OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

02102

Distribution: Limited
UNIDO/INDIA : No. 7
OCTOBER, 1974
Original : English

INTERNATIONAL AGRICULTURAL MACHINERY MANUFACTURING & DEVELOPMENT CLINIC

DELHI, INDIA

(21-30 OCTOBER, 1974)

Technology Transfer in Agricultural Machinery in Developing Countries

By

Dr J.C. SRIVASTAVA (India)

Organised by the Ministry of Agriculture, Government of India in association with UNIDO under UNIDO/INDIA International Technology Transfer Project.

1974

Technology Transfer in Agricultural Machinery in Developing Countries

CONCLUSIONS

The steps to be followed to promote the transfer of technology in agricultural machinery, equipment and implements in developing countries may be summarised as follows:

1. Technology transfer in agricultural machinery and equipment covers not only the transfer of a process design or equipment, but also information pertaining to engineering, metals and metallurgy, automotive, electricals, forgings and heat treatment, effective repair and maintenance services, etc. It also covers the process for adaptation and testing, training and management aspects.

2. There is need for the development of a strong project engineering and design capability, which will enable the development of agricultural machines and equipments in a manner most suited to local conditions and also which could lead to absorption and further development and diffusion of technology within the country itself.

3. A developing country cannot absorb technology, adapt it and improve upon it unless it has adequately trained manpower and an adequate research and development base. The engineering capabilities of the developing countries are of great importance in this context.

4. It is inappropriate to list out the possible help that could be rendered by UN agencies for a developing country in a given field under study. The facilities offered and available are well known. It is for the beneficiary to identify its needs and activate the mechanism for achieving an objective either by itself or with the assistance and cooperation of others.

5. The most advanced, automated, labour-saving technology is not necessarily the best for the developing countries, as they have to consider both the cost of labour and cost of capital so as to optimise the social benefit to the people. This, therefore, probably calls for an appropriate technology*, which should be the major objective of the developing countries.

6. In order to help technology transfer among the developing countries, it would be desirable to compile a detailed directry of R& D information on agricultural machines and equipment which they would be able/willing to transfer or share.

7. Agriculture being a more dynamic process than industry calls for greater flexibility and a thorough knowledge of R & D and how to carry it out, for example, knowledge of high yielding varieties, seed cum fertilizer drill, sowing of long staple cotton (at a distance of 3 feet apart).

---

* Technology particularly suited to the conditions in the developing countries, which are surplus in labour and short of capital.

8. The developing countries should set up an autonomous "National Technology Corporation" or a like including or linked to a financial institution which should function as the main agency for the evaluation and selection of appropriate technology for import and export. This Corporation should be given the responsibility of formulating and implementating an overall policy for the transfer of technology. The Corporation would also collect and display prototypes of implements and machines.

9. There is scope for bilateral and multi-lateral cooperation on research and development in clearly identified and selected areas in the field of agricultural machines and equipment among developing countries and within a country among various regions. This cooperation is also possible through visits of agricultural engineers and scientists for commensurate periods.

10. While working out an R & D programme in agricultural machines and equipment, the importance of aiding the small and medium scale industry sector should be kept in view.

11. Most of the countries have initiated modest programmes for design, development, adaptation and testing. There is need to reinforce these facilities by making provision for assistance to the manufacturing sector to develop locally suitable machinery and implements. These areas provide definite opportunity for cooperation among the developing countries. Small countries could establish jointly "Regional Centre" to catre their needs.

12. R & D in agriculture machines and equipment need low capital but high intellectural investment. Strong linkage have to be developed with the farmers and the agriculture system.

13. The transfer of technology takes place often without the active participation of local R & D agencies. Sometimes, the technology thus transferred is inappropriate; it tends to be static and non-innovative. For achieving best results, the local R & D agencies and Consulting Engineering Firms should be involved in the process of technology transfer.

14. To be useful at the rural level, R & D in agricultural machinery and implements is directly linked to the spectrum of technology. At this level, the approach plays a relatively difficult role, especially in relation to production engineering and to the marketing context of the new technology. Consideration, therefore, should be given, not only to adapting technology, but also to adaptation at rural level.

15. The developing countries could set up a Polytechnological Clinic or Design Development and Research Centre* to serve the agriculture machinery industries on the condition that there is active involvement by the industries in the area for setting up of the centre/clinic and they are prepared

---

* See : annexure 3

to contribute to 50% cost of running of the Centre/Clinic, the balance being the responsibility of the Government.

16. The present stage of indigenous technological development in the developing countries, calls for a fresh appraisal in the philosophy of technology transfer and the scope of future collaboration in the field of agricultural machinery with advanced countries. There is need to bring about a progressive change in the policies of import of know-how and capital equipment. We have also to review repetitive import of technology for the same item. The aim should be to create an atmosphere for imported technology to be indigenously absorbed, not only for the future use, but also for further development.

17. Action programme consistent with the social objectives to realise the food production plan should be co-related to R & D. A strategy in technology transfer has thus to be evolved and followed by working out the following details.

i) latest position in regard to existing capacity,

ii) additional capacity covered by licences/letters of intent.

iii) expectations of realisation of such additional capacities,

iv) the gap to be bridged to achieve the objective and target,

v) items for which foreign technology is necessary.

vi) items for which an option exists- foreign technology may be obtained or indigenous know-how could be developed on the urgency, and

vii) items for which technology was available in a developing country (within the region viz., Group of East African Countries, Arab Group, Andean Group, etc.) and in other areas as well.

18. In order to facilitate the above (item vii) and initiate dialogue among the developing countries proforma* may be designed to elicit information on the following:

i) scope of technology transfer among the developing countries,

ii) cooperative training programme,

iii) cooperation in R & D,

iv) demonstration of equipments made indigenously.

19. The preceding observations are certainly not new. Most of them have been presented and discussed earlier. A developing country should, therefore, study these aspects of technology transfer on a system basis to evolve its own strategy. To quote Prof. P.M.S.Blackett, the developing countries should draw up sensible shopping lists which calls for a bit of home work to make the right choice to suit the specific domestic conditions.

20. The need and objective for the above activity can be justified on the following counts:

i) to assist the farmer the end user to secure the proper type of equipment and implements,

ii) to assist the manufacture to develop appropriate products, bearing in mind the quality and cost, and

---

* Refer: Para 13.3 and annexure 4,5,6 & 7

iii) to consider the product with respect to raw material and energy requirements, quality standards and capital and labour requirements for its manufacture. The object could probably be best summed up in developing and relaying on "Own Capabilities".

Technology Transfer in Agricultural Machinery in Developing Countries *

The economic development of many developing countries is dependent on agriculture. Recent scientific and technological advances coupled with a coordinated progress of extension and new inputs promise manifold increase in production. These developments consequently have a significant impact on the outlook of the farming community. There is a visible awakening in the farming community today to expeditious exploitation of the results of research and development (R & D) and use of appropriate technology in agriculture. Farmers are now looking forward to the evolution of ways and means to produce abunant crop easier and faster.

1.1 A number of factors come into play in boosting agricultural production. More important among them are :

i) improved and hybrid seeds,

ii) fertilisers and pesticides,

iii) irrigation and scientific management of water,

iv) improved farm machines and implements,

v) credit facilities and cooperatives, and

vi) organised marketing.

Author: Dr. J.C.Srivastava, Scientist,
Council of Scientific and Industrial
Research, Rafi Marg, New Delhi (India)

* (The views expressed in this study are those of the author and do not necessarily reflect those of the Council of Scientific and Industrial Research, India).

