved designs of bush knives and sickles for local production by blacksmiths. Various designs of farm knife, an indispensable tool of a farmer, exist in many countries in Asia. A Lao blacksmith may be presented with special-purpose designs to copy and have them tried out by the farmers in his village. The provision of improved designs for blacksmiths to adapt or copy is a form of direct assistance to the metalworking cottage industry which redound to benefitting the farmers especially in the remote villages.

(iv) Rice husk stove from IRRI. This stove, originally designed in Vietnam has such a good environmental impact, viz. elimination of rice processing waste and reduction of use of fuelwood, that with adequate promotion, this energy efficient stove is expected to be popular. In Myanmar, one metalworking entrepreneur has fabricated and sold 11,600 units of the modified stove during the first eight months of fabrication.

(v) Peanut sheller. This hand sheller is available from several RNAM-member countries. It can easily be fabricated by a metalworkshop. If peanut production continues its upward trend (it almost doubled during the period from 1991 to 1992), an engine or electric motor-driven machine may be necessary.

(vi) Peanut oil expeller. Since Lao PDR imports edible oils entrepreneurs may be encouraged to produce peanut oil as a food processing enterprise. This is assuming that peanut production continues to have an upward trend.

(b) Animal-drawn implements

(i) Single-animal drawn steel mouldboard plough from Thailand;

(ii) Single-animal drawn comb-tooth harrow from the Philippines

(c) Mechanical-powered machinery

(i) Axial-flow rice thresher, 20 hp from IRRI. This thresher is portable (four persons required for its operation can move it across paddy fields) and simple in design, making it cheaper than the usually imported models. The model which is powered by a 7-hp engine has a capacity of up to one-half tonne paddy per hour.

(ii) Centrifugal pump from Japan or other countries. Many models of cast-iron centrifugal pumps exist and it is a matter of selecting the most efficient design and the cheapest to make. MMF has already the capability to make large-size centrifugal pumps with 40-cm diameter impellers and should be able to make quality castings of suitable 4-inch and 6-inch (101 and 152 mm) centrifugal pumps from

introduced designs. Popularization of shallow-tubewell pumps will have an impact in rice and vegetable production during the dry season.

(iii) IRRI power tiller. This power tiller has been designed to be simpler than most commercial ones basically to reduce its costs and for easy fabrication by small-scale workshops. It uses chains and sprockets for the transmission instead of gears. Complement equipment, such as mouldboard plough, comb-tooth harrow, paddle wheels, trailer, planter and drilling rig have also been designed to be powered by the power tiller. The engine may or may not be detached to operate water pumps and blowers for driers. Its versatility has made it popular among farmers in the Philippines where its local manufacture, except for the engine, has been competitive with the imported models.

(d) Hydro-powered devices

(i) Micro hydroturbines from Nepal. Cross-flow turbines have been manufactured in Nepal since the early 1980s, initially through technical assistance from foreign organizations. Nepal has the wide experience in the design and manufacture of such devices which are easily adaptable to mountainous conditions in Lao PDR. The costs of civil works, installation and other equipment however, are high if such turbines are to be used for electricity generation. They could be used economically for low-powered grinding of grain, expelling of edible oils such as from peanuts and other useful shaft work like sawmilling and woodworking.

(ii) River water turbine. A commercial design of this machine is available from an Australian company. The turbine can be used to pump river water on which the device is floated by means of pontoons or raft which is held in place by moorings. The propeller shaft is energized by the large water axial-flow rate. It will be useful for pumping water from the Mekong River or its tributaries provided the installation does not impede with normal river navigation.

D. Machinery prototypes and drawings
for exchange with other LDCs

There are no machines indigenously designed in Lao PDR which can be exchanged or transferred to other countries as the existing ones are mostly imported from Thailand.

E. Programme for further development of the agro-related
metalworking industry sector

The thrust of development of AMIs in Lao PDR will be towards small-scale enterprises and will remain so for quite some time. Capital for starting up such enterprises is usually small and scarce. Investors will normally give priority to trading imported goods as it is done at present.

Policies and strategies to encourage local manufacture and divert such capital to production rather than to importation will help develop the agro-related

metalworking industry enterprises. Such instruments are essential to stimulate the establishment of the enterprises in view of the need to produce the mechanical inputs for agricultural production and processing. Policy and strategy formulation are also needed to be addressed to the agricultural sector.

