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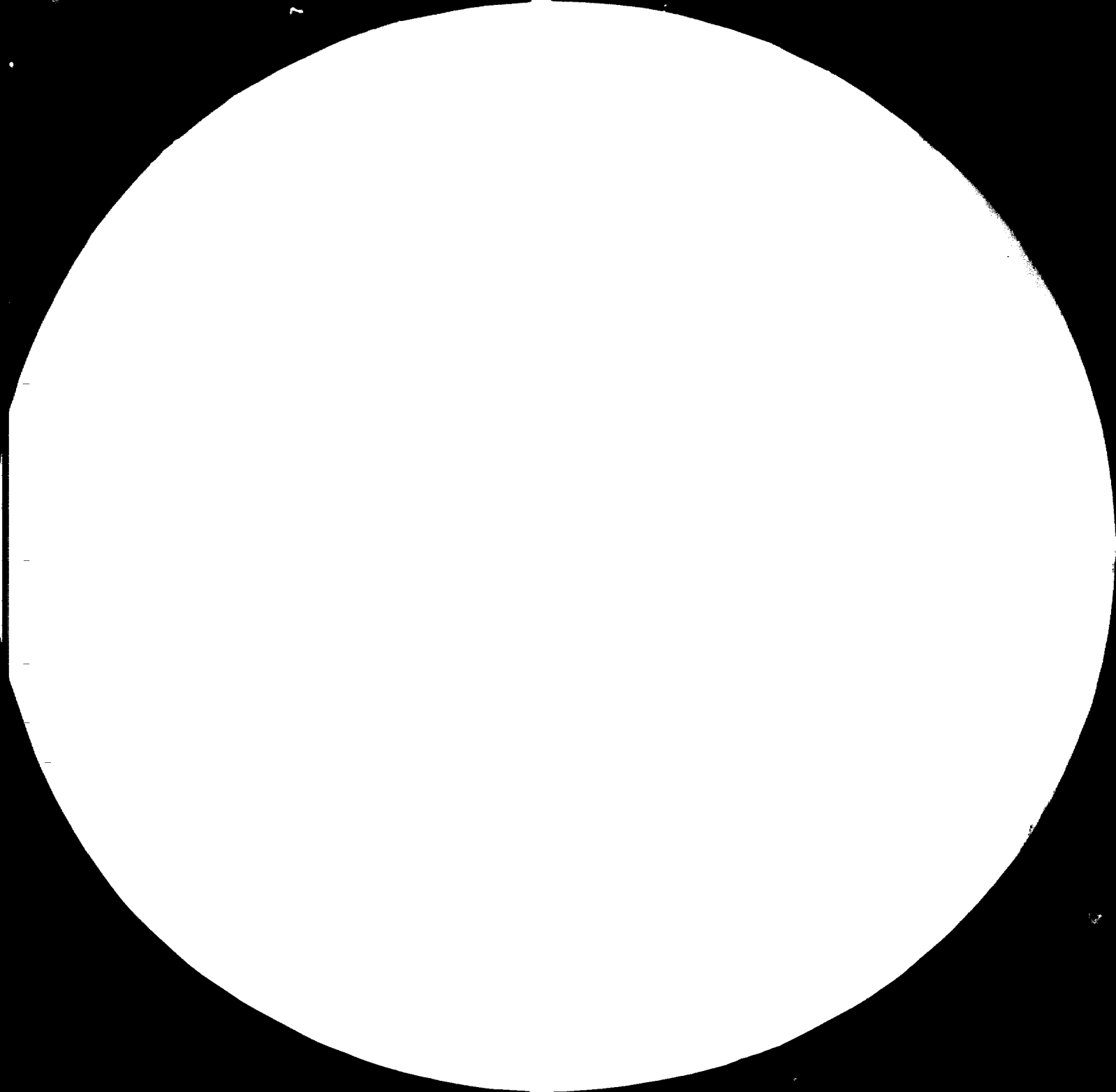
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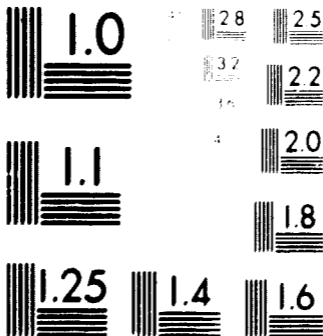
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MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

S.M. Bijli

1979

(R) AGRICULTURAL MACHINERY INDUSTRY. Country studies of the  
Arab and ESCAP regions.

Note to Mr. Hewlett:

11862

I enclose herewith, the country study of the Arab and ESCAP regions on the position of agricultural machinery. I have prepared this on the basis of the discussions I had with you and the directions given to me by Messrs. Swamy-Rao and Pagani. My observations about the status of agricultural machinery in the Arab and ESCAP regions is based on the information I could gather from the various documents, reports, articles and the UNIDO files on agricultural machinery which were placed at my disposal for reference.

Information referring to the following countries has been gathered in the Arab and ESCAP regions:

Arab region

- |            |  |
|------------|--|
| 1. Algeria | 8. Saudi Arabia                          |
| 2. Sudan   | 9. Egypt                                 |
| 3. Iraq    | 10. Lebanon                              |
| 4. Kuwait  | 11. Libya                                |
| 5. Jordan  | 12. Yemen Arab Republic                  |
| 6. Morocco | 13. Peoples Democratic Republic of Yemen |
| 7. Syria   |  |

ESCAP region

- |               |                |
|---------------|----------------|
| 1. India      | 5. Indonesia   |
| 2. Pakistan   | 6. Philippines |
| 3. Bangladesh | 7. Korea       |
| 4. Thailand   | 8. Sri Lanka   |

14 May 1979

000415

## ARAB REGION

On the basis of the relevant documents, files and other literature that were placed at my disposal, I have been able to make the following observations. Detailed country studies have been prepared for each country of the Arab region which I attach herewith for reference. My findings based on these country studies, however, have been summed up as follows:

That there is no policy on agricultural machinery on the whole in the Arab region.

In all Arab countries one could feel the need for developing agricultural machinery.

All Arab countries are deeply concerned with improving food production and in fact most of the Arab nations have crash programmes.

Countries such as Algeria, Sudan, Tunisia, Libya, Yemen Arab Republic and Iraq, have given special emphasis for agricultural development in their development plans.

In Sudan there is a deep-rooted prejudice against the use of animal-drawn implements due to high cost of maintaining farm animals which require feeding all the year round. Hence people depend on mechanization. Application of tractors is unavoidable. There is a need to develop and establish medium-size manufacturing and assembling industries for tools, bars, ridges, ploughs, pumps and other simple machinery and for manufacturing the complete repair and maintenance set up with the aid of experts.

Most of the Arab nations lack technicians both in industry and in the field of agricultural engineering. There is also the problem of migration of the technical personnel. Sudan and Egypt for instance, are finding emigration to Gulf countries due to attractive opportunities.

Research and development is absolutely the word talked about in most of these countries. But nothing has been in evidence in actual fact. UNIDO can play a significant role in this field. However, a testing research station for agricultural machinery and tractors is located at Alexandria in Egypt.

Arab countries in general have no facilities for repair and maintenance of agricultural equipment and it is, therefore, the Government is interested in a national programme in repair and maintenance of agricultural

equipment. Sudan depends on mechanization since the application of tractors is unavoidable for all tillage and seed bed preparation work in irrigated as well as rain-fed areas, yet the country does not have a complete repair and maintenance set up with expertise. In fact, no major efforts have been made to initiate a repair and maintenance programme in the Arab region.

Training is another bottleneck. Training facilities are lacking in the Arab region. Only Tunisia has a training programme for training tractor drivers, mechanics, operators, etc. at the North African College of Agriculture set up under FAO assistance. To a certain extent in Algeria, training is offered to improve the qualification of the users of the equipment on the farms. But the trainees are normally farm workers.

Almost all Arab nations depend on imports of agricultural equipment. Libya, Kuwait and Saudi Arabia, for instance, depend entirely on imports of agricultural implements and machinery. They have virtually no local production of agricultural implements and even small tools such as spades, shovels, and axes are being imported. At Tripoli, however, there is a general industries corporation manufacturing trailers and water tanks. In fact, Libya in the Arab region is the most mechanized country. The Yemen Arab Republic is trying to establish a pilot manufacturing unit for the production of hand tools, pumps and other tillage implements and also trying to establish agricultural repair and maintenance programmes on a continued and regular basis.

In Saudi Arabia, farm holders still struggle with traditional tools and implements rather primitive and inefficient. Although the Kingdom has placed great emphasis on research and development in agricultural mechanization, nothing has been done so far.

In general, almost all countries of the Arab region import agricultural machinery and tools and implements. In the Democratic Republic of Yemen, agriculture is receiving a lion's share of development of Yemen's development plans; the USSR is co-operating in agriculture and health projects.

It seems to me that the majority of the countries and their governments and organizations are unaware of what and how far UNIDO could help them in this regard. Little is known about consultations and I feel they would be eager to have it. UNIDO has sent several missions which I could note from the UNIDO correspondence, but I do not follow-up

measures need to be taken in this direction. There is great potential for these countries to benefit from UNIDO in the field of consultants, expertise, training and financing. Also there is great need to publish relevant literature in the Arab region in this regard and to be widely circulated among the countries to elicit possible co-operation and help for the mutual benefit of themselves.

These countries are still not in a position to use the sophisticated grades of agricultural machinery for industrialized countries and hence equipment and machinery which is made by some of the advanced among the developing countries may suit their requirements. It would appear desirable to identify some of the tools and equipment and to test them for their suitability and adaptability so that such of them as may be acceptable and suitable in this region be propagated and encouraged on a large scale basis with much supportive measures like training, repair, maintenance, equipment, etc.

## ESCAP REGION

ESCAP region comprises the countries of South and South East Asia. There are a number of countries in this region. The position of agricultural machinery in eight countries of this region, namely India, Pakistan, Bangladesh, Indonesia, Thailand, Philippines, Korea and Sri Lanka is summed up as follows. Individual country study is also made which is enclosed for reference.

My observation is that in all the above countries, the primary occupation of the people is agriculture, and agriculture is on subsistence farming. Rice is the predominant crop of this region. The average size of a holding is 3 hectares. However, efforts are being made to increase the tempo of agricultural development through multiple cropping and high yielding methods.

All countries of this region produce power tillers and pumps. Large numbers of rural artisans are manufacturing hand tools and bullock-drawn ploughs. They are skilled artisans but are not able to make a real living. In most of these countries, the artisan or urban workshop has the skills to imitate designs and to carry out fairly complex manufacturing operations. Training of rural artisans is a great necessity. The Indian Government is the only one which is trying to train farmers in the plant protection equipment etc. The evolution of better farm tools is thwarted by limited indigenous research and follow-through to create commercialization.