1.8 Fertilisers, irrigation, pesticides and other like inputs take care of improved varieties of crops to an extent. But the over growing sophistications in agricultural know-how, attention to soil and water management, post-harvest operations and organisation of multiple cropping technique, call for the use of improved items of machinery, equipments and implements. The development of agriculture and relevent agro-engineering inputs is thus one of the priority areas for developing countries.

---

* The opening chapter of the study calls for a clear cut definition of agricultural/farm machinery, equipments and implements.

1. Any tool, implement and machine/which facilitates farming operations and helps to increase agricultural production is a farm machine, while the mechanisation of agriculture involves harnessing of mechanical aids and power to intensify production and assistance in farming operations.

2. Hand Tools: These are usually hand tools viz. picaxes, spades, digging forks, hoes, hand horrows, hedge shares, etc.

3. Animal driven implements: (a pair of bullocks on an average give one H.P.)

These are animal driven and operated viz. ploughs, harrows cultivators, levellers, threshers, seed drills, water-lifts, etc.

4. Machines: These are usually power-driven equipment viz. water-lifts, chaff-cutters, decorticators shelers and other like disc harrows, ploughs, threshers, rice-hullers, oil expellers, etc. either tractor driven or power driven machineries.

(Tractor is only a prime mover of a source of power. This needs various kinds of implements and machines in order to perform various agricultural operations).

5. Heavy equipments:

These include heavy bulldozers and earth moving machineries required for bringing under cultivation virgin lands.

2. Spectrum of technology in agricultural machinery and implements

Agricultural machinery and implements cover a wide spectrum of technology. In a developing country it circumscribe agencies at various levels viz., small scale workshops to multinational corporation. Further agricultural technology has to reckon with a wide variety of products, e.g., hand tools, animal drawn implements, hand operated machines, irrigation equipment, crop-protection equipment and large machinally powdered machines such as wheeled tractors, power tillers, engines, harvester, earth moving machinery, thresher, etc.

2.1 Capital - intensive assembly plants are met with mainly in engines, power tillers and tractor manufacture, where the methods of production and organisation are similar to those in automobile manufacture. The operations within the existing plants are usually concerned with casting, forging and machining of the major parts followed by final assembly and dispatch. However, the technology of manufacture has to depend on the donor agency for many components. In addition, the major material needs of the machinery and equipment industries in the agriculture sector are mainly metall - urgical ones. These include various grades of steel, Copper

and copper products, long staple asbestos, alloys of different types and specifications to suit design requirements. A majority of these materials are at present imported*.

2.8 Like any other engineering industry, agricultural machinery manufacturing involves components of technology pertaining to -

(i) design and development

(ii) metals and metallurgy

(iii) forging, heat/treatment and foundry

---

* In India the position of import of such items are as follows:

Tractors: among the raw materials required for tractor manufacture, pig iron, non-ferrous metals and steel forgings and castings are available indigenously but items like C CA Sheets, bright/ black round bars and flats, bright strips and plates and seamless steel tubes of certain sizes are to be imported.

Discs The major raw materials required for the production of discs is high carbon steel sheets/plates having carbon content above 0.65%. This steel is being imported.

Combine harvesters The indigenous raw materials include alloy and construction steel and steel/malleable iron/ cast iron and casting. CRCA sheets and plates (above 5 mm)are being imported.

Diesel Engines Among the raw materials imported are crank-shaft forgings for multicylinder engines, seamless tubes and turbochargers. For engines [illegible] H.P pistons and rings, governors, cylinder head forgings and cylinder block castings are imported.

Source: Indian Farm Mechanisation, Vol. XIV No X October, 1973, New Delhi, India pp.15-16

(iv) Automotive

(v) Electricals

(vi) fabrication of prototypes, and testing
(vii) manufacture of improved machines

(viii) standardisation and quality control, and

(ix) effective repair and maintenance service

2.3 A fully developed technology, based upon a number of years of actual production and utilisation in the country of origin, have been more attractive to the developing countries. This fact means that many of the engineering and operating problems which any newly designed and technological complex piece of equipment encounters, have been confronted and solved in the country of origin before the technology is exported.

2.4 An industrial enterprise in the developing country confronted with the choice of foreign or indigenous technology and without any constraining governmental regulations to limit its choices, opted for technologies from advanced countries.

2.5 Technological expansion has, therefore, become a prime objective of the developing countries for improving their economy and suitably husbanding and exploiting their local resources.

3. Technology Transfer

Technology transfer covers purchase of technical and technological process, product know-how, expert services for installation, product design, project engineering, patents and trade mark rights, resources inputs, raw material, management, sales, marketing, and even continuing import of technology, which help in the process of manufacture. Such a transfer involves payment of technical fees, design and engineering charges, consultancy fees, recurring royalties, cost of equipment and managerial services, etc. They may have to be paid either in hard currency and foreign exchange or by adjustment against loans on deferred payment terms.

3.1 Technology in physical terms signifies the creation of industrial enterprises, research organisations, universities, R & D establishments, etc., engaged professionally in this work. Within this framework, management, research and engineering provide cross-fertilization, interaction and teamwork by which a constant flow of scientific and operative innovation is disseminated, stimulated and implemented. Thus, the transfer of technology is both a source and a vehicle of technological and industrial progress.

3.2 There is yet another area of technology transfer in the case of agricultural machinery. This refers to the transfer of experience among the developing countries, through movement of skilled people,, agricultural engineers, technical cooperation, joint

undertaking of programmes and development of persons-to-person contact. Because of the similarity of problems and stage of economic development among developing countries, bottlenecks of adaptation are much less in comparable situations when technology is to be transferred from one developing country to another, than from a developed country to a developing one. It will thus be of mutual advantage for the developing countries to work together in joint ventures. This will facilitate grafting of technology and train a large number of nationals to attain self-sufficiency in technological manpower.

3.3 Technology transfer from developed countries is necessary if the rate of economic progress is to be maintained and increased, but only under conditions that involve a minimum cost to the country's economy and do not stultify emergence of vigourous R & D, engineering design and plant construction capabilities within the country. This kind of hard bargaining demands of high level of technological competence within the developing country in the field in which the technology transfer is being negotiated and would require a different weighing of the scales.

4. Problems of technology transfer.

Unsatisfactory progress in the development of agriculture machinery industry in developing countries has been due to such factors as the lack of investment capital, technical skill, trained manpower for workshop floor and the absence of precision in the identification and definition of problems, assessment of demands, development of markets, and lack of coordination in the exchange of information.

4.1 It is within the competence of developing countries to overcome these shortcomings through a policy decision by the government for the building up of adequate indigenous technological infrastructure. However, the problems faced by the developing countries in respect of the import of technology from developed countries are manifold and requires international consideration and cooperation for their solution.

4.2 The following are the main problems:

i) Developing countries are weak in their bargaining power and thus have to agree to exhorbitant terms, and restrictive conditions, thereby putting severe strain on the balance of payments.

ii) Sometimes, camouflaged technology transfer takes place in areas where there is no need to import technology, typical examples are sprayers, threshers, engines and pumps, which could be manufactured in many cases with indigenous capabilities.

iii) Generally, imported technologies are also inappropriate to the factor endowments of the developing countries. This undermines the importance of choosing the right type of technology;

iv) Some of the restrictive conditions are explicitly laid down in the contractual transfers and implicitly followed in direct investment, viz. export restrictions, tied purchases of raw materials, secrecy clauses regarding the use of know-how, scope of national development, etc.

v) Developing countries are also faced with the general limitations imposed by the existing patents and legal systems.