Need for creating demand for agricultural machinery

The commercial viability of the small-scale AMI enterprises depends upon the demand or market for products. A constraint is the fact that the supposed target clientele, the farmers who are the eventual users and benefactors of the agricultural machinery industry, have low purchasing power. Two ways by which farmers will be able to avail themselves of modern machinery technologies to improve their production capacities are the following:

(a) Access to credit. An appropriate and farmer-friendly credit programme, including a loan guarantee scheme for those who cannot put up enough collateral will encourage farmers to buy machinery and other inputs to increase their production. The programme will need credit supervision and technical assistance to farmers towards adopting technologies and farming management systems. The technical and management advice will enable them to derive large enough farm incomes to cover not only the credit repayment services but also to sustain their own needs as well as improve their quality of life. In the end, the demand for machinery will also increase.

(b) Availability of affordable agricultural machinery hire or operation custom services. The wealthier members of society, possibly the medium and large-scale businessmen, may be encouraged to invest in custom field operation service enterprises which, although small-scale in operation, need large capital investments in machinery which are usually not afforded by farmers. Such enterprises will not only generate employment but, more importantly, will also enable farmers to have access to modern farming technologies. Positive results from a programme established for such purpose will help the poor farmers increase their income in a dignified way. It will have impact to the farming economy in provinces far from Vientiane. At the upstream end, the programme will create the demand for machinery and thus, promote their local manufacture.

Utilization of arable land during the dry season

Non-availability of water in farmers' fields during the dry season limits, if not prevents, farming activities during this period. Only 3% of the cultivated area is irrigated mostly by gravity system and quite insignificantly, by low-lift pumps. The better-off farmers are located in irrigated rice areas. A reason for their relative prosperity compared with those in the non-irrigated areas is their opportunity to raise a dry season crop of rice. Provided that water is not limiting, crop production during the dry season permits obtaining higher yields due to higher light intensity as well as lesser weed, insect, disease, flooding, storm and other problems than during the rain season. Engine-pumpsets and shallow tubewell installation could be made affordable by the following strategies:

(a) Group or cooperative ownership and use

Farmers in a contiguous area may be encouraged to form cooperative ownership of a shallow tubewell and pump. Unlike other machines, the output of an irrigation pump is divisible. A pump irrigation cooperative therefore, minimizes, if not avoids conflicts, in the shared use of machinery, the usual cause of failure in most endeavours for cooperative or group machinery use.

With affordable investment contributions in a shallow tubewell and engine-pumpset for each farmer member, the group's income level could be raised. The otherwise idle land could be brought to production to rice, legumes, vegetables and other cash crops. To implement this shallow tubewell pumping scheme, information on the ground water resources and hydrology is needed to avoid possible environmental damage, especially increased salinity of the soil. Pumps would be produced by casting, initially at the MMF foundry and eventually by the private foundry shops which may be put up by the private sector.

(b) Hiring engine-pumpsets

This strategy is discussed in the earlier topic and is one of the examples by which demand for machinery could be created. The farmer's investment in the scheme is the installation of a shallow tubewell assuming that the location of his farm is suitable for one. Entrepreneurs may be encouraged to set up shallow tubewell drilling and installation services, the equipment for which may be fabricated by metalworkshops. A design of a drilling rig using the power tiller has been developed and is available from IRRI. The farmer may fully utilize the tubewell during off-season by installing a hand pump for domestic water supply.

Institutional support infrastructure

Small-scale industries, in general have not received direct support from the Ministry of Industry and Handicrafts (MIH). Although attention has recently been focused on the private sector as the "engine for economic growth", no institutional infrastructure support has as yet been organized for small-scale AMI enterprises.

The staff of MIH and MMF could strengthen their capabilities by participating in or taking advantage of the assistance to be offered by SBDP being coordinated by UNDP/UNIDO. SBDP has several components, each to be implemented independently GTZ, The Asia Foundation and Care International. Among the components are policy, promotion and coordination, technical training in priority sub-sectors of which AMI is one, management training and entrepreneurship development.

In the AMI sub-sector, only MMF is producing some agricultural machinery. The production of hand tools has been stopped. No extension programme, either in industry or in agriculture exists. There is no agricultural mechanization programme nor an office to look after the increasing trend in mechanization in irrigated areas and to formulate strategies because of the lack of it in non-irrigated and economically depressed areas.

Thus, the private sector is at a loss where to get technical information about a business prospect of producing what kind of agricultural machinery, the market demand and procedures for conducting such kind of manufacturing enterprise. In other words, an entrepreneur is on his own to find out, perhaps the hard way, to do business. Mistakes could be costly and financially disastrous.

MIH has the mandate to plan, initiate, monitor and coordinate policies, strategies and programmes for the promotion and development of the small enterprise and handicraft sector. However, its institutional capacity needs strengthening and considering the small number of staff to do the work against several constraints, the attainment of an effective and full strength capacity may take a long time yet.

The human resources at MMF, particularly the engineers may be trained or re-orientated to include in their role, the provision of institutional support to promote and develop AMI enterprises. This role is challenging for them and provides an opportunity to utilize excess capacity at MMF or diversify its products. For such re-orientation and training, external assistance is needed.

