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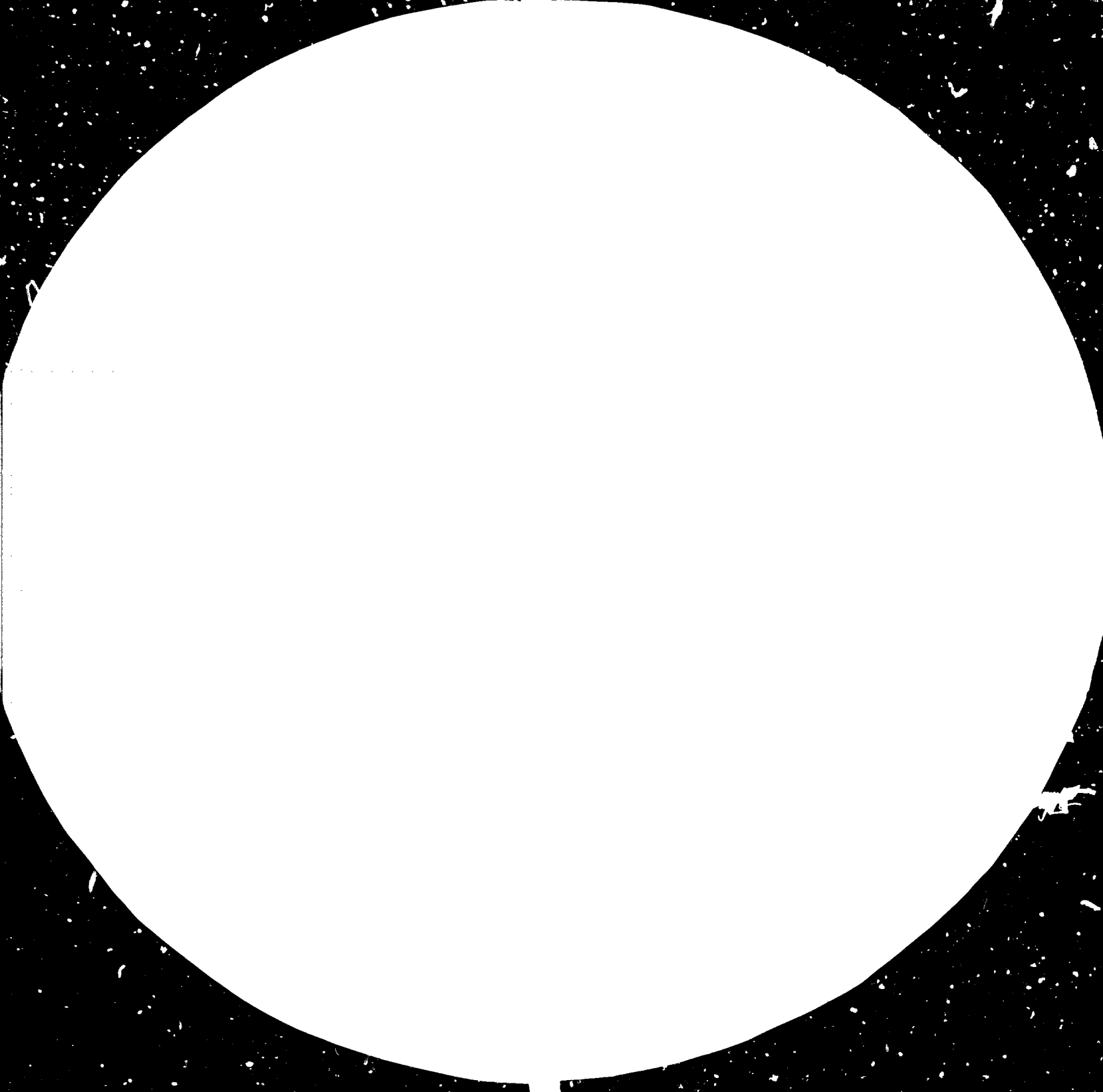