4.3 The drawbacks of such licensing inhibit local manufacture and use of patented components, such as hydraulic pumps, electrical items, etc., which are manufactured by ancillary industries and the normal reluctance of the collaborators to allow changes in design to suit local conditions.

4.4 Another beneful effect of the import of foreign technology from different sources is the absence of standardisation. Machinery and equipment vary from plant to plant, within the same industry. These are supplied by the collaborators accordingly to their convenience, without linking them to the long-term interests of the country. In such circumstances, ancillary industries do not find it economic to manufacture spares and parts required by the industries.

4.5 It may be pointed out that most of the hand and animal drawn equipment, including a few tractor implements, could be manufactured in developing countries, in some cases using imported raw materials. In the case of tractors, power tillers, heavy equipments and engines, developing countries may have to import technology. However, the development of even these items could be undertaken through local efforts on a phased

programme based upon local technological facilities and infrastructure.

4.6 In order to overcome the problems mentioned above, it is evident that positive measures at national and international level are necessary.

4.7 Some developing countries purchase plants and processes on turn-key basis. The "hardware oriented" concept implies a "package deal", covering the purchase of drawings, dies, jigs, fixtures, patterns and technical guidance on manufacture and commercialisation. This not only leads to under-utilisation of local resources and capabilities, but also retards national R & D efforts and perpetuates technological dependance.

5. Attitude of doner foreign companies of developed countries.

The ideal mechanism for the transfer of technology is enterprise to enterprise relationship. A company contemplating an investment in manufacturing facilities in a developing country requires protection of its market, the erection of tariff barrier or protection against failure on the part of licensees. Its investment policy is determied by issues of the receiving country. An important condition of interest to the foreign company is stability. The donor company knows that risks are unavoidable, but it will tend to minimise them as far as possible. The factors influencing stability are a stable government, predictable policies, the prospect of an orderly expansion of the market, satisfactory labour relations, management quality and infrastructure services.

5.1 Economic stability, especially in respect of licence payments, profit remittances and capital repatriation, are part of the stability sought.

5.2 Nevertheless, it is generally agreed that the primary aim of the foreign company is maximisation of profit and it will so organise its internal accounting procedures as to take full advantage of tax differentials, foreign exchange movements, import - export regulations, management fees, royalties and transfer pricing.

6. Viewpoints for the technology receiving developing countries.

To combat the problems of transfer of technology, it is important that the management and technicians of the recipient enterprises should be well-qualified to plan, specify and obtain the proper technology. The consulting engineers and other specialists have an important role not only in identifying the best technology but also in ensuring its quality and effectiveness.

6.1 Most of the problems could be countered by improving the bargaining position of the receiving country; this can be done by adopting realistic policies with regard to the repatriation of profits and by insisting on the share of the foreign company of equity being represented by money rather than know-how alone and on a better understanding of technology on the part of the local entrepreneurs.

6.2 Despite the problems, the mechanisms of licensing are well - established and their characteristics are virtually the same for all types of technology being transferred. The main issues revolve around three questions :

(i) whether the technology is appropriate,

(ii) whether the licensee is able to build up his own technology on the basis of the licence, and

(iii) whether licensing agreements are excessively favourable to the foreign company. In fact, there is need to study the ways of improving all the mechanisms involved in licensing procedures and raising the absorptive technical capabilities of the licensee.

7. Determining the choice of technology.

The choice of technology is a decision normally taken at the level of business enterprise and in practice only an advanced technology may be available or at least readily accessible. The industrialist in developing countries are, therefore, more attracted to advanced countries.

7.1 The factor determining the technology to be transferred include :

(i) transfer the ripe and proven technology which could be adapted almost straightway;

(ii) transfer the technology in a near state of readiness suited to local conditions and use; and

(iii) transfer the technology which would require further development work before commercial exploitation.

7.2 There are cases where considerable R&D effort is required to develop the technology showing promise of technological solution and potential for its usefulness in the development plans of a country. Such projects are of added significence in widening the base of scientific talents and R&D infrastructure facilities in developing economies.

7.3 Much technology in agro-engineering now exists. The mechanisms of transfer are well established. However, the main issues revolve around the following questions :

i) the place where technology is available, with the stage and conditions of availability;

ii) the need and resources of the receiving country;

iii) whether the technology is appropriate;

iv) the manner in which a country would like to transfer or receive the technology; and

v) the type of information needed by the receiving country needs and the access to the source of information.

7.4 For a successful technology transfer the recipient (and the donor) must have considerable analytical capabilities in technological forecasting, long range planning and system analysis. The receiving country should in addition develop the capability to analyse the social-economic implications of technological developments.

7.5 The aim should be to strengthen the national capability for developing and adapting technology, as well as for developing local engineering designs. A strong infrastructure of R & D activity is thus necessary even for an intelligent buyer of technology from elsewhere. However, the developing countries having limited resources of trained manpower and finances required for R & D effort, should concentrate on relatively few areas, which hold greatest promise for economic development, items which have large domestic market and where expertise for innovation and translation to commercial production already exist in the country.

7.6 Where technology has to be created and transferred, one would find a variety of situations ranging from cases where technology should be imported to cases where it should be created or adapted largely through indigenous effort. The question is not to choose

between the two alternatives, but as a matter of convenience, to decide on each case on the basis of merit and the prevailing circumstances. This may be illustrated by the example of the development of an indigenous design for a tractor "The Swaraj" * (22 h.p.) by the Central Mechanical Engineering Research Institute (CMERI) Durgapur, India, licenced by the National Research Development Corporation of India (NRDC) and manufactured by Punjab Tractors Ltd., Chandigarh, India.

7.7 The indigenous development of the design of the tractor would no doubt admirably answer the needs of the country, yet the time element is very important, as the existing demand would not wait for a model to be designed, prototype made and tested before it is conveniently produced. Hence, a number of companies in India engaged in the manufacture of tractors have based their production on imported product design and technology.**

7.8. Choice and acceptance of technology can only be carried out when various ideas are translated and demonstrated in actual field conditions, both with regard to their technological possibility and

---

* It is a 2 cylinder, 23.6 h.p, water-cooled diesel engine, 6 forward gear with a range of speed from 1.22 km/hr, transmission 1000 rmp, lifting capacity 800 Kg and gross weight 1450 kg (licensed capacity 12,000 units a year)

** Refer Ch.12

commercial feasibility. Whatever gaps are found, technological or otherwise, filled up by innovations and new technological developments.

8. Factors influencing identification and transfer of technology in agricultural machinery.

In the transfer of technology in agriculture the factors which influence the decision regarding the appropriateness of a particular design of the agricultural machinery and equipments are :

i) climatic condition,

ii) soil conditions,

iii) cropping policy and pattern,

iv) type of power available, and

8.1 Temperature variations, dust level, corrosive environment and other climatological characteristics demand special attention for protection, modification and use of material and design of these machines, while soil conditions determine the quality of metal cutting parts.

8.2 It is necessary to take into account the availability of skilled personnel, technicians, craftsmen, repair and maintenance men.

8.3 The policy in respect of agricultural development, with reference to cropping targets, cropping pattern, dry farming, small and marginal farms, tenancy and land reforms will also influence the activities of industries engaged in the manufacture of machinery and equipment.

8.4 In addition to the above, the increasing sophistication in agricultural sciences may demand attention to implements like multi-seed drills,

fertiliser distributors, row crop planters and equipment for beet, sugarcane, potato, groundnut crushers, seed treaters, dryers, cane-crushers storage and grain-handling equipment, etc. In wet area under rice production, emphasis could be given to the introduction of improved puddlers, rotavators, transplanters, broadcasters and harvesters.