Among the institutional support activities which need to be undertaken are the following:

(a) Organizing an AMI incubator programme at MMF. Under this programme, the qualified MMF staff will render technical and small business management support to entrepreneurs undergoing incubation. To enhance their qualification, some staff, by arrangement by MIH with UNDP, will undergo training in Small Business Development Programme (SBDP) planned to be undertaken with UNDP/UNIDO assistance.

(b) Conducting demonstrations of new machinery in collaboration with the Lao-IRRI Project and DAE to farmers, especially in remote areas; giving feedback information to AMI entrepreneurs for their own response to produce the machines in demand.

(c) Testing newly acquired machinery in farmers' fields and utilizing feedback to modify the designs to improve them; replicating final prototypes for demonstrations to farmers and to AMI entrepreneurs.

(d) Promoting the quality production by blacksmiths with a view to creating an export market, possibly to Thailand where blacksmithing has become a dying art. This may be a long way yet, government agencies should at least patronize local blacksmithing products for use by their own field workers, but demand high quality. MMF's involvement in quality control could be solicited.

VI. PROJECT CONCEPTS

A. Regional Asia

BANGLADESH, BHUTAN, CAMBODIA, LAO PDR,
MYANMAR, NEPAL, SOLOMON ISLANDS, WESTERN SAMOA

Title: Promotion and development of agro-related metalworking industries in LDCs (Phase II)

Duration: Two years

Total UNIDO budget: US\$ 818,000

Government inputs: All governments are expected to provide services, counterpart personnel (including their salaries throughout project duration), office facilities and administrative support in kind. Details will be elaborated in the final project document.

At the end of Phase II, the following are expected:

(a) Each LDC has an effectively operating institutional infrastructure consisting of a national focal point, a national institute with workshop facilities (the two may be combined in some LDCs) with strong linkages with relevant institutions and organizations which through that focal point make active use of the regional project and any country specific project relevant to the promotion and development of agro-related metalworking industry;

(b) Each LDC has a functioning national network (NN) for agro-related machinery with members consisting of institutions and organizations from the above institutional infrastructure, private sector organizations consisting of those of farmers' and manufacturers, cooperative societies, national and international NGOs which have relevant projects or activities, banks and other credit or financing institutions, chambers of commerce and industry, and others. The NN have frequent exchanges of information and notes regarding relevant activities and its functioning depends mostly on the leadership of the national focal point or national institute. Involvement of the NN members in relevant seminar workshops exhibitions and other programmes organized by other members is an indication of a working national network. A NN newsletter (produced by the NFP) exchanges members newsletters among the NN is another indication of an active NN.

(c) Selected agricultural and agro-related machines introduced by the project have been tested, modified, manufactured, demonstrated to farmers and promoted for commercial production and use through credit financing, if necessary to farmers, manufacturers and custom service entrepreneurs.

(d) National focal point or national institute in each LDC is closely linked

with RNAM and national focal points regarding agricultural machinery and agricultural mechanization.

(e) Human resources in each national institute and focal point strengthened through human resources development programme of the project.

(f) LDC national institutes have adequate facilities to undertake future development projects with or without external assistance.

Development objective

The development objective is to support the agricultural production and processing in the participating countries by improving local capabilities and generating a more conducive environment for local manufacture of agricultural tools, implements and machinery including post-harvest and food-processing equipment.

1. Immediate objective 1

Continue strengthening of national focal point linkages through existing network mechanisms.

Background information

Background information is available in the project document for Phase I and programme summary brief document.

Output

National focal points continuously capable of providing a flow a technical information and advice to small and medium scale enterprises in agro-related metalworking industries and initiate and sustain programmes and project in support of those enterprises.

Activities

(a) Continuation of the information dissemination system between RNAM and the focal points;

(b) Continuation of the promotion of links between the national focal points and public-private enterprises;

(c) Continuation of ECDC/TCDC promotion within the region and

(d) Continuation of managerial and technical advice to the focal points, enterprises and R&D institutions during field visits;

Inputs

CTA-Regional Adviser
2 Associate Experts

To be provided by ESCAP
To be provided by UNIDO

2. Immediate objective 2

To initiate the establishment of an information database through a database for raw materials demand and supply for the agro-related metalworking industries in Bangladesh, Bhutan Cambodia, Lao PDR, Myanmar and Nepal.

Background information

In the LDCs, most of the raw materials needed for the metalworking industries are imported. The quality of the products put out by the industries depend largely on the quality of raw materials used which at the present open economy at least for Bangladesh, Myanmar and Nepal can now be supplied by the private importers and traders.