There are so many obstacles in creating and commercializing agricultural technology. These constraints are caused by cultural, social and psychological factors and others at the specific enterprise level. Existing system of land tenure in many nations of South East Asia also constitute a barrier. Lack of physical infrastructure facilities, of ancillary industries such as foundry and forge shops, of essential materials such as low-alloy steel, of capital - especially foreign exchange - poor inconsistent Governmental promotional policies and the existence of bureaucratic procedure and of package deals tied to foreign aid which tend to inhibit indigenous initiatives.

Attention to mechanization of the farm is negligible. However, increasing efforts are being made in the last six to eight years for improvement of farming methods.



Low level of existing technical education is a great constraint. Many do not yet have agricultural and mechanical engineering curricula in their educational system and vocational schools are also only now being initiated. However, learning by doing is generally more effective than formal technical education. A serious gap exists in management, entrepreneurial and consultancy abilities.

Unless the farmer has a long-term perspective based on clean ownership, he has no more motivation to invest in expensive mechanization. The scale economies of assembly line production of tractors are not available. Consequently, manufacturing costs are high and in turn markets cannot be expanded. As a result, the high cost price structure persists.

Most serious is the lack of well-suited equipment, designs for the crop and commodities for the Asian farmers.

There are only ten manufacturing firms producing walking tractors, power-tillers and wheel tractors in the whole region. In India, however, agricultural drawn equipment, research and development have gone into the country for the past two years. The result, however, is not reaching the farming community. Research and development should have a regular budget. In the Philippines, agricultural manufacturing associations have effective co-ordination between Government and manufacturing bodies. In the Philippines, India and Pakistan, infrastructure is available which is strengthened day by day. In Pakistan, the national farm mechanization Committee of Pakistan, deals with extension, inputs, mechanization, etc. Most of the countries in this region are taking similar steps. There is a great need, however, to develop an agricultural engineering department in every country of the region.

Most of the South East Asian countries do not have power. Power requires some form of energy and many of these countries have no resources of oil - the hitherto primary source.

The reasons for the failure of tractor mechanization programme in this region are:

1. Short life of tractors due to poor maintenance and operation;
2. Low degree of utilization due to poor management;

3. Poor land clearance and small field size;
4. Inappropriate equipment for the ecological conditions;
5. High cost (foreign exchange) for equipment, spares and fuels subsidies by Governments through fiscal measures.

In the long run, heavy tractorization is generally labour substituting. The available manpower is not properly mobilized in most of the countries of Asia, and not given the opportunity to do responsible work. Technical leaders have to be formed and developed. Given the leadership supported by forward looking Government policies, the existing technicians can themselves create the right agro-equipment and commercialization.

Nationalization policies are desperately needed in every country of the ESCAP region. Although much is known about mechanization, it is commonly misunderstood. Almost every farm wants it. There is, therefore, need for a comprehensive feasibility study including the analysis of cost-benefit ratios effect on employment and other social factors.

In fact, after fertilizer, the purchase of agricultural machinery is the largest single expenditure incurred by the farmer. This constitutes a substantial backward linkage to the manufacturing sector. The requirements of agricultural machinery are rising significantly, with Asia itself importing over US\$ 500 million worth of agricultural equipment.

The Indian Institute of agriculture and other organizations have evolved a number of simple hand-tools.

UNEP/UNEPED have sent several missions and survey teams to this region to explore the possibilities of manufacturing tractors and other implements. These Organizations have also conducted a manufacturing clinic on animal-drawn agricultural implements etc. from 21 to 30 October 1974 in New Delhi. Further, ECAFE and UNDP and FAO also sponsored a number of follow-up missions towards this end.

The ECAFE pre-investment feasibility survey team on industry manufacturing tractors and power tillers visited the region in October/November 1971 as directed by the Sixth Session of the Asian Industrial Development Council in January 1971. This survey team observed that:

(i) heavy demands for agricultural tractors and power tillers are to be expected in the near future in the ESCAP region;

(ii) manufacturing of agricultural machinery in this region has not been developed satisfactorily owing to lack of investment, capital, technology, and trained manpower. There are many small-scale manufacturers of tractors, power tiller implements, animal-drawn implements, etc. in the ESCAP region.

The International Rice Research Institute (IRRI) has developed low-cost power tillers with 4 to 6 hp engines.

There is a need for permanent regional institute for agricultural machinery for regions co-operating in the solution of common problems encountered in farm mechanization and farm machinery industries.

While UNIDO/FAO/ESCAP and other international agencies can provide some technical inputs to catalize action, the initiatives, the formulation of policies and the implementation of course, depend upon the Governments themselves. As the agro-equipment industry gathers momentum, other institutions such as professional societies and manufacturers, trade associations, etc. could play a significant role in accelerating technology transfer process in the ESCAP region.

Mr. Bijli  
30 May 1979

ALGERIA

Algeria's principal activity is agriculture. Due to the climate and irregularity of rainfall during the year, agricultural potential could not be increased. Algerian agriculture is structurally non-homogeneous. It includes both a modern and traditional sector which to a great extent correspond to the former Colonial agricultural holdings in its structure.

The country has approximately 200 million hectares and in terms of territory it is one of the largest countries in Africa. Due to the vastness of the Sahara, 4/5th of its territories is non-arable. Arable land constitutes only 20% of the territory of which an important part is taken up by common pastures and grazing land.

With the emphasis on agricultural mechanization and a high level of utilization of agricultural machinery and implements in Algeria, the Govt. of Algeria has given priority to the local manufacture of tractors and matching agricultural implements.

Holdings within the self-managing sector are quite well mechanized. These holdings are equipped with machinery ranging from implements used in the cultivation of soil to those used for harvesting such-soil ploughs, stubble ploughs, plough harrows, tractors, sprayers, reaper-binders, combine harvesters, stationary threshers and pick up presses.

Standard tractors 40-60 hp. are the most common power unit in Arab Countries in general and Algeria in particular. Two wheel power tillers (Walking tractors) are used on a very limited scale. (Ref. Ideas/MS 7/29/79 Second Industrial Development Symposium Arab States 10-1970 or 1971 UNIDO Document).

Three medium scale firms manufacture around 1200 ploughs (all type including animal drawn), 750 harrows and cultivators, 75 trailers and 200-300 units of crop protection equipment.

National Corporation for mechanical Engineering established in 1967 is responsible for the manufacture of machinery and agricultural equipment. Other state owned firms manufacture agricultural equipments such as harrows, trailers etc. (reference: Country Study Report: Status of agricultural machinery in Algeria by the Office of the Director General. National Material Agricola, August 1969).

Government interested in a national programme in repair and maintenance of agricultural equipment. National Bureau of agricultural equipment interested in establishing facilities and testing on a national scale to assist local manufacture programme. The National Bureau of Agricultural Equipment is also responsible for the acquisition, maintenance and repair of agricultural machinery. For this purpose it is maintaining workshops scattered throughout Algeria. Presently, 10-12 regional workshops are in operation.

Training is offered to improve the qualifications of the use of this equipment in the farms. The trainees are normally farm workers.

The work programme of the Government includes (i) establishment of a tractor and engine factory at Constantine (5000 tractors and 10,000 engines); (ii) establishment of a factory for the manufacture of implements, crop protection equipment and trailer at Sidi Bél Abbés and a factory for the manufacture of Pumps at Media. Sonacome manufacture wheel and crawler tractors, diesel engines, cycles, motor cycles, light transport vehicles, trucks and industrial vehicles and pumps.

Establishment of a tractor and diesel engine manufacturing factory is under progress.

#### UNIDO's role

1. Request from the Government of Algeria for assistance to formulate agricultural machinery design, development, testing and technical service factories (Ref. 1969/72, (Algeria) 4).
2. Agricultural machinery implements project formulation mission (Ref. 519/70/760 ALGE-11 PD/A2 519 GA220, ALGE 11).
3. Request for an UNIDO expert in agricultural machinery implements and design development testing and technical series, 1971.
4. Mr. Swamy-Rao's mission to Algeria in 1971. (S.I.S. financing 6 m/m for expert to elaborate the project proposal, assistance to formulate agricultural machinery design, development and testing and technical facilities. (Ref. Project UNIDO/72/1669-ALG.4. UNDP. ALG/72/810).

5. UNIDO Voluntary Contribution financed Project. (2 Mobile units, workshop machinery, 9/m/m expertise) Project VC/ALG/69/004, \$ 138,500 with supplementary SIS expert of 3 m/m. )Project ALG/72/810.).

6. Under the I.P.F. was included the project "Establishment of an institution for training of technicians in agricultural machinery repair and maintenance". April 1973.

7. UNDP recommend financing through Consultants, Components of UNDP (UNIDO) S.F. Project.

2 Experts for repair and maintenance of agricultural machinery. Long term programme on design, development and testing of machinery. (1974-76). Long Term Consultants programme.

Mr. Bijli/rs  
30 May 1979

SUDAN

Economy of Sudan depends heavily on Agriculture. The contribution of agriculture to the GDP in 1968 was 200 million pounds out of a total of 461.6 million for all industries almost half of the GDP (Source: National Accounts and supporting tables 1968. Ministry of planning, July 1970).

Almost all export earnings are from Agricultural products. Cotton exports alone earned 41 million pounds in 1968 out of a total of 84 million pounds.

There is a deep rooted prejudice against the use of animal drawn implements due to high cost of maintaining farm animals which require feeding all the year round.

Government made a provision for setting up a factory for agricultural machinery in its f.y plan 1971-72/1974-75. Government of Sudan has given priority to agriculture in its development policy.

Water supply in Sudan for cultivation is by irrigation and flood from the River Nile and its tributaries.

Sudan has large scale farming system. It has large areas and relatively small farmers. People depend on mechanization and are particular to have tractors, because the application of tractors is unavoidable for all tillage and seed bed preparation work in irrigated as well as in rain-fed areas (Report of FAO Expert Horst Gallus and UNIDO Expert Pratab Jaranan, DA. 220(Sudan)19).

Wide range of agricultural implements are used. Manufacturing facilities are nil. Hence, Sudan depends on imports of agricultural equipments. Hand tools such as shovels, spades, rakes, axes, etc. are imported. Others such as hand hoes (torea) nagama's, Kodankas, Garye's siekls etc. are fabricated by black smiths from scrap iron.

Tractors and agricultural machinery are extensively operated by the Government, stations, schemes and the private sector.

There is need to develop and establish medium size of manufacturing and assembling industries for tools, bars, ridges, planters, pumps and other simple machinery - for repairing the complete repair and maintenance set up with the aid of experts.

Government of Sudan is interested in establishing a tractor assembling plant as well as factory for local manufacture of selected agricultural implements, hand tools, trailers, specialized machines for potatoes, cotton ground nuts and oil seeds, seed drills, fertilizer distributors, and other hand operated machines (IDCAS/KSL/39/4/79 p.6).

Total number of tractors in Sudan is about 14,000 in 1977 and 700 combines. (ref. SEMA enquiry into Arab countries FAO production year 1977 vol.3).