8.5 Agricultural engineers engaged in R & D work have to take the above mentioned factors into consideration before deciding upon the development of new machines or transferring technology from other countries. In addition, agricultural engineers and scientists engaged in R & D activities should correlate their findings with their country's structure of local large and small manufacturing industries, and the problems faced by them with regard to the country's policy towards production, raw material supply, finances, product diversification, expansion programme, imports, foreign exchange investment, quality control and standards, price control, etc.

8.6 These factors also influence the initiative of local endeavour and incentive towards self-reliance in the field of agricultural machinery and equipment.

8.7 The overall commercialisation programme includes market research, product specification, demand analysis, assistance in national import policies, assistance to manufacturers in product development and diversification sales, service, spare parts supply, demonstration, extension, product popularisation, training and rural credit and financing. It also involves the establishment of national marketing organisations, dealership and a programme to assist the farmers.

8.8 Considerable effort must be directed to feasibility studies which should

i) determine the economic feasibility,

ii) establish practical technical concepts, and

iii) assist in the completion of financing.

Other factors of importance are :

i) assured availability of raw materials,

ii) assessment of the problems associated with the production of the agricultural machines, implements and equipment best-suited to the needs of the country, and

iii) market evaluation to determine product demand.

With such basic information, an agriculture engineer can further develop his practical concept of the project and ascertain the optimum manufacturing approach.

8.9 In the area of transfer of technology in agro-engineering an aspect generally overlooked by the

developing countries is the knowledge and resources for the establishment of equipment repair and maintenance service. The problem of repairing equipment and keeping the farm machines in working order is connected with the achievement of high efficiency, the savings of foreign exchange and with a better utilisation of the available resources.

8.10 Repair and maintenance facilities, supported by central workshops and mobile units, spare parts store, qualified persons in the organisation and operation of these activities, constitute a major need in the developing countries.

9. Technology transfer among the developing countries.

The developing countries could be put under two categories:

i) those with organisations and individuals who can generate technologies, and

ii) those who want to import technologies.

9.1 As compared to the transfer of technology from developed to developing countries, the extentof transfer among the developing countries themselves is quite small. It appears that not enough is known about the technologies available in developing countries. Most of the developing countries are more closely connected with developed nations and look to them as the first source of technology. In spite of this, for agricultural machinery and equipment thereis much scope of transfer of technology among the developing countries. Many developing countries are experimenting in these areas independently of one another and often transfer of know-how between them had been extremely helpful.

9.2 Examples of successful development of farm machines through indigenous effort in developing countries are power tillers(5-7 hp) developed and manufactured in Thailand and Phillippines, open propeller type low-lift pump in Vietnam and Wheat threshers,

multiple seed drills and one way mould board ploughs in India. Developing countries should aim at attaining a judicious blend of imports and domestic manufacture, local assembly and manufacture of a full range of agricultural machinery and implements for helping progressively the demand from within. This also helps in the development of ancillary industry and labour intensive production. It is possible in many developing countries to establish local production for agricultural machinery at a level of technology appropriate both to the manufacturer and the farmers.

9.3 There are many opportunities for technology transfer among developing countries. The areas in which this can be attempted profitably are :

i) identification of needs :

the developing country should identify specific technological needs both for the present and future, formulate and delineate areas of local technology development, import of technology and blend of both;

ii) dissemination of information :

knowledge of requirements and of availability of new technologies can ensure success of the process of technology transfer. This is best done through

a) better communication, collection and dissemination of information,

b) training of technocrats and shop floor personnel, and

c) better mobility and exchange of agricultural engineers and R & D personnel for long period;

iii) technology performance :

the reliability of a technology is very important in the transfer process. It will, therefore, be of utmost importance to give guarentees of performances through practical demonstrations;

iv) direct specific units :

this is possible through Embassies, Trade Missions, Agricultural Attaches and other agencies concerned with the supply of information on technologies available in their country.

9.4 The technology transfer among the developing countries in the field of agricultural machinery and equipment need not be purely commercial transaction. Such transactions can be looked upon as exchange of know-how, cooperative system of development wherein expertise and knowledge can be shared* based on complementarity for the development of specific agricultural machinery and equipment.

9.5 Some better equipped developing countries are able to absorb imported technologies from developed countries, process them for the specific indigenous conditions and then make them available to other developing countries.

---

* See also : Para 13.4 and annexure 4,5,6 & 7

10. Research and Development (R&D)

R&D plays an important role in the area of agricultural machinery and implements. An essential step in this direction is the creation of a sound R & D base.

10.1 Indigenous R & D not only helps in the importation and absorption of transferred technology, but also supports and encourages the local efforts and initiative for the country's industrial expansion.

10.2 Except in a few cases, industries engaged in the manufacture of agricultural machinery and implements do not appreciate the need for R & D. Furthermore, there are many small scale industries which are unable to sustain R & D effort of effective size. From the national point of view, this situation should be clearly understood and the Government of the developing countries should take the lead in setting up R & D institutions within the appropriate Government sector

10.3 This will not only accelerate the development of agro-engineering industry, but also spread the technical knowledge pertaining to quality control, specifications, standards, problem solving and lead to design improvement.

10.4 Interest could be aroused in the industries for encouraging the organisation of their own R & D by allowing certain concessions in taxation and

by setting up "Design, Development and Research Centres" and "Poly technological Clinics*. Thus Agricultural Machinery Research and Development Centre could have the following functions:

i) assist manufacturers, on request in design development, machine testing, prototype manufacture and performance evaluation studies,

ii) provide advisory services and training,

iii) function as clearing house for information and for exchange of experience with regard to design development and extension services related to agricultural machinery, and

iv) engage in the assimilation of technology, its transfer and its adapation to the distinctive requirements of the farmers

10.8 A unique feature of agriculture in Asia is the opportunity of multiple cropping. Because of the three distinct seasons, open channel irrigation, and the small holding, countries of Asia can produce 2-3 crops in a year from the same land. This,therefore, needs a different approach towards R & D in farm mechanisation and management. The objective should be that the machine should maximise yields and food production and help to reduce the high labour requirements during peak periods. It should matter little whether the power source is animal, human or mechanical.

---

* See: annexure 3

10.6 The relationship among the different types of organisations engaged in R & D in agricultural machinery and implements is very complex. For example, in India R & D activities in agricultural engineering are performed by the following types of institutions :

i) Agriculture universities and colleges,

ii) State Agriculture Departments,

iii) Central Tractor Training & Testing Centre, Bundi and Hissar,

iv) Indian Institute of Technology, Kharagpur, (Divn. of Agricultural Engineering

v) Central Mechanical Engineering Research Institute, Durgapur

vi) Regional Agricultural machinery Research Testing & Training Centres of ICAR,

vii) Indian Agriculture Research Institute (IARI) New Delhi (Engineering Division).

viii) Central Commodity Research Stations of ICAR.

Research on such aspects as metals, electricals, automotives, foundry, etc., is carried out by different institutions in the country. A number of private manufacturers have also evolved and developed agricultural implements and equipment.

10.7 The important issue is the exchange of experiences and knowledge among those engaged in such activities as education, agronomical practices, engineering, metals and metallurgy, quality specifications, testing, and trials in agro-engineering. However, in India the agricultural engineering and implements

industry, especially in small sector, is greatly influenced by the R&D conducted by agriculture universities and State Agriculture Departments. Though some machines have been developed, yet very few have passed research stage.