Most of the small-scale workshops get their raw materials from the private importers and traders because of the quick response to their needs unlike in government-owned trading corporations which had been established to do bulk importation and distribution primarily to state-owned factories and secondly, to private enterprises. Many small-scale workshops face difficulties in procuring raw materials directly from the state-owned trading corporations.

In the open-market system, there is no systematic method of determining by the importers what and how much to import and supply to the metalworking industries. They estimate by experience but most often, workshops make do with whatever raw materials are best and available. Most of the workshops need assistance in specifying the best type of raw materials needed for their jobs and, even if they know, there is no convenient and effective way for their requirements to reach the importers or traders on a consolidated basis for their necessary action or response.

A database which will get the raw materials requirements and process such data for the information of suppliers will be of great help in achieving efficiency in the raw materials market which redounds to benefit the metalworking industries. Measures will be taken to ensure that accurate data is gathered from both users and suppliers.

Outputs

(a) Database headquarters established at the chamber of commerce and industry (CCI) or manufacturers association's office;

(b) Most small-scale workshops responded to the call to submit data requirements to designated collection points which relayed the data to database;

(c) Private raw materials importers and distributors making use of data in their respective operations network and

(d) Data available for exchange among the countries in the region through regular RNAM channels.

Activities

(a) Development of a database for raw material information and prepare necessary software for this database by an international consultant in one of the countries for replication in the others;

(b) Identification of an organization to manage the database. Normally, the CCI or another association with direct private sector participation would be in a position to undertake the activities of the project as it is to the interest of its members. It may have the option to expand the database to other industry subsectors to utilize excess capacity of the computer facility and staff. The database facility could be made self-liquidating by charging service fees from the users or importers who would like to have access to information. The National Focal Point (NFP) will assist the workshops in making specifications through the R&D member institutions in the National Network (NN) since they have the engineering staff who designed or tested the machines or at least familiar with them. Moreover, they are in a position to best consult and coordinate with the standards agency of the government;

(c) Formulate a strategy for obtaining correct and honest information about raw materials needs from workshops. Data gathering is a time-consuming activity which may be eased through the local business association or cooperative. Since small-scale workshop owners are not usually members of the CCI, they should be encouraged to form their own groups and federate them (refer to Immediate Objective 5). The department of cottage and small-scale industries may spearhead the move in collaboration with the NFP. One benefit to be gained by joining the association is the receipt of information through a newsletter. Workshop owners can also cooperate by returning by mail the canvass form sent by the CCI for the purpose. In return they may receive updated information on the material status over a specified period. Linkages will also be established with statistical services and other relevant databases in the country;

(d) Establishment of the database headquarters. The needed facility includes a personal computer set, a database programme, a printer and a photocopier. Only one staff trained in computer operation is necessary. This may be one of the

secretaries in the CCI office who will be trained to operate the database as one of the office duties. After all, the work only entails data entries which may be done in batches. If the headquarters decide to expand the facility to other types of raw material requirements, it may have to make staff adjustments. Facsimile facilities would be helpful in getting timely data from towns and cities:

(e) Supply of information to interested parties, particularly importers and suppliers as well as government policy and planning offices. The information may be sold at nominal cost to recover the cost of operation. The service may be expanded to other raw materials using the same computer facility and personnel:

(f) Monitoring and evaluation. Random field checking of data gathered will be done to detect spurious data. The database established for all small-scale metalworking workshops will be utilized in the monitoring and evaluation. Benchmark information on problems related to raw materials procurement will be gathered prior to the start of the project or before the effect of the project is felt. Data will again be gathered periodically to detect any changes. Data on how the small-scale workshops have been benefitted or adversely affected by the project will be evaluated.

Inputs

International expert for software development (1.5 w/m)	US\$	18,000
One computer expert per country (locally recruited)		10,000
One set of personal computers with printer for each country		30,000
Six photocopiers and facsimile machines		24,000
Miscellaneous		10,000
Component total	US\$	92,000

3. Immediate objective 3

To upgrade the skills of blacksmith trainers in all participating countries.

Background information

Village blacksmiths play a major role in the supply of tools and implements to farmers in the LDCs. Most of them learned the trade from their fathers and grandfathers and some skills may have improved or deteriorated along the way. Any improvements in their operations are tied up in the kind and quality of basic blacksmithing equipment they have inherited or added to the modest facility.

There is a need to upgrade both skills and equipment to increase the productivity of blacksmiths. Having skilled blacksmiths who are given access to new technologies, such as improved tools and implements redounds to the benefit of

farmers they are serving in the villages, who also need the proper tools and implements to be efficient and productive in their farming activities.

Output

A minimum of ten trainers capable of conducting training courses in each province or district per year in each country to enable participants to manufacture hand tools.