#### F.y plan

Sudan has a five year plan. There is provision in the F.y plan of Sudan for agricultural development. The Government aims to establish an Agricultural Machinery factory between 1973-1975 with an estimated cost 1,00,000 L.S; Also a factory for the manufacture of spare parts for public sector enterprises to be operated between 1971 and 1973 (cost 384,000 LS).

#### Repair

Ministry of Agriculture keen on establishing modern facilities on a major scale for repair and maintenance. Facilities to repair and maintenance are at the Government workshop which are run by skilled artisans but are short of well trained mechanical and agricultural engineers.

#### Training Center

Government prepares agricultural machinery training centres at Barakat, Mascal, El Goras and Kihereika. These centres shall include the following three sections:

1. Advanced machine maintenance and repair;
2. Machine and implement manufacturing
3. Training of technicians and mechanics and other skilled personnel.

Market for tractors is limited. But the market has presumably to be expanded to neighbouring countries.

The Government feels that two sizes of tractors will be demanded in future:

- i) Light tractors for smaller operations (low price class, conventional year with 6 speeds 40-50 hp)



- ii) Heavy tractors for large operations 75-110 hp and hard soil condition

The above two sizes of tractors are to be equipped with:

- i) gear system with six forward speed;
- ii) hydraulically operators three points linkage;
- iii) power-take-off of 540/1000 per hour;
- iv) electric starter;
- v) comfort seat, etc.

#### Design and adaptation

Sudan is interested in establishing integrated facilities for design, development, adaptation, and testing to assist local manufacture. This is due to emphasis by the Government on increased mechanization and large scale utilization of machines and implements in Saudi Arabia.

(UNIDO technical assistance Project of 1971-72, UNIDO-IDCAS Mission indicated possibilities 1974).

#### UNIDO activities

UNIDO technical assistance project 1971-72 UNIDO-IDCAS.

Report of the technical Committee on Agricultural Machinery and implements, December 1970 Khartoum.

Second General Conference of UNIDO, Lima, Peru, 12-26 March 1975, ID/Cong/3, 15 January 1975.

Implications for activities of UNIDO of the recommendations of the UN World Food Conference - Note by the Secretariat of UNIDO.

UNIDO/World Bank Cooperative Programme fielded a mission to Khartoum from 19-27 June 1976 for evaluating the proposals submitted to the Government of Sudan by international manufactures of agricultural tractors and automatic tractors, offering to set up the assembly and subsequent manufacture of these equipments in Sudan. No follow-up action has been taken so far.

Mr. Bijli/rs  
30 May 1979

IRAQ

Iraq has 4,150,000 ha of rain-fed farming and 1,150,000 ha of irrigated farming.

Presently, it has 19,000 tractors and 4,000 combines (Ref. Agricultural machinery report of Arab region, IDCAS, August 1978).

Government of Iraq has placed steady importance on agricultural mechanization. The Government organizations engaged in agricultural production are:

1. Agricultural Projects Committee
2. Project farms and co-operatives assisted by administration such as greater Mussiyab, Klalis etc.
3. Farm operated by the state company for agricultural production.
4. The State organization for agricultural studies providing agricultural machinery hiring services.
5. Co-operatives
6. Farm units not belonging to Co-operatives.

UNIDO sent four experts and three associated experts in the agricultural engineering field (farm mechanization) Iraq/71/530, Iraq 74/541, Iraq 69/575 and Iraq 69/525.

Project proposals for establishment of a farm machinery institute in Iraq with UN assistance was submitted in 1972.

There are 3 agricultural equipment studies in addition to the six major studies in operation.

Government manufacturing programme includes establishment of tractors, and implements at Iskandria.

Capacity 1,200 tractors and 9000 implements per year.

The factory has a capacity of 33,000 implements for 12 types per year.

Engineering section of the ministry of agrarian reform in cooperation with state company for engineering industries is interested in establishing facilities for design and testing.

Regional Cooperation

Arab study conference on regional co-operation was held in Baghdad in May 1972. It was felt that the automotive and agricultural machinery industry Iskandria in view of its large manufacturing capacity may meet all Arab requirements of agricultural implements manufactured in Iraq in the Iskandria factory. (IWP/68/R.S.4. indicative work plan for agricultural development to 1975 and 1985). FAO Rome Production year Vol.21, 1967.

UNIDO's role

UNIDO-UNESOB mission on agricultural machinery and metal working industry, Iraq Republic, 21-26 April 1970.

Agricultural machinery development, design and Project performance evaluation (Mission Zakariah) No. 19/IRQ/71/809 IPF 1973 9 m/m up to September 73.

Report of Zakariah on Agricultural machinery design and development, October 1972. (OA 220 IRQ-16) IRQ/72/015/D/01/37, 12 m/m.

Follow-up action on Zakariah's project proposals on the establishment of an Iraq Agricultural Machinery Institute.

Project No. Iraq/70/016, Iraq 72/015 to assist the Iskandria Industrial complex - one expert (Agricultural Machinery design and development).

MR. Bijli/rs  
30 May 1979

KUWAIT

Scarcity of water is the main problem for agricultural development in Kuwait.

All agricultural machinery is imported. In 1967, Kuwait imported 58,830 K.D.worth of machinery. The position of agricultural machinery in Kuwait as at 1967 were as follows:

175	- Engines
170-200	- Pumps
50	- Sprayers

No agricultural machinery and implements are manufactured, although excellent factory facilities for manufacturing certain special items (small engines and components for regional market is available.

Priority established by the Government for agricultural machinery and equipment and related products.

UNIDO mission on agricultural machinery and metal working industry, Kuwait, April 4-7 1970. (Ref. Beirut, 14 May 1970, Swamy Rao and Abdul Monien).

Mission recommended no assistance in the field of agricultural machinery in Kuwait.

The Arab Fund for Economic and Social Development is a regional development and finance institution whose share capital of KD 100 million is shared by all member nations of the Arab league. This fund requested UNIDO assistance for the development of mechanical engineering industry in the Arab region in 1974.

Institute of Scientific Research established in 1967. Activities in this field of agricultural development was started by the Arid Zone Agricultural division in October 1968.

Agricultural statistics Survey in the villages of Al-Jahra, ABO-Halife, Almagag, Al-Fahaheel and Um-al-shagaya was taken 1967-68, which gives the area of holdings in the villages, land utilization, size of holdings etc.

Industrial Development Symposium for Arab States was held in Kuwait (10-17 October 1971).

UNIDO-UNESCOB Mission to Kuwait in 1970.

Based on 1971 UNIDO-UNESCOB Mission, assistance to the existing factory to produce agricultural pumps and small engines to the Arab regional market was recommended. No follow-up action taken.

Mr. Bijli  
30 May 1979

MOROCCO

Government of Morocco has given importance to the development of industrial sector based on agriculture.

Morocco has 6,735,000 ha of rainfed farming and 500,000 ha. of irrigated farming in 1975.

Presently it has 18,000 tractors and 2,000 combines. Percentage of farm using energy of

Machinery	11%
Animal	52%
Machinery and animal	5%
Manpower	52%

(Reference IDCAS, Agricultural Machinery Report of Arab Region August 1978).

Trailers and agricultural tillage implements and tools are manufactured by the 'A Technologique Marocaine'. Also irrigation pumps. Animal drawn equipment needs further development as well as the introduction of Assembly/Manufacture of tractors and engines.

There are 65 Centres engaged in land reclamation and rehabilitation.

There is great need for machinery repair and maintenance facilities.

The Centre for Agricultural Mechanization in collaboration with agricultural engineering students of the Institute of Agricultural Engineering is contemplating to organize research, documentation testing of agricultural machinery and implements.

UNIDO's role:

UNIDO/FAO/SIS. 70/1137/Ann.5. Mor-015-A(SIS) 1972 on the basis of the general emphasis indicated by the country programme document 1973-1977. Organisation and operation of agricultural machinery and equipment, repair, manufacture and maintenance facilities on the Mor./70/205. (Ref.OA 220 Per.(13)). UNIDO/FAO programming mission (Mor.015-A(SIS) visited Morocco in 1970.

Recommended agricultural machinery plants and facilities (see ECA Reports) assistance in establishing a tractor manufacturing plant (Up to 100. Estimated demand in North Africa around 40,000 up to 1990.

No follow-up action taken.

Mr. Bijli/rs  
25 May 1979

SYRIA

The Syrian Arab Republic has a total of 4,900,000 ha of rain-fed farming and 600,000 ha of irrigated farming in 1975.

Present position of agricultural machinery in Syria is:-

15,500 tractors and 2,100 combines in 1977 (reference IDCAS Agricultural Machinery Report for Arab region August 1978).

The UNIDO/UNESCO mission visited Syria on 28 April 1970. This mission recommended UNIDO assistance in

1. Organization and operation of engineering complex.
2. Foundry technology
3. Forge shops technology
4. Engineering sub-contracts.

These recommendations were supported by El-Halfway UNIDO SIDPA who visited Syrian Arab Republic 11 May 1970.

UNIDO also sent long mission which visited S.A.R. in November 1970. analysed long-term need of UNIDO technical assistance to MGM Aleppo. It recommended 16 m/m years of international expertise and short-term consultancy (Industrial Management, foundry, forge and tractors, cost accounting 3 m/years of fellowship and 60,000 equipment. Total UNIDO contribution 500,000.

UNIDO production engineering expert (UN 220 Syria 23 post Syria - 611) completed one month assignment at Aleppo industrial complex in SAR (August 1970) and analysed the need for integrated UNIDO/UNESCO technical assistance to UN.

The mission recommended a team of 6 experts of 12m/m each.

- (i) Expert in establishment of foundries.
- (ii) Expert in establishment of operation of a forge shop.
- (iii) Quality control engineer for production
- (iv) Production engineer (farm tractor)
- (v) Senior expert in the organization and operation of engineering industries.
- (vi) Senior expert in the organization and operation of engineering industries.

(reference SYR - 015 - A/515 Shabaner report on rationalization of agricultural machinery in S.A.R. October 3, 1973). (See page 2.)

Government of Syria decided to erect a tractor factory at Aleppo. Aleppo factory started operation officially 13 December 1972. (UNIDO approved Projects IS/Sept/71/809 Project Report on Aleppo; Assistance to mechanical engineering complex Aleppo (File No. t/12/17 220 SYR 26 March 1972).

Bilateral Hungarian-Syrian cooperation on agricultural machinery assistance to agricultural implements factory (potential UNIDO-Hungarian farm machinery, Research Institute Cooperative Programme).

Agricultural machinery design and development and product performance evaluation (Mr. I. Blonci) No. IS/SYR/71/810, 12 m/m up to September 1973).

Rationalization of agricultural machinery implements manufacture Shabanaore, see page 1.

IDCAS work programme (field survey of Industrial Legislation in Syria 1972/73. Final report UNIDO, design and development adaptation and testing of agricultural machinery implements (Istvan Boloni, Damaskus 1973).