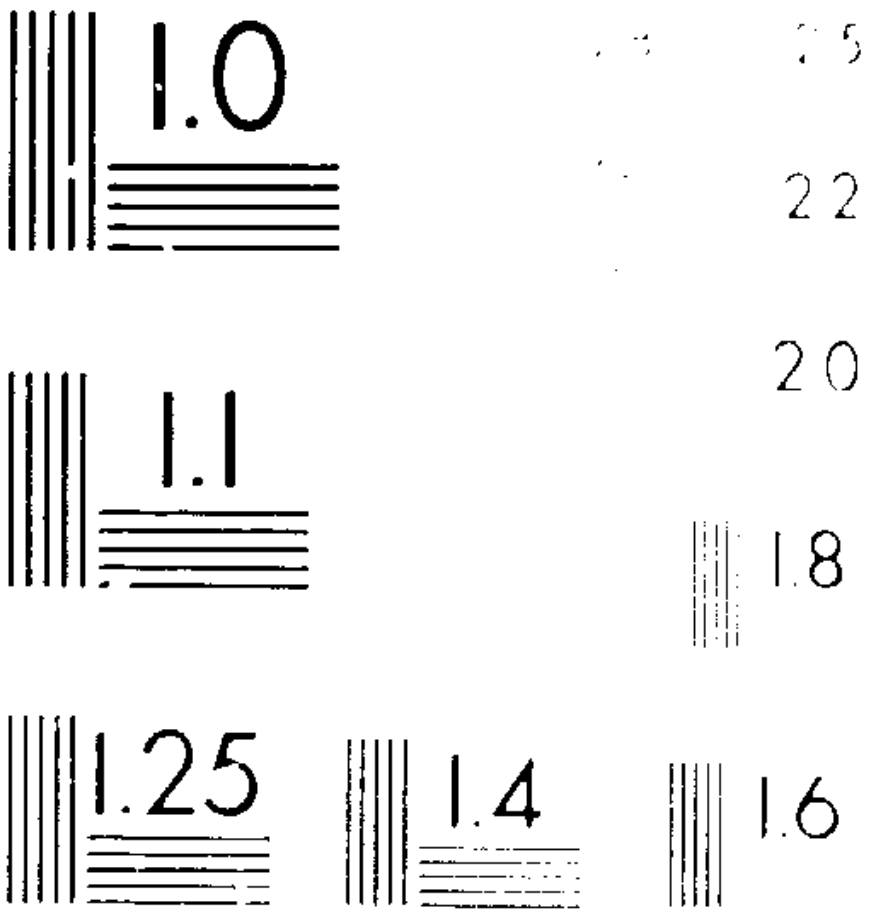
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Agricultural Machinery and Implements in Developing Countries

Issue No. 3

DEVELOPMENT OF LONG TERM ARRANGEMENTS BETWEEN PRODUCERS AND DEVELOPING COUNTRIES FOR IMPORTS, LOCAL ASSEMBLY AND MANUFACTURE OF TRACTORS, ALLIED POWER MACHINERY AND TRACTOR DRAWN IMPLEMENTS

- Present status, potential, import agreements, assembly and local manufacture agreements, physical production facilities, terms and conditions, means of technology transfer, financial magnitude, programme of action, international assistance, and the role of UNIDO

by
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22 May 1979

This paper is based on various field missions, analysis and techno-economic documentation review of around 30 tractor and agricultural machinery manufacturing plants/contractual agreements in 13 developing countries and personal knowledge of more than 10 manufacturers in industrialized countries.

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SECTION I

PRESENT SITUATION IN DEVELOPING COUNTRIES

(a) Modalities of Meeting Demand

1. Today the developing countries could be divided into four categories regarding the ways and means adapted to meet local requirements for agricultural tractors and allied equipment.

A. Those who fully import;
B. Those who import partially (PKD)/semi(SKD)/completely(CKD) knocked down components;
C. Those who have local manufacturing facilities (Phase I) 20-30% local content;
D. Those who have local manufacturing facilities (Phase II) 50-60% local content, and sometimes above.

2. The following countries can be grouped into each of the above four categories:

CATEGORY A COUNTRIES: Afghanistan, Angola, Bahamas, Bahrain, Bangladesh, Barbados, Benin, Bhutan, Bolivia, Botswana, Burundi, Cape Verde, Central African Empire, Chad, Comoros, Costs Rica, Cuprus, D. R. Yemen, Dominican Republic, Ecuador, ElSalvador, Eq. Guinea, Ethiopia, Fiji, Gabon, Gambia, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Jamaica, Jordan, Kuwait, Laos, Lebanon, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mauritius, Mongolia, Mozambique, Nepal, Nicaragua, Niger, Oman, Panama, Papua New Guinea, Paraguay, Qatar, Rwanda, Saudi Arabia, Sierra Leone, Singapore, Somalia, Togo, Trinidad-Tobago, Uganda, UAE, Tanzania, Upper Volta, Uruguay, Yemen, Zaire and Zambia.

CATEGORY B COUNTRIES: Sri Lanka, Burma, Chile, Colombia, Congo, Cuba, Ghana, Ivory Coast, Kenya, Libya, Nigeria, Senegal, Sudan, Cameroon.

CATEGORY C COUNTRIES: Egypt, Indonesia, Iran, Iraq, Malaysia, Morocco, Pakistan, Peru, Philippines, Swaziland (local design), Syria, Thailand, Tunisia, Venezuela, Vietnam.

CATEGORY D COUNTRIES: Algeria, Argentina, Brazil, China (PR)., Greece, India, Mexico, Rep of Korea, Spain, Turkey, Yugoslavia.

3. It should be noted that most of the countries in categories B, C and D are, to some extent, importing fully built tractors.