Activities

(a) Adoption of the FAO manual in blacksmithing as syllabus for the training course;

(b) Organization and implementation of training courses by the NFP in cooperation with the Ministry of Industry or Department of Cottage and Small-scale Industries and

(c) Monitoring and evaluation of impact of regional and national training courses.

Inputs

Expert in blacksmithing technology from the region (8 w/m)	US\$	90,000
Equipment - basic blacksmithing sets for selected blacksmiths		25,000
Group training programme		30,000
Miscellaneous		10,000
Component total	US\$	155,000

4. Immediate objective 4

To promote the production of small-scale machinery for agro-based food-processing light industries in Bangladesh, Bhutan, Cambodia, Lao PDR, Myanmar and Nepal.

This objective includes the following sub-objectives:

(a) To catalyze the development of agro-based food-processing industries by making readily available the machinery required in the processing of food raw materials involved;

(b) To strengthen the capabilities of small- and medium-scale metalworking industries in fabricating machinery required by the agro-based food-processing industries and

(c) To strengthen the comprehensive local machinery and equipment support sub-system for the food industrial system covering that from the production and post-harvest processing of agriculture-sourced raw materials to food-processing, packaging and handling for the market.

Background information

A bottleneck in the promotion of agro-based industries, especially the small-scale ones for the rural areas, is the lack of suitable processing machinery. Most often, the needed machines have to be imported although they are simple enough to be fabricated in local small- and medium-scale workshops especially those having engineering staff and qualified technicians. New entrepreneurs may not be aware of the capabilities of the local fabricators who can satisfy their engineering requirements if given the specifications or requirements.

The cost of machinery for a small-scale agro-based processing enterprise represents a large percentage of the total capital requirements. If such machinery could be made to order locally, the potential entrepreneurs will be encouraged to invest in such industries because of the convenience and perhaps, the reasonable cost and readily available repair services.

UNIDO has made a recent (first half of 1993) report each on the development of food-processing industries in Bangladesh, Bhutan, Cambodia, Lao PDR and Nepal. Eventual responses of the governments will lead to the establishment of new industries, most likely small- and medium scale ones and privately owned. In such food-processing industries, particularly oil, sugar and rice milling as well as dairy and fish processing, special machinery are an important component and in fact, itself a major determinant of the scale of each industry type and the quality of the final products. Special food vessels and containers made of aluminum or stainless steel which can be sterilized using heat, are simple enough to be made by the local industries according to specifications and accepted standards.

In Bhutan and Nepal, fruits, vegetables and spices are grown in mountainous, rugged terrain and remote areas. Transporting the raw materials fresh is often uneconomical and discouraging because of bulk, weight, low value and perishability of the horticultural products. Hence, there is a need to process such food raw materials and increase their value per unit volume or per unit weight. Processing such raw materials will create employment in the remote areas, particularly for women. The hygienic requirements in food processing may be assured through the design of the machine, the process involved and training of the processors and handlers of the raw materials.

The project concept calls for a regional cooperative effort in exchanging machinery design information together with the processing technologies involved. For example, designs of driers of high-valued products, like fish, fruits, vegetables and meat pelletizers and mixers of feed for fish, livestock and poultry, and mills for

edible oils exist in some countries which are relatively advanced in some areas. If machine exchange is not possible, information on design will be exchanged and given to machinery manufacturers which have engineering design and construction capabilities.

Outputs

(a) At least one machinery design and technical information on the small-scale food-processing involved for raw materials such as fruit, fish, vegetable, meat, oil, sugar, grain, legume and milk, exchanged among the LDCs and other developing countries or adapted from advanced countries;

(b) At least one medium-scale local metalworking manufacturer assisted by the project resulting in its diversified production of specialized machines for small- and medium-scale food-processing industries and

(c) Strengthened national network.

Activities

(a) Identification of food-processing industries which merit high priority for development on account of highest feasibility considering the most likely sustained production of raw materials, ready market, simplicity of processing technology, low investment requirements, mass-base benefits and other criteria; decision to promote or encourage the establishment of the industry will be made in consultation with the private sector and with support of feasibility studies;

(b) Compilation of information on the food-processing technology, including the machinery requirements and sources of their designs or prototypes, costs and other data;

(c) Establishment of collaboration work with 2 or 3 medium-scale metalworking enterprises having at least one design or production engineer on its staff and with fairly adequate machine tools and fabrication facilities for staff.;

(d) Provision of technical advice to entrepreneurs in food-processing industries and maintenance of collaboration work with them to enhance their productivity, maintain quality control and hygienic production conditions, reduce waste, protect the environment and perform other activities for promoting the food-processing industry in general;

(e) Training of trainers in small-scale food processing using the locally fabricated food-processing equipment;

(f) Initiatives by the National Focal Point to maintain constant contact with institutions and organizations for co-ordination activities regarding the sustainability of the food industrial system, e.g. promotion of contract growing among farmers for supply of raw materials for the food-processing plant, giving designs or technical

advice/prototypes of agricultural machinery to metal workshops for fabrication or replication and

(g) Organization of a national demonstration workshop for manufactured equipment prototypes to interested entrepreneurs.