10.8 In order to meet the challenge and the immediate need, the local R & D should identify some agricultural machines and implements already in use of other countries and test the most useful models in the country.

i) If found satisfactory, the model choosen could be manufactured without major changes, of course using local raw materials.

ii) Minor modifications could be made in manufacturing engineering to adapt the designs to local manufacturing industry.

iii) Taking into consideration the best features of the design choosen, new machines could be developed.

10.9 In R & D programmes for agricultural machinery and implements, as far as possible, the local manufacturers must be involved, as they would ultimately take the responsibility of manufacturing.

The manufacturer can be sold the idea easily if he is involved in such projects since their inception to the stage of development. It is likely that he may play a positive role through knowledge of the available raw materials, economics of production and marketability.

11. Information

Transfer of technology is also an information and communication process. This is specially ture in respect of agricultural engineering technology. However, there is a difference between the transfer of operative technology and the transfer of information and data. While in the former case, the knowledge to be transferred must be embodied in an actual operation of some kind on terms and conditions determined through a process of commercial transaction with the immediate benefit falling within its scope, the transfer of scientific and technical information and research results is for building up knowledge and generally no financial transactions are involved in this process.

11.1 In agricultural engineering, retrieval and dissemination of scientific and technical information from one country to another has played a significant role. However, this is mostly been confined to basic or fundamental knowledge. The publicity material handed over by the government agencies contains general statements on achievements. There is thus need to identify and specify the types of information required and to drew up a classification of needs and suppliers.

11.2 Transfer of information takes place most effectively through person - to person communication, seminar, clinics, etc. Much depends on the attitudes and conscience of people participating in these countries.

11.3 A major handicap for the developing countries has been the difficulty faced by them in having ready access to the source of information, and if the information is available, to use it profitably. International organisations like UNIDO* and FAO can play a positive role in this connection.

11.4 The anticipated growing demand for technology transfers will make necessary the increased use of technology information system to supplement institutional flows and increasingly to bring about direct transfers.

---

* See: The role of UNIDO in promoting the agricultural machinery and implements industry, UNIDO, Vienna, May 1972.

12. Technology Transfer on Indian Scene.

To boost the farm output and utilise the benefits of research in agriculture, there is need for mechanisation. Indian scene and experience has its own significance in this area of operating the policies of mechanisation.

12.1 The restricted size of farm holdings due to adoption of land ceiling do not justify individual ownership of extensive farm machinery.

ii. An average farmer is not literate enough or technically oriented to efficiently use and maintain such machines and equipment.

iii. The overall shortage and high cost of tractors in the country require that the available tractors be utilised by as large a number of farmers as possible. A large majority of farmers own much less than one hectare of land.

iv. The economic condition of marginal farmers is also a handicap for the purchase and maintenance of heavy equipment and machines.

Area (in acres).

	Irrigated	Non-irrigated
1. Average farm size for a pair of bullocks.	5-8	15-20
2. Average farm size for power tiller (for wet land cultivation)	5-8	X
3. Average farm size for 35 H.P. tractors	25	50

(2.5 acres = 1 hectare)

12.2 With the above background two situations developed:

i) mass importation of technology in the area of agricultural machines and equipment, and

ii) establishment of 'custom hiring'* system of farm machines and allied implements.

12.3 The import of technology in agricultural machinery by India was permitted and encouraged with the aim of catching up with advanced countries and establishing a base for mechanised agricultural technology thereby helping in improved agriculture and higher production.

12.4. The technologies were imported mainly for machines like tractors, power tillers, harvesters,etc.,from both the capitalist economy countries (UK, USA, West Germany, Japan, Switzerland) and the Socialist economy countries (Hungry, Czechoslovakia, USSR, Poland, Romania) The technologies have been received with financial cum technical participation, technology as know-how, etc.

12.5 India is manufacturing various ranges of tractors with the technologies obtained from

---

*Under 'Custom hiring' system, services are organised through the hiring out of tractors and other farm machineries with team of operators, service and maintenance personnel. This system is practiced by Agro-Industries Corporation, AgroService Centres, Marketing and Service Corporations, Enterprising individuals and farmers.

foreign countries. There have been fourteen such collaborators* from eight countries during 1961-1973. (Table 1)

The horse power (HP) wise break up of these collaboration are :

Horse Power (Tractors)	upto 25	26-35	36-50	above 50
No.of foreign collaborations (Tractors)	6	4	6	3

18.6 To meet the country's requirements** the production and imports of tractors have been as under :

Year	Indigenous Production (No.)	Imports (No.)	Total
1961-62	550	2327	3,877
1962-63	1414	2616	4,030
1963-64	1983	2349	4,332
1964-65	4323	2323	6,646
1965-66	5796	1939	7,735
1966-67	8816	2591	11,407
1967-68	11894	4036	15,930
1968-69	15437	12397	27,834
1969-70	17101	12701	29,802
1970-71	19536	14678	34,214
1971-72	16536	16000	32,536

* Source: Report on the Status of Agro-Industries in India Directorate General of Technical Development (DGTD) Agro-Industries Dte., Government of India (See Annex. I)

** Source: Demand for tractors, National Council of Applied Economic Research, New Delhi, June 1974 pp.6-7 The study has estimated the annual demand of tractors in India for 1973-74 to be 38-40 thousand units rising to about 70 thousand by 1978-79 (pp.49)

12.7 Power tillers, which are two wheeled walking type tractors in the 5-12 h.p. range, are considered to be particularly useful for paddy cultivation, hilly region cultivation, orchards and small holdings. The Working group on Agricultural Machinery and Implements (Planning Commission 1970-71) has assessed the demand of power tillers as 80,000 numbers a year.

12.8. So far six units have been licenced for the manufacture of power tillers for a total capacity of 40,000 numbers a year in the range of 5-7 h.p and 8-12 h.p. (Table 2)*

12.9 It may be true to some extent that a number of foreign collaborations have been granted by Government of India during the period 1961-1973 for a similar technology by many firms, but it is not always possible to eliminate at this advanced stage some of the duplications of technology import. It probably became necessary in case of tractors to import at frequent intervals new technology even for the same product, lest the country is cut off from the mainstream of technological advances. As time passed, Indian industry became wise and selective in choice of technology in agriculture machinery.

12.10 One Indian firm is having collaboration with M/s Tysak of U.K. for the manufacture of agricultural discs. Rest of the manufacturers

* Sees annexure 2

are manufacturing these discs from the indigenous know-how, whose quality compares well with the imported discs. Similarly only one firm (M/s Vicon Ltd., Bangalore) is manufacturing* tractor mounted combine harvesters with the collaboration of M/s Vicon of Holland. Very selective collaborations are under consideration with renowned countries for special types of equipment viz rotavators, power harrows, tractor drawn and self propelled combines etc.

12.11 The cost of importing technology is an important factor in technology transfer. However, for several reasons it has not been possible to draw up a balance sheet of costs and benefits of the foreign collaborations in agricultural machinery by each individual case. There are difficulties in computation of royalty income, sales, turnover, dividend income accruing from technical fees and the intangible and hidden elements of costs besides other problems.

12.12 The Directorate General of Technical Development (DGTD) in the Ministry of Industrial Development (manned by specialist, scientific and technical personnel) acts as "watch dog" in regulating foreign technical collaboration and transfer of technology in India. They are assisted by well equipped tractor testing centres under the Ministry

---

* The firm has an installed capacity of 500 units a year and its actual production in 1972 was about 240 units.

of Agriculture, where machines are first tested. These test reports are regarded as official test reports. The Indian Standards Institution, India is now standardising test procedures.