Mr. Bijli/rs  
24 May 1979

## EGYPT

Egypt is a Semi-industrialized agricultural country. In 1975 industrial production represented 40% of the GNP, whereas, agriculture contributed to about 60% of GNP.

Egypt has a five year plan (1976-80) - aims at an annual rate of growth of GNP between 7 and 10%.

Anticipated planned growth rate during the period 1975-80 is: 20% agricultural production; 60% industrial production; 30% construction.

Animal drawn agricultural implements and hand operated machines and simple power equipments were in use in Egypt till 1960. From 1960 onwards a revolution in farm machinery has taken place.

Egypt needs mostly tractor drawn agricultural implements and machinery for use as tractors above 60 hp. (Reference UNIDO draft project document, 15 July 1975).

Manufacture of some type of tractors and farm implements and mechanization of farm have found their way to the heart of villages in Egypt.

There is a tractor factory at Halven. It manufactures 1500-2000 tractors per year. A number of engineering units exist and they produce ploughs, trailers, sprayers, pumps and threshers.

A testing research station for tractors and agricultural machinery is located at Alexandria (1962) involved in development testing.

Annual production estimated for 1978 for Egypt of agricultural hand tools like axes, spades etc. and the rest for mechanical tools as spanners, hammers, pliers etc.

2000 tons agricultural hand tools.

3000 tons mechanical hand tools.

### Present position

Egypt has 17,000 tractors and 300 combines at present. (reference Agricultural Machinery Report IDCAS August 1973).

Percentage of farms using energy of no kind 38%

Percentage of farms using animal and human energy 44%

Percentage of farms using manpower 18%

(Reference Agro-Industries, Prof. Bassili of Egypt)

Demand forecast

Future demand of tractors estimated at 3,000 units per year for 1980-81. (reference country report ANNEX Egypt) also (study of agricultural mechanization in selected countries of Africa - Progress Report No. 2, 4, 6, 7 and 8).

Agricultural mechanization demand

1. Tractor with rubber wheels with operation service like milling, transportation and preparation of the land for plantation.
2. Tractors with chair for the heavy duty service.

	Required No.	Available at present	Scercity
Tractor with rubber wheel from 55/65 hp	27,000	18,000	9,000
Tractor with rubber wheel from 35/40 hp	8,000	3,000	5,000
Tractor with a chair from 50/100 hp	5,475	4,475	1,000

UNIDO's role

1. The UNIDO draft project document 15 July 1975 recommended a pilot demonstration plant for manufacture of agricultural tools, animal drawn implements and simple hand operated machines with facilities for proto type fabrication, for design, development and expansion and for product evaluation, repair and maintenance and training (a composite integrated project).

Recommended the need for expanding the existing tractor testing station at Alexandria. The project aimed to be the nucleus for training of local technical personnel and thus catalysis rural industrialization and local enterpreneurship and will facilitate promotion and establishment of industrial aspects and facilitate basic training in Industrial technology, production techniques extension, commercialization and management which are essential for transformation into commercial venture.

2. Peoples republic of China cooperative project for supply of samples of walking tractors, hatching implements, multipurpose diesel engines, hatching attachment and machinery and provision of field testing experts with a view to testing farmers suitability, acceptability and suitability with regard to local soil and crop condition etc.

UNIDO- IDCAS mission 2 UNIDO small low-cost tractor report (UNIDO/ITD/202).

Report from H.L. Halfway on 3.7.78 for UNIDO-IDCAS-UNDP. Possible project assistance to IDCAS for the development of industrial inputs for agriculture in the Arab region (agricultural machinery, fertilizers and pesticides plastics etc.)

3. Agricultural machinery: Assistance to small and medium metal working industries for the manufacture of accepted industrial implements (product diversification and production expansion).

UNDP/UNIDO input expert services 24 m/m months in product identification and adaptation (8 m/m).

First mission 4 months  
Second mission 4 months  
Expert in production technology 16 m/m.

4. Workshop in engineering designing capability, technology transfer amongst developing countries of Middle East and North Africa at Cairo 1975.

5. Engineering industries design development center (EIDDC) Cairo established by the Egyptian Government with the cooperation of UNDP/UNIDO.

First Phase 1969-72	UNDP input	\$ 1 million completed.
Second Phase 1973-76		\$ 1600,000 implemented.

6. EIDDC rendered technical assistance to local industries, develop 60 new products, 300 tools, dies, fixtures and trained 70 local engineers. (Stress was on development of design capabilities in horizontal function) (machine tools selection, dies, fixtures, dies, lessons and design of castings, forgings, sheet metal, fabricated items). The aim of the workshop was to promote factory level and engineering institutions level cooperation to build a local engineering designing capabilities.

Mr. Bijli/rs  
30 May 1979

JORDAN

Cultivated area of Jordan covers 13,000 km i.e. 13.4% of the total area and 5.8% of the total cultivated area is irrigated land; and 43.2% depends on rain, 20.9% not exploited because of lack of water.

Number of holdings amounts to 118,776. 98% of the holdings do not exceed 500 donums.

Rain-fed farming in 1975 - 460,000 ha  
irrigated farming - 40,000 ha

Jordan initiated development planning under a f.y plan for 1962/63-1966-67. It was replaced in 1963 by a seven year plan to cover the years 1964-70.

First seven year plan 1962-70 gave emphasis on infrastructure. The agricultural sector was given top priority. The plan aimed at the transformation of rain-fed farming into irrigated farming, use of underground water and new system of irrigation, exploitation of uncultivated land, use of hybrid seeds, fertilizers, corporate farming, marketing and agriculture credit and use of modern agricultural machinery and equipment.

Three pilot units on the use of underground water was started in South Jordan (Ref. FAO/SF Project on dry land farming in 1967 on a 7,000 ha pilot area of Bagaa valley near Amman).

Agriculture suffers from the precarious conditions of security.

Four major Projects:

Dry farming project  
Wheat project  
Irrigated project  
Tobacco project  
Department of crop project \*)  
Department of agricultural research and expansion \*)

\*) To strengthen the Project, a separate department for crop project and another for agricultural research and expansion was set up.

Disc ploughs are used for primary tillage operations in dry land areas where wheat, barley and chick peas and lentils are mostly grown (UNIDO-Barbic mission to Jordan, 8-9 June 1972).

Present position (1977)

Tractor	3,900
Combine	260

Percentage of farms using energy machinery 32%; of manpower 12%; of animal 21%; of machinery and animal 35% (Ref. IDCAS 1978, Agricultural machinery equipment report 1978).

Jordan entirely depends on import of farm machinery. Production of farm machinery does not exist in Jordan.

Government Policy

Farm mechanization just started and only 10% of the required mechanization have been achieved. Implements, sprayers, levellers and combine harvesters are being commonly used. Tillage and sewing operations for lentils have been mechanized.

There is still no significant progress in the successful usage of farm machinery on vegetable crops (tomatos and melons) and olives. No Government subsidy to the farmers is given for the purchase of agricultural machinery.

Government policy is to encourage further mechanization at the early date, of the major cereals, vegetable, crops and others.

In 1968 the position of the total agricultural machinery were as follows:

No of tractors	2,507	Disc ploughs	500
Reaper combines	53	Disc harrows	365
		Disc cultivators	90
		other implements	114

Estimated that there are 1,600 hand operators sprayers  
200 powered knap seeck sprayers  
40 motor sprayers  
35 hand sprayers  
5 powered ducters.

Common agricultural machinery used are:

Standard wheel tractors 60-65 hp,  
disc ploughs,  
disc harrows, and  
trailers and hand operated knap sack sprayers.

Total annual demand for agricultural machinery estimated by UN experts,  
importers and Government officials are:

Tractors 400;  
Disc harrows 50-70;  
cultivators 30-60  
PTO operated threshers 150-200;  
hand operated knap sack sprayers 500;  
deep well pumps (90-180 on depth) 50;  
chisle plows 400.

Saudi Arabia

The Kingdom of Saudi Arabia has a high GNP. Due to lack of industrial skill and experience, a great part of the population has low income. 80% of the income comes from oil. The Government of this country desires diversification of the economy through industrialization. Hence it requested UN assistance to encourage industrial activities.

(Ref. Basic agricultural statistics of the Kingdom of Saudi Arabia. 24 October 1968.)

The Kingdom has laid great emphasis on irrigation, extension of scientific dry-land farming and has placed great importance also on research and development in agricultural mechanization.

The country is experiencing shortages of suitable farm equipment. At present there are no agricultural implements and machinery manufacture in Saudi Arabia.

Numerous small holdings account for as much as 80% of the country's farm total. Farm holders still struggle with traditional tools and implements - rather primitive and inefficient. Their farms rarely offer opportunities for the use of applications of power farm machinery, and this does not permit them to take advantage of the Government's farm machinery hire service which provides farm equipment at very attractive rates.

(Ref. FAO Rome 1965 Expanded Programme of Technical Assistance No. 1611.)

The Government intends to initiate an integrated repair and maintenance programme for agricultural machinery and implements.

(Survey Report mission 7-13 April 1969. (UNEP/UNESCO Liaison).)

Agricultural machinery is important to Saudi Arabia.

They are:

Pump and engine

Centrifugal

Deep well

Submerged

Electrically driven

Tractor: Disc

Patrol

Plant protection equipment:

Generator, low volume sprayer

Harvesting and threshing equipment:

Reaper, hay conditioner, mower

forage choppers and blowers.

Processing equipment:

Seed tractors, seed cleaners.

Other items:

Down attachment,

Loader attachments etc.

- Agricultural equipment: Hand tools, spades, pick axes, shovels, weeders.
- Hand-carried equipment: sprayers, seed treaters.
- Power driven equipment: cultivators, harrows, ridges, seed drill cum fertilizer distributors, planters cum fertilizer distributors, tool bars frame, levellers, mowers, harrow threshers.
- Tractor drawn implements and equipment: disc ploughs, sub soiler, cultivators, ridges, poor hole digger, levellers, land plane and harrows.
- Other machinery imported: Chain tractors with bulldozers, ploughing machinery with tyres. Other ploughing machinery of various types. Harrow machines. Seeding and fertilizer equipment. Seed/fertilizer drills. Plant/fertilizer drills.
- Present position: Saudi Arabia has 2,500 tractors, 550 combines in 1977. (Ref. ID218, agricultural machinery equipment in Arab region. August 1978).

In 1975 rainfed farming 615,000 h.a.  
 irrigated farming 120,000 h.a.

Farm Engineering Centre at Riyadh attached to the Ministry of Agriculture and Water for training technicians, instruction in the field of farm machinery operation and maintenance and in repair practices. It is conducting field tests and demonstrations of farm machinery and mechanized farming practices that are available. This Farm Engineering Centre Project at Riyadh was undertaken by UNIDO in cooperation with the Ministry of Agriculture and Water of the Kingdom of Saudi Arabia.

The Centre is also engaged in the repair and maintenance of small farm machinery and equipment. Yes, there is a need for a shop which maintenance and repair of the equipment in the project area.