Inputs

Expert in food processing equipment manufacture 2 w/m per country X 6 countries = 12 w/m	US\$ 150,000
National consultants in food-processing to coordinate field activities, 3 w/m x 6 countries	12,000
Preparation of demonstration workshops	12,000
Food processing prototypes	15,000
Materials and supplies for manufacture	15,000
Miscellaneous	5,000
Component total	US\$ 209,000

5. Immediate objective 5

To promote and develop commercial machinery prototypes for all participating countries.

The immediate objective has the following sub-objectives:

(a) To acquire from LDCs, RNAM member countries and other sources, commercially available machinery identified as needed in the agro-industrial system project for adaptation to local conditions;

(b) To test, modify and replicate the prototypes acquired from other countries and introduce them to farmers, manufacturers and potential entrepreneurs dealing in custom hiring and

(c) To promote the commercial manufacture of the adopted prototype through marketing strategies.

Background information

Often a machine that is suitable for the job in the agricultural production or processing stage in the agro-industrial system is available from other countries. Effort, time and money for R&D to design and develop a machine will be saved if the machine could be acquired through an institutional facility like the Regional Network for Agricultural Machinery (RNAM), a project of 11 Asian countries executed by ESCAP.

The National Focal Point (NFP) in the recipient country turns over the

machine to the R&D institution most appropriate for testing, modifying and adapting the machine to work under local conditions. From the experience of RNAM, commercial, rather than experimental prototypes should be exchanged. If no commercial machine is available but R&D efforts have resulted in an experimental prototype, drawings or conceptual designs may be requested as sources of ideas. In all cases of exchanges, proprietary rights have to be respected and permission from the inventor or designer will be obtained.

Output

Entrepreneurs capable of manufacturing the introduced prototypes in respective countries.

Activities

(a) Machinery demand survey of the machines identified under Phase I. The initial list of hand-operated tools and devices, animal-drawn implements and mechanical powered machinery is included in the detailed report prepared for each country. The prioritization of the final list of machinery is to be done by the NFP in consultation with the leaders of various sub-projects, the R&D institution members of the NN and the agro-industrial machinery expert.

(b) Testing, modification and field or factory trials of the machine by the R&D group in cooperation with one or two manufacturer co-operators and the farmers or the processors depending upon the application of the machine. This activity involves the participation of several persons connected with the agro-industrial system project. The NFP who plays a lead role in the machinery NN will coordinate the activities of all the people involved to ensure success of the sub-project which involves perhaps more than one machine to be developed. Typical assignments are fabrication by a co-operating manufacturer of a modified component or assembly, testing of a part for durability by the engineering laboratory of a university, organizing a discussion group to brain-storm on possible solutions to a technical problem, machinery trials in a farmers field or in a processing plant to demonstrate the superiority of the machine over the traditional or existing ones, replicating the machine in one or more manufacturers' workshops, organizing demonstrations for introducing the machines, conducting trial custom work or renting services in cooperation with an entrepreneur, mapping out strategies with the extension units with technical backstopping by the R&D units, etc. The avenues for collaboration are many.

(c) Monitoring and evaluation by organizing demonstration workshops at the end of the manufacturing process.

(d) Extension and commercialization of the machines. These activities are covered by a strategy suitable for different agro-ecological zones of the country. Farmers, agro-industrial processors, manufacturers and repair work service entrepreneurs are the important targets of the extension activities.

Inputs

Agro-industrial machinery expert from the region (8 w/m)	US\$ 92,000
National consultants (16 w/m)	30,000
Demonstration workshops	20,000
Procurement of commercial prototypes - At least 3 machines/country x US\$ 2,000/ machine for 8 countries	50,000
Replication of prototypes for demonstration	30,000
Miscellaneous	20,000
Component total	US\$ 242,000

BUDGET SUMMARY

US\$

Objective 1 (networking)

Component total covered by contributions in kind

Objective 2 (raw material databases)

Personnel	28,000
Equipment	54,000
Miscellaneous	<u>10,000</u>
Component total	92,000

Objective 3 (village metalworking)

Personnel	90,000
Training	30,000
Equipment	25,000
Miscellaneous	<u>10,000</u>
Component total	155,000

Objective 4 (food-processing equipment)

Personnel	162,000
Training	12,000
Equipment	30,000
Miscellaneous	<u>5,000</u>
Component total	209,000

Objective 4 (commercialization of prototypes)

Personnel	122,000
Training	20,000
Equipment	80,000
Miscellaneous	<u>20,000</u>
Component total	242,000