12.13 Administrative machinery by way of Licensing Committee, Foreign Investment Board, and Capital Goods Committee receives applications and grants governments' sanction for setting up of industry with foreign technical collaboration and financial participation.

12.14 India has also build up considerable infrastructure* in agriculture engineering research and development. Regional Research and Extension Services have also been set up by the Indian Council of Agriculture Research (ICAR).

12.15 The National Committee on Science and Technology has recommended the establishment of a National Agricultural Machinery Institute in India. The project is under study.

12.16 In view of dependence on agriculture and on draft animal power, a large variety of implements (ploughs, harrows, ridgers, planters, seed and fertiliser drills, etc.) and agricultural hand tools like shovels, powrahs, pick axes, rakes and a variety of garden tools, suitable for farm needs have been developed and are constantly being

* Refer; Para 10.6

improved upon through research and development. In so far as these implements, India is fully equipped to meet the internal needs and the experience gained in this field could advantageously be utilised by other developing countries. There is adequate capacity in the country to meet both the local and foreign requirement.

12.17 Almost 100 per cent import substitution has been effected in case of vertical diesel engines below 15 h.p. and horizontal engines below 50 h.p. For other types of engines, 90-95 per cent of the raw materials are available indigenously.

12.18 Almost 100 per cent import substitution has been achieved in power driven pumps.

12.19 The country is also exporting various types of agricultural implements to the extent of about Rs.9-10 millions worth a year in terms of value ** and major portion of this is bullock driven and manually operated implements, viz. light mould board ploughs, sprayers, cultivators, hoes and drills.

** Source: Indian Farm Mechanisation, New Delhi, Vol.XXIV, No.X, October 1973, pp.20.

13. International Cooperation between developing countries.

An impetus was given for international cooperation by the organisation of International Seminar on Technology Transfer (ISTT)* held in New Delhi, India during December 1972. The three themes under discussion were:

i) Technology transfer from advanced to developing countries,

ii) Technology transfer between developing countries, and

iii) Technology transfer from research laboratory to

13.1 Some of the undermentioned conclusions of the Seminar on Theme (ii) are of special interest to this study, since technologies transferred from one developing country to another tend to be more appropriate** and generally require less adaptation than those transferred from an industrial to a developing country:

i) Transfer among developing countries is small and little information is available on those transfers which do take place.

ii) Little is known about the technologies in use in the developing countries. The suggestion was made that each country should "publish an inventory of information on technology".

---

* Source: Proceeding and Recommendations of the International Seminar on Technology Transfer, New Delhi, India, Council of Scientific and Industrial Research, New Delhi May 1973 pp 74-78

** Many of the agricultural machinery problems so defined are really applicable to more than one developing nation.

iii) Suggested priority areas for consideration when planning transfers included:

- agro-industries
- agro-engineering equipment manufacture
- rural housing, transport, water purification etc.
- national resources development
- upgrading of coal and low grade mineral resources.

iv) Special attention should be given to transfer of information on less sophisticated machines and equipment and of plants of smaller capacity.

v) Transfers of technology among developing countries can foster self reliance and decrease dependence on the industrial countries.

vi) Developing countries should "set up suitable agencies to promote sale of technology"

vii) Developing countries should identify future technological needs and cooperate in development programme to fill the needs.

13.2. Consequent to the International Seminar a "note of understanding"* was signed between Govt. of India and UNIDO for a programme of cooperation for industrial/technological development.

13.3 One of the activities resulting from the above is the organisation of the International Clinic on Agricultural Machinery, Manufacturing and Development held in New Delhi(India) during October, 1974

* ISMT Report op.cit.pp.107-108 "The objective of the programme of cooperation is to develop and improve the industrial technological capabilities in India and to make available to the extent possible Indian industrial and technical experience to other developing countries".

13.4 In order to facilitate mutual consultations and initiate dialogues among the developing countries participating in the International Clinic four proforma* are being introduced. These are designed to elicit information on the following:

i) technology transfer among the developing countries,

ii) cooperative training programme,

iii) research and development (R & D) cooperation, and

iv) demonstration of indigenous equipment in the interested developing countries.

13.5. The analysis of the information thus collected is expected to lead to the following:

i) evolve programme of action,

ii) help to solve common and individual problems in specific areas by mutual assistance and cooperation,

iii) facilitate UNIDO to identify areas where UN can render appropriate assistance, and

iv) complementary programme where India would cooperate with other developing countries under UNIDO's auspices.

---

* See: annexure 4,5,6 and 7

annexure 1

Foreign Collaboration in Agricultural Tractors*
1961 - 1973

S. No.	Indian firm	Make/ Model	H.P.	Foreign Collaborator	Remarks
		CZECOSOLVKIA			
1.	Hindustan Tractors Ltd., Baroda	Zetor 3011 Super	35 50	Motokov of Czeck Praha	P
2.	Hindustan Machines Tools Ltd.Pinjore	Zetor 2011 Zetor 2511	25 25	-do-	P
		WEST GERMANY			
3.	Eicher Tractors India Ltd., Faridabad.	E-2011 E-2511	20-30	Eicher, West Germany	P
4.	Kirlosker Tractors Ltd., Nasik	Deutz D-3006 D-4006 D-6006 D-10006	25-75	Klockner Humbottat Deutz	P
5.	Perfect Tractors Ltd. New Delhi	Hanomag	32	Rheinsthall Hanomag	NP
		U.K.			
6.	Tractors and Farm Equipment Ltd., Madras.	MF-1035 MT-555/ 558	35 30	Massey Ferguseon	P
7.	International Tractor Co. of India, Bombay.	B-275 423	35 43	International Harvester	P
8.	Premier Irrigation Equipment Ltd.,Calcutta	David Brown-990	55	David Brown	NP
9.	Auto Tractors Ltd., Lucknow	Layland 154	25	Layland	NP

* Based on "The status of agro-industries in India" Dte. General of Technical Development, Agro-Industries Dte, Govt. of India, 1971

P- Production
NP- Not in production

S. No.	Indian firm	Make/ Model	H.P.	Foreign Collaborator	Remarks
		POLAND			
10.	Escorts Ltd., Faridabad	27 W E-37/3036	25-35	Motoimport	P
		U.S.A.			
11.	Escorts Tractors Ltd., Faridabad.	Ford 3000	46	Ford Motor Co.	P
		USSR			
12.	Harsha Tractors Ltd., New Delhi.	T-25	25	Promnesh Export	NP
		RUMANIA			
13.	United Auto Tractors Ltd., Hyderabad	U-500 U-650M U-651M	50 65	Industrial Export	NP
		JAPAN			
14.	Byford Tractors Ltd New Delhi.	Shibaura S-2000	37	Ishikawajima Harima H.I.	NP

Annexure 2

Foreign Collaboration in Power Tillers*

S. No.	Indian firm	Make/ Model	H.P.	Foreign Collaborator	Capacity per annum (numbers)
1.	Krishi Engines Pvt Ltd., Hyderabad.	Akitu	5-7	Akitu Sangyo Co. Ltd., Japan.	3000
2.	VST Tillers Tractors Ltd., Bangalore	Mitsubishi	8-12	Mitsubishi Heavy Industries Ltd., Japan.	5000
3.	J.K.Satch Agricultural Machines Ltd., Kanpur	Satch	5-7	Satoh Agricultural Machine s Mfg Co., Japan.	6000
4.	Kerala Agro-Industries Corporation Ltd., Trivandrum	Kubota	8-12	Kubota Ltd., Japan	12000
5.	Indequipp Engg. Ltd Ahmedabad.	Iseki	5-7	Iseki Agricultural Machinery Mfg. Co. Ltd.,Japa n	10000
6.	Maharashtra Cooperative Eng. Society Ltd., Shiroli	Janmar	8-12	Yanmar Japan Ltd.,Japan.	4000
		Total capacity per annum			40000

* Source: DGTD report op.cit.