(Ref. Country Report on Saudi Arabia Industrial Studies and Development Centre).

UNIDO accepted in principle a survey mission to work out in detail the proposed repair and maintenance and fabrication shop equipment etc. within a two month term of 4 to 6 months. Also to examine the possibility of establishing a plant for assembly of agricultural machinery.

The mission was completed in Riyadh on 15th March 1978. The report of the mission is attached herewith.

(Ref. Industrial Services and Development Centre, Riyadh, UNIDO/FAO, Country Report on Saudi Arabia Industrial Studies and Development Centre, Project UN-11/10-11/1977.)



Ministry of Research and Agriculture Development of Saudi Arabia  
initiated a project on agricultural machinery design and development and  
product performance evaluation. SIS/70/333 SAU - 13 in 1971. Project was  
discussed by UNIDO-UNESCO mission with the FAO field expert at the Farm  
Engineering Centre and the Resident Representative.

UNIDO/FAO technical consultation meeting 8 January 1971. Rome/FAO  
supports UNIDO project.

UNIDO/UNESCO mission on agricultural machinery and metal working  
industries April 7 to 19, 1970.

Organization and operation of facilities for repair and maintenance  
of agricultural machinery. Saudi Arabia. IS/SAU/71/307/11-01).

Project findings and recommendations. Terminal report prepared by  
the Government of Saudi Arabia (George Churchill).

Draft final report, Saudi Arabia organization and operation facilities  
for repair and maintenance of agricultural machinery by Churchill UNIDO  
expert (IS/SAU/71/307) February 1974. Review of past work, present situation  
policies and preparation for the next five years. Han Akked D. G. Research  
and Development: Saudi Arabia Ministry of Agriculture and Water. Agriculture  
Research and Water Development Department (undated).

Final report of the Government of Saudi Arabia (SAU/71/LA) on farm mechanization  
needs and services by Habbat Sal, Farm machinery expert FAO, Rome 1962.  
Report of the UNIDO/UNESCO preparatory mission on Technical Assistance for the  
establishment of a pilot mill project for the Development of Agricultural  
machinery and tools etc. to suit the arid/semi-arid countries of the Arab region.  
(undated)

## Lebanon

Lebanon has an area of 265,000 h.a. in rainfed farming and 35,000 h.a. in irrigated farming. At present there are 4,000 tractors and 60 combines (vide. Agricultural machinery report on Arab region IDCAS August 1978).

The Ministry of Agriculture is interested in establishing facilities for training in repair and maintenance of agricultural machinery and implements to meet the requisites of the "Green Plan".

Faculty of Agricultural Sciences, American University, Beirut engaged in development, adaptation and testing of agriculture implements.

At present there is one central workshop and two training schools at Panar and Abdesh. Three more schools are contemplated.

UNIDO-UNESCO mission on agricultural machinery and metal working industries in selected countries of the Middle East. May 22, 1970, Swamy Rao.

Based on 1971 UNIDO-UNESCO mission, the Government of Lebanon submitted two SIS requests:

1. for design and development
2. for repair and maintenance.

Both these projects completed in 1972.

Based on Bellini report, the draft country programme includes a large scale project on agricultural machinery design and development in the final country programme.

UNIDO missions 23-28 March; 11-14 Nov 1970 to Lebanon.

Lebanon - Design, development, adaptation and testing of agricultural machinery (1970-1974-1975).

Report 1975/76, 1976/77.

Design, development, adaptation and operation facilities for repair and maintenance of agricultural machinery and implements. 1975/76, 1976/77.

WFO report on the position of agricultural machinery manufacturing industry in Lebanon prepared by M. W. L. Bentley for the director of technical co-operation division UNIDO Vienna (Date not mentioned).

Annual report for 1970 for the Inter-Agency Consultation Board by Resident Representative of the UNDP Lebanon March 1970).

## LIBYA

The Government of Libya has ambitious plans to develop agriculture. Currently 800 million hectares are under crops with 268 million hectares under complete irrigation. This indicates that the Government will require a substantial amount of agricultural implements and irrigation pumps.

Farming in Libya is mechanized. At present there are 12,500 tractors and 3,000 combines.

(Source SEMA Engineering in 10 Arab States FAO Production Year Book 1977 Vol. 31). Arab Organization for the Development of Agriculture). in the agricultural machinery and equipment industry in Arab region. August 1978 IDCAS).

Agricultural implements needed must be tractor driven auxiliary equipment such as trailers are required.

Overall policy of the Libyan Government is the promotion of local manufacture of suitable simple agricultural implements, pumps, small engines etc. and/or the importation of appropriate production technology and training of local personnel.

Use of animal drawn agricultural implements is entirely unknown in Libya. The implements currently in use are completely tractor drawn. Almost all implements are imported.

They are:

disc harrows, cultivation tillage, mould board ploughs, fertilizer spreaders, boom hole diggers, water pumps, rollers, hand tillage, hand tools, etc. (only hand tools are made locally in Libya). Lawns, mowers, water pumps (small capacity only).

There are no local manufacturers of these types of equipment.

Virtually no local production of agricultural implements of any kind such as graders, shovels and cranes etc. are imported. However, there is the establishment (via) General Industries Co. Tripoli which is manufacturing harrows, trailers and water tanks.

Production level - small and insignificant in view of easy availability and preference for imported equipment.

Ministry of Agriculture is engaged in growth of agricultural mechanization.

The Ministry has a technical assistance program with the help of which and other industries, local equipment used as outlined. International facilities for development, design and adaptation, and transfer of agricultural machinery and

Research work covering mechanized crop production has been carried out during the past years by the Agronomy section of the Department of Agricultural Mechanization itself.

Further research and trials with particular emphasis on crop rotation, seed rates, depth of sowing, time sowing, types of equipment for different operations in different areas, Certification of Production and soil and water conservation practices.

Thorough study is needed for ascertaining the size of farms best suited for crop production. Under the prevailing conditions in Libya (is) dry land farming and irrigated farming.

No major scale manufacturing programme for agricultural machinery and implements. High priority has been given by the Government to agricultural organization. However, agricultural machinery and implements are considered as an important aspect of industrial development.

(Reps. of FAO No 2060 Government of Libya P.3.)

Major factor in future development of agriculture is the availability of water. At present a large part of water requirement is met from ground water except in coastal and sub-mountain areas where the traditional dry farming continues.

Yemen Arab Republic

The Republic of Yemen is undergoing a rapid transition from a purely agrarian economy to balanced agro-industrial economy.

Agriculture is still traditional, but it is still the dominating factor in the national economy as 90% of the GNP is derived from it.

Water shortage still represents a major handicap to agricultural development. Absence of suitable tools and implements and of agricultural machinery are handicaps for agricultural growth and development.

The Yemen Arab Republic has 1,340,000 h.a. in rainfed farming and 230,000 h.a. in irrigated farming.

At present it has 1,000 tractors.

(Wide, IDCAS Report on Agricultural Machinery August 1978)

The Yemeni Government has initiated a programme in repair and maintenance of agricultural machinery and in establishment of agricultural tools and implements manufacture in small and medium engineering sectors. (Ref. LA 320 YEM. 17 May 1973. From BUBIC, CHIEF, Europe and Middle East).

The Government is interested in establishing pilot manufacturing institutions for the production of hand tools, pumps and other tillage implements.

Submitted 2 project proposals 1973. UNIDO supported this request.

The Government is interested in establishing pilot manufacturing institutions for the production of hand tools, pumps and other tillage implements. (Ref. LA 320 YEM. 17 May 1973.)

The Government of the Yemen Arab Republic intends to establish an agricultural machinery repair and maintenance programme on a community and rural basis.

UNIDO project proposals are:

1. Demonstration pilot engineering workshop for assembly, manufacture of agricultural and industrial tools, hand operated machines and allied simple metal products including local hand pumps with repair and maintenance activities.

2. Pilot demonstration agricultural machinery repair and maintenance station on a community and rural basis.

## People's Republic of Yemen

The People's Republic of Yemen has assigned higher priority to agriculture in its development plans. Agricultural sector is receiving a larger share of development of Yemen's development plans. Priority projects are given to agro-industries.

The three National Development Plans 1971-72 - 1973-74 devoted 36% of the public investment to Agriculture 1975-76 - 1978-79 P. Y. plan aims at increasing agricultural production through an investment of 36% of total public expenditure. At the same period, 25% of total investment is devoted to industry.

The contribution of industry to the GNP is 22% in 1970.

In 1975 the total rainfed farming was 165,000 h.a. and the total irrigated farming 5,000 h.a. At present the People's Republic of Yemen has 1,200 tractors.

(Ref. IWAS Agricultural Machinery Report August 1978).

The USSR is co-operating in agricultural and health projects.

### Role of UN

The UN has provided a total assistance of \$ 26 million in several projects in Yemen ranging from agriculture to health, education, transport, etc. since the start of industrial assistance to Yemen in 1968. The UNDP assistance for the five year cycle 1972-1976 is \$10 million. The UNDP assistance by 1978 developed in to a broad range programme amounting to \$200 million from all sources. (IDP, SIS and regular programme). UNDP has also financed several projects in the agro-industries field such as the purchase of agricultural implements and tools, repair and maintenance of agricultural implements, fertilizers production and distribution, etc.

UNDP has also financed the requirement of the agricultural tools workshop for expanding its production line to include agricultural machinery.

(Ref. OR 410 REV 5 15 April 1975.)

A new agricultural tool factory in prospect. Democratic Republic of Yemen giving agricultural machinery hiring and manufacture.

Possible UNIDO-USSR contribution as a pilot plant.

Assistance to the revolutionary government of Yemen by the D.P.Y. (UNDP, UNICEF, etc.)

The Government requested the expert mission to assist in the establishment of agricultural tools pilot workshop with country. After the project (UNDP) was approved, the Government cancelled the project. (See also the report on the bilateral assistance for the People's Republic of China).

TUNISIA

Mr. Bijli  
30 May 1979

Relatively low percentage of agriculture population in Tunisia compared with the other African Countries - apparent scope for agricultural mechanization in Tunisia.

Production level of agriculture is low. Hence more input into agriculture needed.

In 1975 the rainfed farming amounts to 4,670,000 h.a. and irrigated farming 130,000 h.a. There is no systematic development of agricultural machinery manufacturing sector.

UNIDO recommended long term planning on agriculture. A factory exists to produce implements, tools and allied equipment. Tractors are assembled in Tunisia. Not much progress towards developing higher percentage of locally manufactured components and promotion of locally ancillary and supporting industries.

Government has launched extensive agricultural development programmes and private enterprises encouraged to participate in developments, agricultural and industrial. (Report on Tunisia UNIDO-IDCAS Fact Finding Mission Sept. 1971).

Diesel engines are manufactured locally with the help of imported parts. (69-81% imported parts) Assembling figure during 1970-72 for 3 hp to 102 hp., for 1971 the target was 1570.