Common expenses

Administrative support to RNAM/ESCAP office	30,000
Travel non-UNIDO staff	40,000
UNIDO staff travel	20,000
Equipment for overall project support	10,000
Miscellaneous	<u>20,000</u>
Component total	120,000

Project total 818,000

B. Lao PDR Country-specific project

Technical training in priority subsectors for small-scale industries (Component II of the GOL/GTZ/UNDP/UNIDO/Asia Foundation Small Business Promotion Programme)

A. **CONTEXT**

A.1 Problem to be addressed

Based on the Lao Urban Labour Force Survey (July 92) conducted in 5 major urban areas, 45% of the work force were self-employed; about 79% of the self-employed had no education or only primary education. Among employers, 40% had a primary education and 36% has secondary education or above; 6% of them had no education. An inventory of technical and professional training institutions (UNDP 1991) reveals that short skill-upgrading courses and services to enterprises by these institutions are not adequate. The survey of household/productive units carried out by ADB (1992) confirmed that lack of skilled labour is one of the constraints faced by small enterprises in the industrial and services sector. The situation is compounded by the fact that those enterprises lack access to credit and to information sources, particularly on technology. Major obstacles to improvements in productivity and quality are lack of business management, insufficient knowledge of marketing strategies, low level of process technology and narrow product ranges and technology options.

Although there may not be a shortage of skilled labour in quantity (given the number of technical training institutes spread over the country and various fields of training offered), there seems to be a gap between the qualifications of those entering the labour force and the needs of the private sector. Low levels of technical training are leading to low productivity, poor product quality, poor enterprise performance and inefficiencies. The small entrepreneur has no opportunity to enhance skills through short practical courses.

In view of the above there is need to focus on appropriate technical training, with a view to help enterprises improve their product design, production process and finishing techniques which will enhance productivity, get exposure to new, appropriate technologies, as well as improve market potential.

A.2 Target beneficiaries

The Programme Component will benefit existing and prospective small entrepreneurs in selected priority sub-sectors in improving their production process, product design and quality and productivity of the enterprise.

In addition, the capacity of selected national technical training institutions involved in the preparation and conducting of the training will be strengthened. Moreover, the focal points in the selected provinces will be involved in the

preparatory work of the training and thus learn how to promote and organize such activities.

Indirectly the people at large will benefit from the improved quality of locally produced goods and services. They will benefit from the growth of the small business sector through additional employment and income opportunities as well as better standards of living.

A.3 End of programme component situation

Targets to be achieved at the end of the operational phase of the component include:

- (a) Improved technologies and production processes in those enterprises participating in the six technical training programmes in 3 priority sub-sectors in each of the 4 selected provinces.
- (b) New products produced and/or quality of previously manufactured products improved.
- (c) Capacity of selected training institutions to organize such practical training programmes strengthened.
- (d) Improved energy efficiency and environmental performance through better/modern production techniques.
- (e) Improved coordination between enterprises of the same subsector including among various sizes.

A.4 Rationale for UNIDO involvement

Private sector development and poverty alleviation feature among UNDP's central development themes for the 1990's. In order for domestic investment in small enterprises to assume the role of an 'engine of growth' in Laos, the requisite policy framework and promotional measures have to be introduced to foster local businesses. In addition to an enabling policy environment, effective institutional support to promote small business development are prerequisites in achieving the objectives.

There is a need to help small enterprises to improve product design and quality, the production process and finishing techniques. The programme component constitutes an effort to facilitate access of small entrepreneurs to practical technical training in their field of business and build up local capacity by carrying out the training with involvement of local technical training institutions.

There is a lack of national expertise to implement the programme component. GOL calls upon UNIDO as the implementing agency, to provide technical support in implementing the component, given its sectoral specialization and experience in specific sub-sectoral development in many countries over the years.

B. PROGRAMME COMPONENT

B.1 Objective, result and activities (outline)

Immediate Objective 1:

Assist in improving production techniques and product quality through upgrading skills of entrepreneurs in 3 priority sub-sectors (tentatively agro-related metalworking, garment and woodworking industries).

1.1. Output 1:

Technical skills of 90-120 entrepreneurs upgraded in each of the three selected subsectors.