Annexure 3

Guidelines for setting up specialised services by CSIR *

Since India is a vast country of long distances separating specialised laboratories from users, there is a good case for extending facilities in diverse forms to assist the industrial and economic develoomentof various parts. This could be done in one or more of the following ways:

1. Technical Information Centres for Specialised Industries
2. Polytechnological clinics or Information & Liaison Centres
3. Design, Development and Research Centres

1. Technical Information Centres of Specialised Laboratories

The Centre at Bombay for the Chemical Industry has functioned successfully and has earned a good name with the chemical industry. 50% of its finances are provided by the Indian Chemical Manufacturers' Association, the rest being provided by CSIR. The scientific staff is on the rolls of the CSIR but their salary is included in the 50% share of the CSIR. The Centre has served as a contact'point by arranging meetings between the Directors/Scientists and Industrialists, collecting data on imports and exports, identifying projects for small scale industry and

* Extracts from the guidelines forsetting up specialised Laboratories as recommended by the Chairman of Inter-Laboratory Coordination Councils at their meeting held on 18.3.72 and approved by the Vice President, Council of Scientific and Industrial Research (CSIR) India

publishing a bulletin providing information to the industrial firms on specific projects being worked in the CSIR-Laboratories. It is located in the premises of ICMA, Bombay.

CSIR may agree to such requests for opening of Information Centres for specialised industries provided the representative organisations of these industries bear at least 50% of the cost for the setting up of such a Centre. For reasons of security of career the scientific staff may be on the rolls of the CSIR but seconded to the industrial organisation. For the successful functioning the Technical Information Centres should have proper organisational support and transport facilities.

2. Polytechnological Clinics

These Centres are in the nature of diagnostic, information and direction Centres for the group of industries in a particular area. Their capabilities should consist not so much of problem solving but of being able to understand the problem and direct the industrial firm concerned to source where its problem could be tackled within or outside the CSIR. These could be useful links with the Directors of Industries of the States, small and medium scale industries and the Small Industry Service Institutes, IITs and Universities on the one hand and the CSIR Laboratories on the other.

The CSIR could consider setting up of such Centres suitably equipped with technical literature and manned

by people having a wide spectrum of knowledge and information experience provided the State Government concerned takes the responsibility of 50% capital and recurring budget financing. The contribution by the Chambers of Commerce should form a part of the contribution of the State Government but the responsibility should be with the State Government.

3. Design Development and Research Centres:

These Centres should be set up to have a direct relevance and provide scientific and technical potential for the planned industrial and economic development of the State of their location. They should essentially be development advisers and engineers consultants with an inbuilt component and infra-structure for research and investigation facilities to meet their captive needs and such Centres have been set up with the help of Battelle Memorial Institute in Beruit (Lebanon) and South Korea and have proved of considerable help and have become a major factor in successful technology transfer. The specialisation and facilities in the Centre should correspond to the raw materials, agricultural, mineral resources and industrial plans in which these Centres will be directly involved. The primary aim of the Centres is development and promotional helping the State Governments to expeditiously evaluate resources, acquire or develop the technology and provide the technological and engineering component for setting up industrial projects.

They should also be capable of advising on quality control, analytical and testing facilities, technical advice and facilities to local industrial firms. These Centres would have a much higher component of engineers, technologists, planners (economists, statisticians, survey experts) that of research scientists. Where the States are too small, such a Centre could serve 2 or 3 neighbouring States by mutual agreement on research programmes etc. They will have the following primary divisions:

i) Division on Planning and Survey of Mineral, agricultural, forest and other resources, industrial information, statistical information and liaison

ii) Division of Industrial design and engineering Projects

iii) Pilot plants division

iv) R & D Division related to the specialised resources of the region such as paper ceramics, chemical, drugs and pharmaceuticals, metallurgical etc.

v) Division on quality control, testing and analysis

These Centres may be set up provided the State Govt/ Govts. concerned agree to the following:

1. The State Govt (s) must assure a direct interest and involvement by making at least a 33% contribution to the capital and recurring expenditure of the Centre.

2. The Design Development and Research Centre should have a direct access to and be an ex-officio consultant to the Department of Industries, Agriculture, Forestry and Planning. The Director/ Scientists should be involved in all industrial/ technical planning of projects handled by these department.

3. The industrial firms in the country should be associate members of the Centre and contribute a regular amount to the capital and recurring expenditure. This could be on the basis of a compulsory levey by the Industries Department in relation to production.

4. The Govt. and associate members would have representation on the Advisory Council of the Design Development and Research Centre.

5. The overall controll of the Centre would rest with the who would be the management agency for the Centre. This is essential to give it a National Character as also ensure mobility and interchange between the staff of the Centre and the national and regional laboratories.

6. The programme Advisory Committee of the Centre should be composed of representatives of the State Govt., associate members and the CSIR. The Executive Committee of the Centre would be on the same pattern as all the National Laboratories, viz. the Director would be the Chairman and would consist of some project leaders.

7. The financial share of the State Govt(s) and levy from industries would be contributed to the CSIR by the State Govt.(s)

Annexure-I

Transfer of Technology in agricultural machinery among the developing countries

ooo

1. Name of the country

2. Name and address of the relevant coordinating agency in the country.

S.No.	Name of equipment	Specification	Year of production in the country	Indigenous production per unit/year in units (1973-74)	No. of parties engaged in manufacture	Main raw material & components used	Size of minimum economic production unit	Import of the equipment in units (1973-74)	Import price of the equipment (in U.S. $)	Any other information relevant to technology transfer
1	2	3	4	5	6	7	8	9	10	11

N.B. The above information may kindly be mailed to:

International cooperative training programme in agricultural machinery design, development and manufacturing among the developing countries

***

1. Name of the country:
2. Name and address of the nodal/apex coordinating organisation in the country:

Organising country	participating country
1. Area/s in which training could be organised:	1. Area/s in which training is desired ...
2. Proposed duration in weeks:	2. No. of persons to be trained ....
3. No. of participants acceptable:	3. Acceptable financial participation in the programme e.g. international travel/boarding & lodging/ internal travel.
4. Desirable qualification of the participant.	4. Name of the country of preference.
5. Approximate fees to be charged, if any. (in US $)	
6. Approximate boarding and lodging expenses per day per person (in US $)	

N.B. The above information may kindly be mailed to:

Annexure-6

Research & development (R & D) cooperation in agricultural machinery design development and manufacturing

---

1. Name of the country
2. Name and address of the relevant coordinating agency.

---

1. R & D problem definition of the country
2. Details of cooperation envisaged (please explain in some detail)
3. Do you wish to collaborate/cooperate/ sponsor/ any R & D project with any developing country (please specify).
4. Do you wish to associate any of your scientist/technologist/engineer with the above project.