So COMESA Co. manufactures higher agricultural appliances like mount ploughs, harrows, tillers, rollers cambridge, water tanks and cultivators etc. 9,000 hectares are engaged in different farms for land cultivation. 1 tractor of 47½ hp. is used on 200 hectares (12 hp. per acre).

UNIDO's role

UNIDO recommended assistance in establishment of agricultural tillage, agricultural machinery plants and other activities based on ECA reports 1969 - both small and tractor drawn (capacity around 2000 tons/year) taking in to account the requirements of Libiya also.

Assistance in the establishment of agricultural equipment plants (seed drills fertilizer distributors, threshers, harvestors) with a capacity of 6000 tons a year.

Assistance in the establishment of a plant centrifugal irrigation pumps (capacity around 3000 tons/year by 1980) taking into account some regional demand in North Africa.

Establishment of agricultural hand implements factory with a capacity of 1300 tons/year by 1980.

Mr. Swami Rao prepared Project Data Sheet with SIS for agricultural machinery manufacture and feasibility study mission. (Expert agricultural machinery manufacture study 3 months).

Programme was prepared to investigate in detail the feasibility of manufacture, project identification, pre.investment analysis and establishment of manufacturing plants in agricultural machinery and implements.

#### Training

Extensive programme for training tractor drivers, mechanics, operators at the North African college of Agriculture set up with FAO assistance. Standards and facilities are very high at the College to help neighbouring Arab countries.

#### Present status of Agricultural Machinery in Tunisia

18,000 tractors and 1,300 combines in Tunisia in 1977. (Ref. Idcas. Study on the Agricultural Machinery and equipment industry in Arab Region Aug. 1978).

#### UNIDO's Role

1971 Fact finding mission Tunisia September 14/20 1971 UNIDO/IDCAS.

1972 Agricultural Machinery and implements manufacturing feasibility study.  
(1 expert 12 m/a agricultural machinery and implements adviser)



UNIDO's Role contd:

1973 Pre Investment Study for the manufacture of tillage implements, fertilizer and seed distributors, threshers, irrigation pumps, and hand tools. (3 experts 36/m/m).

1974 Establishment of pilot demonstration manufacturing units for  
1976 selected items (5 experts - 180 m/m). UNDP contribution to equipment and testing facilities U.S.\$ 500,000.

## KOREA

Even though agriculture is still the most important industry in Korea, farmers still use manual and animal power to cultivate their small area of farm land. The Government successfully completed its First and Second Five-Year Plan and the policy of industrialization. Accordingly various industries have developed. Therefore, the developing industries have brought about rural migration to the urban centres of economic opportunity, the result of which has been a shortage of farm workers. The actual farm population decreased. Hence the necessity of farm mechanization in view of the serious proportions of rural urban migration.

In the Korean War (1950-1952) most of the farm machinery factories were damaged, but by 1968 there grew to be 236 factories out of which 77 were members of the Association of Farm Machinery. Korea experienced difficulties in producing new farm machinery due to difficulties in purchasing raw material, the low domestic demand and the crudeness of production techniques. Initially only small farm tools such as shovels, sickles and weeding hoes were produced. From 1960 onwards, Government began supporting the farm mechanization policy. Yet, a large amount of farm machinery is imported because of the crudeness of domestic manufacturing techniques and the lack of capital.

The Government has established a plan for the utilization of farm machinery:

1. co-operative cultivation association directed by farmers - planned to help establish 1,000 co-operative associations from 1972;
2. joint utilization through agricultural organization;
3. the model farm mechanization district.

In this all procedures, ploughing, soil preparation, fertilizing and transporting will be done by farm machinery. These model districts will play an important role in demonstrating the efficiency of mechanized farming.

4. individual ownership - enterprise scale agriculture or large scale farmers also own their farm machinery.

There is an Institute of Agricultural Engineering and Utilization established at Suwon in 1962. It aims to carry out design and development of farm machines, farm adaptation and evaluation engineering aspects of water management, farm products utilization research and rural energy development.

Due to better design of implements, rice cultivation at present takes 170 hours in low land and 132 hours in upland. Those have been reduced to 80 and 25 hours respectively for 0.1 hectare.

Status of mechanization

In 1966	-	320 power tillers
In 1976	-	122,000 tillers and 164,000 sprayers and dusters
In 1977 the machines in use are:		
pumps	-	95,341
threshers	-	144,700
seeders	-	1,525
straw choppers	-	4,877
rice transplanters	-	84
reapers	-	69
hullers and polishers	-	100,903
engines	-	74,308
motors	-	26,174

(Reference: Country Report ESCAP Newsletter October 2, 1978)

There are two problems of marketing farm machinery in Korea. They are production and supply and demand. From the point of view of production, the industrial technique level is low and capital is small. Hence it is difficult to develop new suitable machines for Korean farm conditions at low price. Secondly, difficulties in purchasing farm machinery. The farm size of Korean farm is small to achieve fast mechanization.

## INDONESIA

Indonesia is made up of 3,000 islands and the five largest island groupings are:

Java and Madura, Sumatra, Kalimantan, Sulawesi (Celebes), Bali and other islands, West Irian and the Irian Jaya.

65% of the total geographical area comprises forest and the crop area is about 23%. Various kinds of agricultural machines and tools are utilized in Indonesia ranging from simple manual tools as hoes, harrows, rakes, ploughs, sickles, etc. to tractors, pumps and modern rice mills. A small proportion of the above-mentioned implements is produced domestically while a larger proportion is still to be imported from various countries.

Agricultural machinery has been put on top among the priorities in the industrial development for which a particular institute is required to investigate and to study its development. Due to low purchasing capacity of the farmers and that of loans and subsidies, the present demand for farm machinery is limited only to simple equipment such as hand sprayers, small pumps and hand tools.

The Government of Indonesia requested assistance for the development of its agriculture and to modernize its agricultural equipment.

The UN ECAFE/UNIDO fact finding team on industrial manufacturing agricultural machinery visited Indonesia from 6-12 January 1969.

UNIDO Field Adviser Mr. Ramm Ericson visited Indonesia between 26-28 August 1971 to discuss the UNIDO proposal for new projects and local production of agricultural tools, implements and machinery, assistance to rice processing machinery, diesel engines, irrigation equipment, hand tractors, hand sprayers and small tools.

UNIDO mission (Mr. Fairbanks) for assistance in licensing and contract negotiations. Assistance in reinforcing agricultural machinery and implements development adaptation, prototype fabrication and testing. DP/INS/72/055.

UNIDO Senior Adviser on basic industry Jakarta for one year. Under this scheme, training for agricultural equipment was also included.

UNDP assistance to the machine and tool design section in the Metal Industries Development Centre Bandung. 11/INS/73/034.

One m/m mission Senior Technical Adviser agricultural machinery and tools design and development (TS/INS/74/003/11-01/01) to formulate a

project including strengthening and expanding activities of agricultural machinery tools, designing and metal industry development centre, Bandung.

UNIDO assistance to the development of agricultural machinery for local manufacture one year. DP/INS/74/XXX/30102 October 1975.

UNIDO assistance for the specification for standardized rice processing units for the use by Boud/Kud and the establishment of co-operative technical facilities. IS/INS/75/XXX/1975.

UNDP assistance for pilot tractor hiring station with stationary workshop. INS/73/035/A/11/37.  
TS/INS/74/002.

UNIDO Consultant Pelizzi and Turrini on agricultural marketing in 1972 (TS/INS/74/002/11-01/01).

Expert recommended that UNIDO should assist the Government in the creation of a Centre for technical training repair and maintenance and organization and machinery hiring service.

Training programme in marketing and management of modern grain storage and drying equipment IS/INS/73/036/A (UNIDO's complementary activity).

UNIDO mission for design and construction prototype rice storage bins in Indonesia (TS/INS/73/003/11-01/01) by Howkey UNIDO expert and Berty Industrial Development Officer recommended:

1. a grain bin manufacturing plant;
2. assistance be given to Bulog for the manufacture of grain dryers
3. a tractor hiring station.

Fellowship for training Indonesians - 5 fellowships awarded.  
IS/INS/74/049 Design and development plant protection equipment.  
TS/INS/74/007 Specification for standard rice procuring units (BUUD)  
DP/INS/74/050 Development of agricultural machinery for local manufacture.  
INS/74/025/FAO Pest Control, improvement in building techniques and training (UNIDO mechanical engineering expert for two years to work out technical aspects of equipment usage and analysis of local manufacture of storage equipment, accessories etc. Assistance to BULOG in the management and production of modern storage and drying system by training local engineers and technicians. TS/INS/74/006/11-01/01. Technical report by Hawkey expert UNIDO 1975. UNIDO policy mission for agricultural machinery repair. INS/76/3 months to assist the Ministry of Agriculture to determine the needs of agricultural machinery repair and to draw an

overall policy.

Country study report on the rice mechanization machinery and implements manufacture in the selected nine countries by Pellizi.

## THAILAND

Thailand is called the rice bowl of Asia. The agricultural population of Thailand is about 75% of the total. 70% of the cultivated land is occupied by paddy fields in which deep and wet fields are up to 50%. The average cultivated land for a farmer is about 3.2 hectares of which 80% is the landowners. They do not use fully agricultural machinery as production tools and the land farming is not enough. The average yield of paddy field is about 2 tons per hectare. The majority uses primitive methods of cultivation. The popular implements are mounted disc ploughs, cage wheels and disc barrows. The size of farm holdings (at an average) is 3-5 hectares per family of 5-6 members. However, since the last 15 years, several large farms have been established and it varies from 16 hectares to 160 hectares.

Agricultural machinery manufacturing industries are still in the early stages of development. Basically there is a wide gap in conditions employed for farming in Thailand - both mechanical and psychological. Different ideas, techniques and primitive ways vary from the North to the central plains and even from province to province. Partially due to varied soil conditions and crops, many unique conditions dictate unique circumstances. At the same time there is a lack of proper methods being employed and proper technological investigation being made to produce larger and more viable cropping. However, the importance of mechanization in Thailand is being realized and the Government is giving important incentives for the development of industrialization. Foreign and local companies are offered good facilities for setting up mining and supplying new plants. Government assistance is being given to farmers towards development of farm mechanization with subsidies, prices of main crop facilities, help in setting up co-operatives and the expansion of the Government irrigation system.

There are no complete manufacture of power driven water pumps in Thailand. The bulk of water pumps used in agriculture are assembled locally using imported engines. Large centrifugal pumps for agriculture and rotary, turbine and reciprocating pumps for industrial and other uses are generally imported as complete units. Hand pumps are manufactured locally and there is reported to be a significant although undefinable number imported.

Presently there are 41 significant water pump dealers and importers in Thailand. These importers are mainly located in Bangkok.

9  
A number of new firms primarily concerned with advanced methods of soil conditioning. The iron baler is widely welcomed.