Activities:

- 1.1.1 Carry out technical training needs assessment through the activities of MIH focal points and consultations with small business community (linked with activities under UNDP Component I on small business policy and programme coordination).
- 1.1.2 Identify host institutions for conducting short technical training programmes through MIH focal points at the province level.
- 1.1.3 Select international experts/trainers and finalize the programmes for the training. Two training programmes in each of the three priority subsectors are foreseen. The training and process demonstrations will be repeated in each of the four provinces and will have 15-20 entrepreneurs per course. Prior to the training, the entrepreneurs participating in the training will be visited by the trainers.
- 1.1.4 Assist the selected host institutions to arrange the logistics and to develop the training programme with assistance from international experts/trainers. This activity will be carried out with the objective to improve the capacity of the selected institutions to conduct similar practical training in the future (with external trainers as necessary). In selecting the training location, an existing enterprise may be chosen as a venue for the practical training.
- 1.1.5 Conduct technical training/process demonstrations in the selected sub-sectors (based on the identified needs of small business with inputs from programme component I).
- 1.1.6 Provide training extension services subsequent to the training. After a period of approximately 2-3 months, the trainer is expected to visit the enterprises to assess the impact of training on production process and product quality, and to provide on-the-spot advice.

B.2 Inputs:

Government inputs:

- national component director (MIH) who will also be responsible for coordination with other ministries and institutions (particularly the technical training institutions) to ensure their support and full collaboration in the implementation of the programme component;
- staff of selected technical training institutions (part-time)
- staff of focal points;
- training venue as required; and
- office space, office furniture.

UNIDO inputs:

- short-term consultants (12w/m; 4 w/m for each sub-sector; split missions: 2 w/m for preparing and conducting the training programme, including post-training evaluation; 2 w/m for follow-up training extension activity 1.1.7;
- local travel;
- local expenditures for training;
- expendable equipment (training materials, materials for process demonstration etc.); and
- miscellaneous.

C. COORDINATION AND LINKAGES BETWEEN COMPONENTS AND WITH OTHER PROGRAMMES

The programme component will maintain continuous linkage to Programme Component I and to the Programme Component implemented by GTZ -establishment of a multi-sector institution for entrepreneurship development and management training. Technical and management training should be complementary; therefore entrepreneurs attending various training programmes will be assessed for their training needs for management or technical training respectively and referred to the appropriate training course.

The programme component will also maintain linkage with the component covering credit to small business. The technical training provided may entail investment in new equipment to enable improvement of processes and products. In such cases, the impact of the training can only be achieved if subsequent investment can follow to improve the production process.

The preparatory activities in agro-related metalworking industries and food-processing industries in all Asian and Pacific LDCs, carried out under the UNIDO Special Programme for the Industrial Development of Asia and the Pacific (projects US/RAS/92/072 Promotion and Development of Agro-related Metalworking Industries in LDCs, Phase II, and XP/RAS/92/038 Programme for the Development

of Agro-industries in LDCs), have resulted in detailed proposals for interventions in these industries in Lao PDR. Those proposals will be incorporated, to the extent feasible and relevant, in the present project on technical training for small scale industries.

The programme component will attempt to establish TCDC arrangements to recruit technical trainers from South East Asian countries.

D. SKELETON BUDGET

International personnel (12 w/m, short-term consultants; 4 w/m for each sub-sector selected)	US\$ 120,000
Local travel	15,000
Organization of training programmes (six)	15,000
Expendable equipment (training materials, materials for process demonstration)	20,000
Miscellaneous	10,000
<u>TOTAL</u>	US\$ 180,000

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9. Phanthavong, Somvang, J. M. Schiller and A. C. Morales. Farming systems research in the rainfed lowland environment of the Lao PDR. Paper prepared for Asian Rice Farming Systems Meeting, Suweon, Korea, 30 August to 3 September 1993.

TERMS OF REFERENCE

JOB DESCRIPTION
US/RAS/92/072/11-01

Post title: Expert in Agro-related Metalworking Industries

Duration: 10 m/m

Date required: 1 March 1993

Duty station: Bangkok/Thailand, with travel to selected LDC's of Asia and the Pacific Region

Purpose of project:

The purpose of the project is to provide assistance to the Least Developed Countries in the Asia and Pacific Region in terms of technical support to agro-related metalworking industries through fuller utilization of existing networks, technology exchange and promotion of TCDC. Preparation of detailed technical cooperation programmes in the areas of raw material procurement and cottage industries is also envisaged.

Duties:

The duties of the expert will be as follows:

- o collect data on ECDC/TCDC potential through visits to member countries.
- o provide ad hoc technical advice to enterprises and R&D institutions during field visits.
- o identify concrete prototypes needed in the participating countries.
- o establish the final list of prototypes to be exchanged.
- o undertake a preliminary review of needs, in the countries expressing interest, in the following areas:
 1. Raw materials procurement;
 2. Support services for cottage industries;
 3. Concrete programme for the development (identify constraints in the agro-related industries, and suggest possible remedies, including technical assistance projects.

o suggest projects to be formulated by UNIDO, and prepare some project concepts for further development by UNIDO.

Qualifications:

A mechanical engineer with extensive experience in metalworking, specifically related to the production of agricultural equipment, as well as product techniques.

Language: English

Background information: Refer to the project document.