P.S. The above information may kindly be mailed to:

Annexure-7

Demonstration of agricultural machinery and implements made in India

****

i) Name of the country ...

ii) Name of the coordinating agency in the country.

i) Name/s of equipment identified

ii) No. of each equipment required for demonstration;

iii) Approximate number of demonstrations to be carried out;

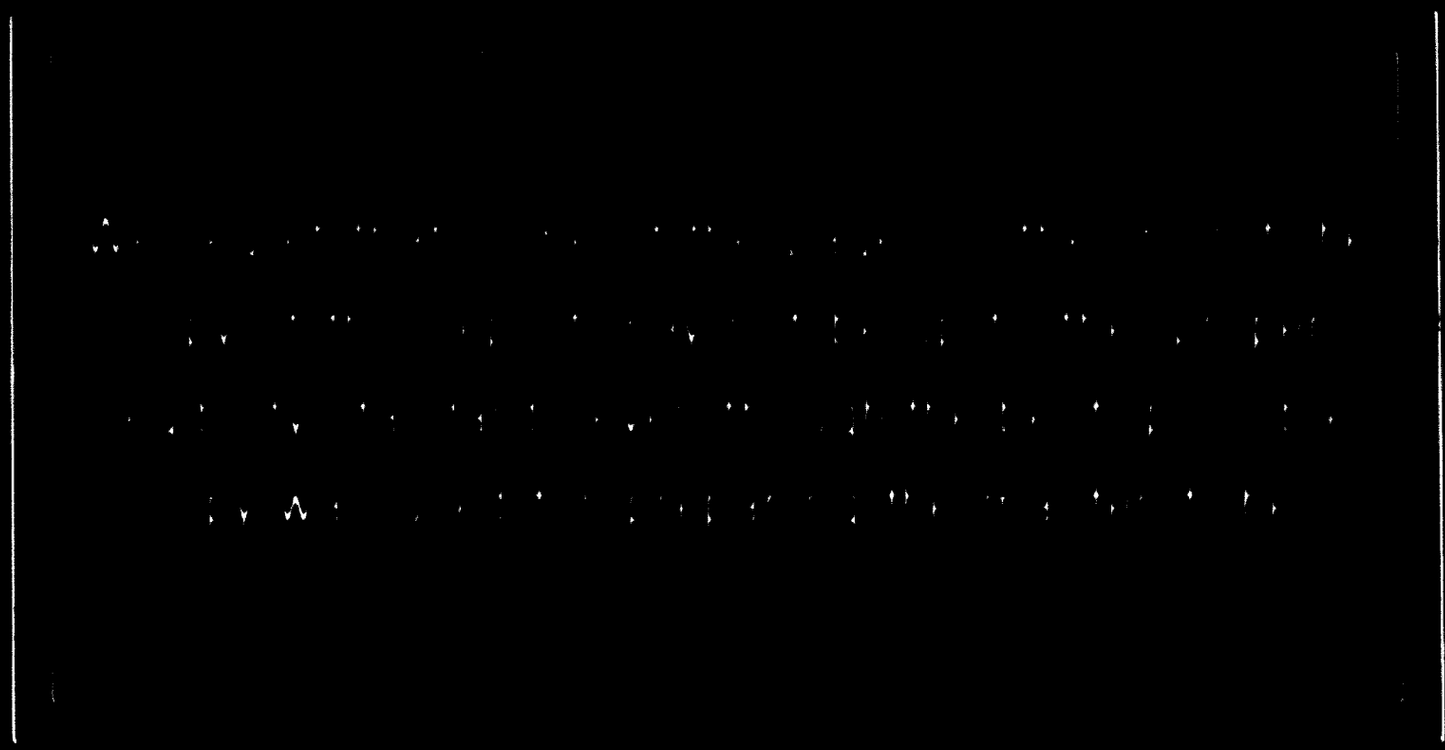
iv) Terms of demonstration :

1. By outright purchase of equipment by the receiving country (the cost of visit of demonstrator to be met by the manufacturing firm).

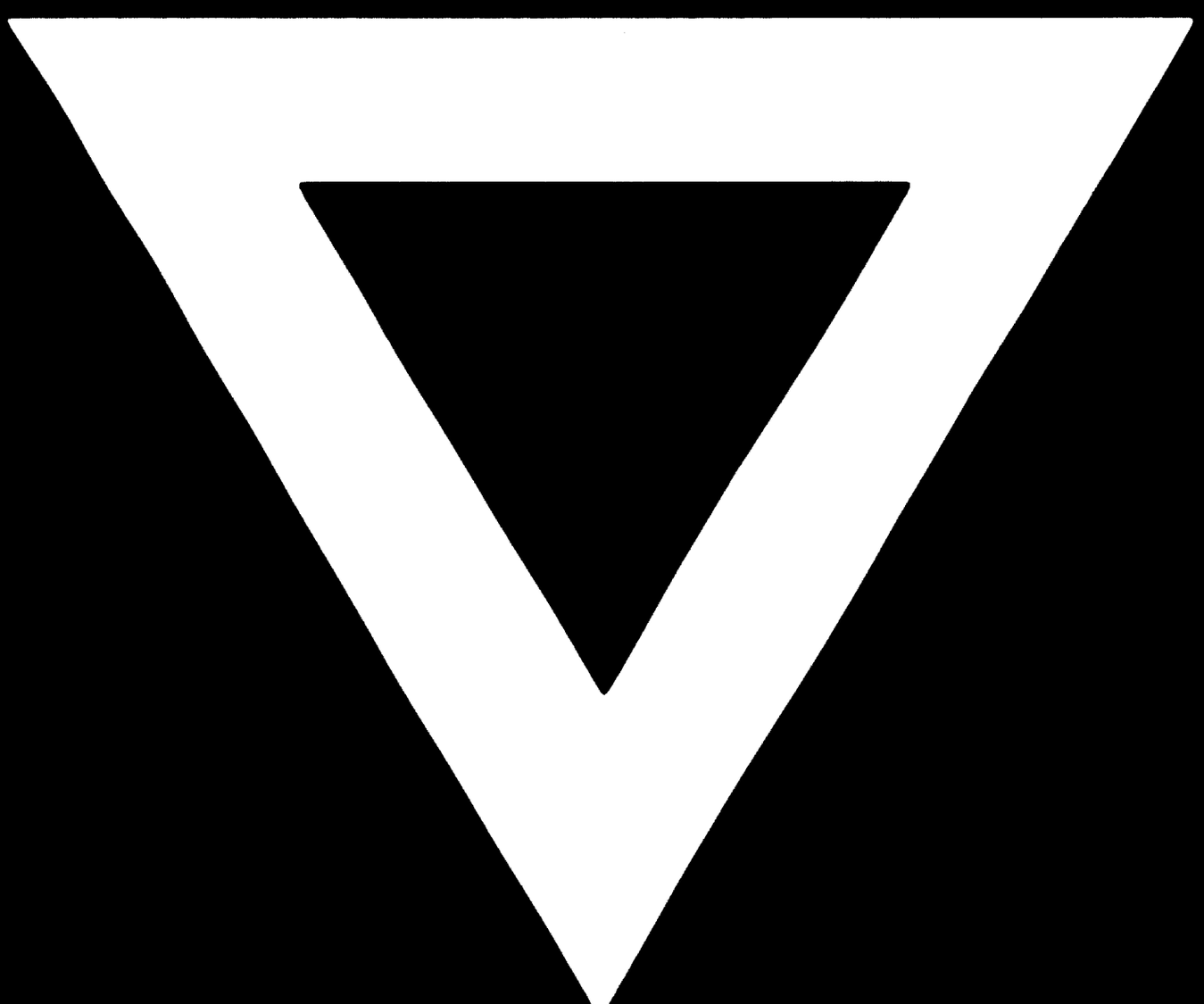
2. on deferred payment after a successful demonstration;

3. Cost of visit of demonstrator to be met by the receiving country and the equipment imported at manufacturers cost.

4. anyother terms as suggested by the receiving country.



C-925



82.10.28