Four firms are known to manufacture iron ploughs and disc harrows. They are small enterprises and are located up country. The biggest one in Chemburi producing 3,000 iron ploughs per year. Mechanization of agriculture in Thailand has been slow. The reason is the abundance of relatively cheap labour. However, there is great expansion of farm mechanization in Thailand over the past ten years due to the gradual increase in the number of local manufacturers.

Upland areas need large tractors. Animal power is still used in this area not only for land preparation, but also for cultivation. The use of higher horse power tractors, about 70 h.p., is favoured for commercial operations during peak season. Many small manufacturers and local workshops competent enough to produce the simple two-wheeled power tillers and their attachments. Power tillers are widely used since they find it cheaper than human and animal labour. (Reference: Report of the ECAF expert team on tractors and power tillers, 1-7 February 1972).

The report of the expert team recommended the development of 'Asian Power Tiller' by suitably modifying the power tiller used at present in Thailand. ESCAP may collaborate with IRRI in the development and trial of 'Asian Power Tiller'. The team recommended that the Asian Agricultural Machinery Institute should undertake projects to improve the multitude of designs and sizes of agricultural machinery available in the region. (UNIDO/ECAF fact finding team mission on agricultural machinery industry December 1968).

UNIDO/ECAF country report December 1969 and the country report prepared by ASRCT 1970. UNIDO expert assistance in the manufacture of small internal combustion gasoline engines (TMA - 13) and (11). Manufacture of farm and artisan hand tools (TMA - 14) 1970.

Provision of services relating to a study of manufacture of farms and artisans hand tools in Thailand to investigate the desirability and feasibility of the manufacture of farm and artisan hand tools and recommended to the Government a suitable line of action. SIS/71/1/62 TMA 26 - Contract 71/85. SIS/71/1163(Thai-27)PA International Management Consultant Limited, London.

UNIDO -- investment promotion workshop. UNIDO - Centre of design, development and prototype fabrication of agricultural machinery. UNIDO assistance in the field of agricultural machinery, design, development testing. ECAF survey team visited Thailand 18-20 March 1970.



## PAKISTAN

Pakistan comprises an area of over 310,000 square miles divided into four political divisions called the provinces of Punjab, Sindh, North-West Frontier Province and Baluchistan and the areas administered directly by the Federal Government. It is an arid area which has wheat as the main crop. Because of its drier climate, irrigation has been of even more importance in the development of agriculture.

Population is predominantly agricultural, earning its livelihood directly or indirectly from farming. The vast plains of the Punjab and Sindh are called the Granaries of Pakistan. Besides, they also produce the foreign exchange earning crops namely cotton and rice. Agriculture is the largest single sector accounting for more than 45% of the GNP. Notwithstanding the predominant position of agriculture in the national economy, this sector was always neglected in the past and its development was taken for granted. On the other hand, industrialization was given the highest priority and was considered to be the prestige sector. This notion led to the past ills and difficulties of the Pakistan economy. A successful agriculture with growing rural purchasing power that ensures will provide the buoyant demand for manufactured commodities on which local industry can be based. Intensive farming may swell sales of manufactured inputs, open new vistas for agricultural processing industries and will provide employment in farm and rural non-farm occupations.

Realizing this, agriculture has now been given an important place in the development plans of Pakistan. The farming community feels that crop production operations with machines on those farms which can sustain such investment are more effective, timely and economical and result in much better yields. Until 1965 the country depended on foreign sources for such equipment but the drain of foreign exchange resources could not be permitted for an indefinite period. Hence Pakistan developed an interest to promote the establishment of powerful national farm equipment industry in order to achieve perpetual farm mechanization.

There are many tractors, implements, machinery, engines, pumps and allied equipment in Pakistani agriculture. An estimated 30,000 tractors are owned by Pakistanis (UNIDO/ITD 294 1974). A significant number of the same remain idle due to lack of extensive repair and maintenance activity and spare part supply.

The UNIDO fact finding mission on Pakistani manufacturing agricultural machinery with Mr. Swamy Rao and Knepp from UNIDO and three experts contributed by India, Italy and Japan visited 13 countries including Pakistan from 3 November 1968 to July 1969. The team recommended four pre-investment survey missions, six technical study teams and five technical assistance

projects, three seminars and one development agency. The Asian Industrial Development Council met at Bangkok from 12-18 February 1969 and approved the recommendations and recommended the follow-up action.

The UN ECAFE expert team on rice processing machinery (November-December 1969) visited Pakistan to examine the problems involved in processing the different varieties of rice in the countries of the ECAFE region and to investigate the need and feasibility of adopting integrated rice procuring systems and to recommend appropriate rice processing equipment for each variety of rice to identify specific projects for the establishment of the manufacturing facilities on a national and regional basis and submitted the report.

UNIDO mission to Pakistan to assist the Government in the organization and operation of repair and maintenance services, and to assist the Government in the operation of a mobile workshop to be provided by UNIDO through voluntary contributions financing (UNIDO/TCD/254) 5 December 1973.

The expert was attached to the Pakistan Industry Technical Assistance Centre (PITAC) at Lahore which received the first mobile Workshop Gosmiti - 2 in 1972.

Comprehensive report on maintenance and repair including local manufacture of spare parts was prepared (UNIDO/TCD 14 July 1971) and a preliminary programme was worked out which included two mobile workshops accompanied by experts.

With the assistance of experts the Government formulated plans for establishing regional central workshops at Chung Murkaz. \$85,000 worth of equipment was ordered under UNIDO General Trust Fund resources for delivery in May 1976.

UNIDO commissioning of the regional service workshop at Chung Murkaz IS/PAK/75/076/A/11/37.

UNIDO assisted Pakistan by sending an expert mission (Mr. Bazruck) for agricultural machinery repair shop and mobile unit (VC/PAK/69/008). UNIDO supported and endorsed Mr. Bazruck's recommendation on pilot tractor machinery workshop and granted \$329,520 under IPF for starting the project.

UNIDO voluntary contribution of \$76,000 with equivalent under project VC/PAK/69/008 to be delivered late in 1976 was allocated for this project at Larkana or Chunkmurkaz.

## PHILIPPINES

The Philippines Archipelago has 7.8 million hectares of arable land of which 5.6 million are cultivated. The total population is 34.6 million out of which 57% are engaged in agriculture. The density of population on cultivated land is 6.2 per hectares. The main crops are paddy (40%) and maize (27%).

Work animals, mostly water buffalos, are widely employed on farms. Farms cannot afford machinery here hence the demand for tractors is not adequate. The large assemblers are operating at only 30% or their rated output. There is great need to develop industries for the manufacture of small machinery suitable for small farmers who cannot afford to buy expensive equipment.

Two firms namely the International Harvester and GAMMI Incorporated assemble about 1,200 tractors. Japanese small four-wheel tractors are introduced. Tractors with 60-65 h.p. range are popular in the Philippines.

The Philippines have a substantial market for powerful tractors within the range of 55-70 h.p., power tillers within 8-15 h.p., engines, pumps, rice and maize dryers and processing equipment and simple implements for paddy cultivation.

The Government of the Philippines has undertaken to establish and to manufacture small Paddy tractors and this entirely includes the manufacturing, fabrication, assembly and marketing to direct dealers and farmer-users of 6 four-wheel Paddy tractors and powered by gasoline or diesel engines complete with all necessary implements and accessories. It intends to supply for the domestic market and at a later stage it is expected to be exporting to neighbouring countries. This project was presented by the Pacific Tractor Manufacturing Corporation.

Training courses exist at the University of Philippines at Laos Bamos College, Laguna, Philippines on Post-Harvest Rice Technology, conducted by the R/P/UNDP SF/ PHI-70/534 with FAO as executing agency.

The International Rice Research Institute supported by the Rockefeller and Ford Foundation is located at the premises of the University of the Philippines College of Agriculture at Laos Bamos, conducting studies on:

1. economics of farm mechanization;
2. the design of machinery.

There are firms producing pumps for agricultural use and rice and corn milling equipment. Some firms produce limited quantities of threshers, hullers and animal-drawn equipment.

EEAF -fact finding mission (FAO/UNIDO) of 1969/1970.

ECAFE Survey Team on the recommendations of the fact finding mission visited the Philippines in March 1970.

ECAFE pre-investment feasibility survey team on industry manufacturing practice and power tillers from 20 October - 22 November 1971, as directed by the Sixth Session of the Asian Industrial Development Council, January 1971. This team observed that heavy demand for agricultural machinery tractors and power tillers ought to be expected in the near future in the ECAFE countries. Manufacturing machinery has not been developed in this region owing to lack of investment, capital, technology and trained manpower.

## SRI LANKA

Sri Lanka has a total area of 6.5 million hectares of which 1.66 million are cultivated.

The main crop is paddy with 0.5 million hectares of which 0.15 million only are irrigated. Manufacturing facilities and ancillary industries appear to be limited. Only pumps and sprayers are made in significant number by private enterprise and hand tools by the Government factory.

No tractors are manufactured, but most of them are assembled from C K D Components.

Power tillers are not manufactured at all. Agricultural trailers (3-5 tons range) are manufactured by private firms. All implements for riding tractors are imported. No exclusive privileges are given to agricultural machinery manufacturing industry.

The implements quite common and important in Sri Lanka are tine cultivators - basic tool for the cultivation of many hundreds of thousands of acres.

There exists a design and testing station in Maha Illu Ppalama. There is presently too little information regarding machines that are really acceptable to the farmers.

UN/ECAFE/UNIDO fact finding team in industries manufacturing agricultural machinery visited Sri Lanka 12-18 December 1968. After detailed discussion with 25 organizations and 50 individuals, a report was submitted to the ECAFE.

The ECAFE/UNIDO fact finding team recommended:

1. a study mission for six months to recommend a programme for indigenous tractor and power tiller assembly plant in Sri Lanka under SIS project;
2. a study mission for three months to recommend a programme for indigenous small engines (2-5) manufacture under SIS;
3. assistance to design and testing unit of agricultural machinery at Maha Illu Ppalama (4-year organization co-operation with manufacturers and long-term programme under S.F. Project).
4. pilot demonstration plant for manufacture of small agricultural engineering or tractor drawn implements S.F.

UNIDO/FAO sent its first representatives to the Government in April 1971 just as the future demand of agricultural tractors and machinery as its manufacturing capacity and other manufacturing proposals and recommended future line of action for manufacturing. An FAO expert was appointed to review the state of agricultural machinery and analyse the stage of agricultural machinery implements and tools etc. emphasis given to the study of four and two-wheel tractor selection.

UNIDO sent a mission in 1969 to discuss further details regarding technical assistance with agricultural machinery and implements.

UNIDO assistance expert for three months under agricultural manufacturing and rationalization (tractors, and power tillers) (expert Mr. Austin submitted report in June 1971 SIS/70/810/CEY-17) (File OA. 220-CEY 17).

Joint UNIDO/FAO SIS mission SIS/70/811/CEY-18. Reinforcement of design and development facilities in the field of agricultural machinery and implements.

Tractor Commission report of Ceylon which submitted its report in 1971 January observes that mechanization should be subject to a social cost benefit evaluation.

The future development of agriculture requires selective yet speedy mechanization. Agriculture must be modernized if it is to attract the younger generation.

## BANGLADESH

Bangladesh comprises an area of 55,126 square miles with a population of 83 million people. It is primarily an agricultural country. Nearly 75% of the people are engaged in agriculture which is the largest sector of the economy contributing to 56.3% of the GDP in 1970. Yet it is deficit in food and depends on imports of rice from other countries. It is in fact far behind many developing South and South East Asian Nations.

The size of holdings are very small. Implements used are wooden wedge ploughs. Animals are still the main source of power for most agricultural activities. From land preparation to processing a reasonable number of operations have been mechanized through Government agencies by the introduction of imported tractors, power tillers, irrigation pumps, tube wells, locally made push type weeders, pedal thrashers and insecticide sprayers. Due to shortage of spare parts, trained operators, adequate workshop facilities, the imported equipment becomes unserviceable after only a short period of operation.

More than 80% of the holdings are less than 2.5 hectares. Country made ploughs drawn by bullocks are still the main source of power.

Although various attempts were made to improve the agricultural sector which included the transfer of advanced technology from developed countries through import of machinery, improved varieties of seeds, fertilizers, etc. yet it could not produce a lasting impact. This was due to the fact that agricultural technology of the advanced nations was not suitable for application to the socio-economic conditions of Bangladesh. Western technology was evolved primarily for replacing human labour which is a scarce resource.

Mechanization of agriculture is a highly controversial issue in Bangladesh. Yet people are very much enthusiastic about the use of such equipment. Modernization of agriculture should allow significant absorption of labour at an increasing productivity level.

The following manufacturing facilities are available:

Drum Metals Ltd	-	6,000 hand sprayers
Atlas Honda	-	Seed drill and hand hoe on order
Marshall	-	Paddy thrasher
Saw mill and Engineering Works	-	Shed
Machine Tools Factory	-	Low lift tool and centrifugal pumps. Yaman - power sprayer (Japanese)
Rotos Engineering	-	Deep well turbine pumps
Village blacksmiths	-	wooden plough and hand tools



Assembly firms of power tractors have been started in collaboration with Massey Ferguson in Chittagong.

The Agricultural Development Corporation of Bangladesh has imported 1,100 power tillers and 1,000 tractors of several types. They are sold to the public and are given on hire basis.

In fact, mechanization of agricultural production is not so much recommended as the use of hyv-seeds, fertilizers as well as intensive water management, because these inputs are cheaper than mechanization itself, demand less know-how for the farmers and hence create less additional costs. Development and improvement of traditional techniques and use of work animals is recommended to encourage local rural industries.

The Bangladesh Government has future production plans of deep well pumps, centrifugal, sewerage, tractors, pumps and trolleys, rice hullers, ploughs, spades, iron rakes, hand operated pumps, rice weeders, seed-drills for jute and paddy, pedal thresher, winnower, hand operated sprayers, rice dryer. UNIDO can assist the Government in these areas.

The UNIDO clinic at New Delhi recommended:

1. assistance to diversify production of agricultural machinery to machine tool factory;
2. assistance for the strengthening of design development - prototype fabrication, testing, industrial liaison, etc. for animal drawn implements and hand tools.

## INDIA

Agriculture in India is governed by a critical period and has to constantly fuse the vagaries of the weather. The cultivated area is at present only about 50% of the total area. Rapid progress is being made in exploiting the area under cultivation because of increased irrigation facilities.

Universal implements like the wooden wedge plough have been passed on from times immemorial. But to increase production the use of agricultural implements especially designated for each operation has to be introduced. The machinery required for the production of agricultural implements of simpler types like animal-drawn implements and hand-operated machines are general purpose machine tools. High yielding varieties and multiple cropping have greatly increased the demand for tractors since mechanized agricultural operations are not only cheaper but also time-saving. Due to variations in soil, topography and in the crops cultivated in different parts of India, the type and horse-power range of tractors and power tillers required varies and therefore, one or two makes cannot cope with all the requirements. The Indian Government has, therefore, embarked upon massive production of tractors and power tillers.

Since the cultivable land area is only 50% of the total area which means that there is still enough land to be covered under various crops, the need for mechanization is increasingly felt due to the introduction of multiple cropping and high yielding varieties. Unfortunately the existing production capacity for tractors is much below that required to meet the demand.

The Government has undertaken large-scale manufacture of agricultural implements through both Government factories owned by either Government or agro-industry corporations. They are located in cities like Lucknow, Jaipur, Piruchirjipalli and Bhubaneswar. Other ones are privately owned, small-scale manufactures and they number about one hundred.

We are aware that developing countries have certain limitations. Despite their limitations, they will have to make efficient use of the available animal and human power through improved implements and hand tools. India is making significant progress in designing, testing and extension of agricultural machinery in a way suitable to her. Her experience could be utilized by the lesser developed countries through the facilities of designing, testing and manufacturing of machinery and training of personnel.

The history of tractors in India started in 1940, primarily through major organizations like the Central Tractor Organization and mechanical cultivation schemes in the State Governments. During the last twenty-five years, rapid strides have been made by India in the mechanization of her agricultural operations leading to the establishment of a modern agricultural machinery industry which includes production of tractors, power tillers, combine harvesters etc. One of the major developments in the machine tools industry in India is the establishment of a large base of production of machine tools in the public sector. Varieties of agricultural implements suiting different conditions of manufacture through a network of small and large-scale units numbering over three thousand. In the large-scale sector alone, there are more than one hundred units producing more than 45,000 tonnes of agricultural implements. To offset the vagaries of monsoon conditions affecting agricultural production, substantial capacity has been created for the production of diesel engines and parts. There are thirty-two firms who produce 135,000 diesel engines, more than 300,000 tonnes in the large-scale sector. India has established a very wide base for the production of agricultural implements and machinery of all types as well as supporting and complimentary machinery for the agricultural industry, such as diesel engines and parts.

#### Role of agriculture in the development plan

The Government of India has laid great emphasis on the development of agriculture. They have a policy for agricultural development. In its five-year plan the whole emphasis was on agriculture and subsequently in each of the following five-year plans agriculture was given a prominent place in the development plans. For that matter, agriculture was always given a place, even during the British Raj. For example, as early as 1880, the Imperial Council of Agricultural Research was established.

In the agriculturally progressive areas, demand for agricultural machinery, particularly tractors and power tillers, has increased. The Government has taken the following steps:

1. tractors and power tillers industry has been exempted from the licensing provisions of the Industries Act 1951;
2. tractors and power tillers industry has been excluded in the list of priority categories and foreign exchange up to the installed capacity is allowed to import components from abroad;
3. the Government has liberalized the allocation of foreign exchange for import of capital goods required by the existing units;

4. credit is extended to farmers for the purchase of tractors and implements through co-operative institutions;
5. agricultural engineering is given pride of place in the engineering colleges and agricultural universities;
6. training is imparted in the maintenance and operation of agricultural machinery all over the country and after-sales service facilities are provided for the various types of agricultural machinery;
7. the Indian Government has opened a number of agricultural universities which award degrees in agricultural science, including agricultural engineering;
8. sales and after-sales service facilities are provided for the various types of agricultural machinery.

In addition to the above, in the public sector different kinds of tillage implements are manufactured, tractors are manufactured in various ranges. A wide variety of machine tools including agricultural machinery are manufactured.

(Reference: Country study report on status of agricultural machinery in India by Prabakaran. Expert Group Meeting on Agricultural Machinery Industry in Developing Countries, Vienna, 22 August 1969).

When the Fourth Five-Year Plan was formulated, the Government of India appointed a Working Group for the formulation of the Fourth Five-Year Plan proposals on agricultural machinery and implements in April 1968.

(Report of the Working Group on Agricultural Machinery).

The Government has established 17 State agro-industries corporations with Rs. 730 million authorized capital and Rs. 610 million paid up capital. The Government plans to develop integrated agro-based industries.

UNIDO has sent several missions at the request of the Government of India to study and recommend the areas where agricultural machinery could be used and produced. The Expanded Technical Assistance Programme FAO Report No. 910 Report to the Government of India on agricultural workshop organization management and practices, Rome 1958 by Carl Koneka, FAO Workshop Engineer.

UNIDO mission on agricultural machinery and implements 31 July - 4 August 1972 (Swamy Rao) to discuss in detail the areas in the agricultural machinery and implements field for which UNIDO assistance is desirable.

First country programme was submitted by the Government of India for a seven-year period beginning 1972. UNIDO assistance IND/73/014. N.C. Centre for Metal Working Industries.

UNIDO assistance IND/73/023 Modernization of Engineering Design and Consultancy Services E.I.L.

UNIDO assistance IND/74/019 Automotive ancillaries testing centre.

Swamy Rao mission to India 27 May - 1 June 1977. This mission recommended assistance to agro-industries corporation, the establishment of integrated crop based agro-industries complexes under the second country programme UNDP/IPF finances. It recommended agricultural machinery institutes. Swamy Rao mission discussed agricultural machinery programme in India and recommended training and assistance to village artisans and rural technical personnel.

Agricultural machinery hiring stations, assistance to small implements manufacture. In the hilly areas, small equipment development. Low cost tractor development. Techno-economic assessment of present tiller manufactures etc. (Report of Swamy Rao mission 1977). No follow-up action taken.

UNIDO has the largest programme in India. Opportunities for UNIDO/India co-operation under UNDP auspices and/or otherwise are immense.

1. \$2 million earmarked for the second country programme for agricultural engineering alone for assistance to the Central Institute of Agricultural Engineering, in design and development and manufacturing promotion (UNDP input \$1 million).
2. Assistance to the Central Mechanical Research Institute in the development of small low cost tractors (UNDP input about \$1 million).
3. Assistance in training village artisans and rural technical personnel for setting up implements and machinery repair and service units.
4. Assistance to small implements manufacture.
5. Techno-economic assessment of present power tiller manufactures and design simplifications, standardization and protection rationalization.

#### Other efforts

Proposals for manufacturing promotion of agricultural tools, improved animal implements, hand operated machines and simple power equipment in the selected least developed countries.

(Report prepared by the Government of India, CSIR, New Delhi, June 1977).

(Report of the Working Group for formulation of Fourth Five-Year Plan Proposal on Agricultural Machinery and Implements. Government of India, Ministry of Food and Agriculture, Community Development and Co-operation, New Delhi.)

Fifth Plan the importance of agricultural engineering research is stressed. Proposal for establishment of a National Institute for Agricultural Engineering was made.

Indian Standard Institute at New Delhi has made specifications for agricultural tillage discs, January 1959.

Central Mechanical Research Institute (CMERI) Report on the development of low cost, low horse power tractor (with the assistance of UNIDO)  
- Central Mechanical Research Institute (CSIR) Durgapur.