(b) Potential for Lower Category Countries to Reach Higher Categories

4. Among the A category countries, the following countries have potential to reach the higher category of B and in some cases C as follows: Afghanistan (B), Bangladesh (B and C - small tractors/ power tillers), Bolivia (B) Central American Countries - Costa Rica, Domincan Rep. El Salvador, Guatemala, Honduras, Nicaragua, (B and C if regional co-operation is established), Ethiopia (B), Jamaica (B), Liberia - Sierra Leone (B + C under Mano River Union), Mozambique (B), Paraguay (B), Somalia (B), Tanzania (B), Uganda (B), Upper Volta (B), Uruguay (B), Zaire (B) and Zambia (B and C) in next 3-5 years.

5. Among the B category countries, there exists a potential for most of the developing countries to reach the category C within the next 4-5 years. Similarly, present C category countries could reach category D in the next 5-8 years.

(c) Problems of all Developing Countries on Total Importation of Equipment

6. As all/most of the developing countries are meeting some/most of their needs through full importation of tractors + equipment, the following problems are being encountered for the following reasons:

- Firstly very few countries have a full analysis of which tractors/equipment are required, with which specifications + why. How many are needed now + how many in the next 5 years to come.

- Most of the developing countries have no analysis/programme for demand development within the country, which should incorporate rural finance, repair + maintenance with after sales service infrastructure and co-ordination of mechanization policies (if at all) of product requirement, cost structure and escalation in prices.

- There has been no regular budget allocation towards annual tractor imports and imports are mostly on an adhoc basis - depending upon World Bank + Regional Bank loans; bilateral aid; barter deals; some local export (of other products); incentives to import (tractors); some foreign assistance programmes; incentives for citizens abroad to send tractors through foreign exchange payments and some programmes on second hand tractor import.

- As a result, the import of tractors on an unplanned basis has resulted in many makes, many models, many configurations, and vast technological variations in components.

- This also resulted in failure to incorporate: an operators training programme; R + M training programme, spare parts supply/local manufacture, locally manufactured matching implements, establishment of a systematic rural marketing network and development of a longterm agreement on local manufacture.

7. Therefore the first step needed to develop local assembly/production is to rationalize import policies on a medium term basis.

(d) Problems of Countries with Local SKD/PKD Component Assembly (Category B)

8. Many countries in this category, in addition to non-rationalization of tractor makes, type and demand volume, have in most cases agreed upon an adhoc basis for local assembly, from SKD/PKD components and sometimes CKD components, without a real techno-economic analysis and medium term planning. In addition, 4-5 makes may be assembled each with a low share and without considering the possibility of developing a long term agreement. These assembly activities have not really developed into a higher category manufacturing programme as governments have not undertaken any investment analysis and the assembly operations are left to local import dealers. No Government regular budget funds are allocated and assembly operations are on an adhoc basis.

E. Problems of Countries with Phase I Local Manufacture

9. Many developing countries in this category have started Phase I operations without making an indepth techno-economic analysis, on foreign exhange/technical manpower and domestic financial long term requirements. The problems arising therefore, are as follows:

- Quite often due to non scrupulous checking of contractual agreements, by developing countries, the foreign partners have withdrawn from the venture after costly buildings and facilities such as assembly halls, machine shops (light and Heavy) have been built and money has been spent on importing dies, jigs and fixtures (for a particular model) and first batches of PKD components and spare parts have arrived. This has then resulted in developing countries agreeing with the same foreign partner to more favourable terms, or, looking for a new foreign partner who will only agree on his own terms.

- Many a time the technology transfer agreement clauses (royalty, spare parts, exports, training, licencing fees etc) have been unfavourable to the developing countries, due to the fact that at the time of agreement, the developing countries did not have the capabilities to analyse the terms.

- In many cases the developing countries have allowed more than one firm (in some cases 3-4 firms) to enter into phase I operations. As a result the developing countries are paying for 'repetative technology import' with each having a low share in a limited market, thus preventing each other from reaching phase III operations.

- In most of the developing countries, as governments do not make budget provision on a medium term basis for foreign exchange, most of the phase I plants are working under capacity. It is interesting to note that even in such cases, the countries may import other fully built tractors if finances come from other sources (eg. bilateral aid, barter deals etc) and in many cases such imported tractors are not the same make/ model as locally assembled ones (Phase I) according to financial implications.

- As Phase II has not been investigated in depth, the ancillary industry development has no possibility of taking deep roots in the system. Thus in many cases in spite of 6-10 years operation at Phase I level, things have remained at Phase I level. There is underutilization of production capacity, non-development of allied services (marketing, spare parts, training, rural finances) and non-expansion of local production in implements, spare parts and tractor components.

(F) Problems of Countries with Phase II Local Manufacture

10. These countries, due to existing infrastructure and ancillary industry development have achieved Phase II to a certain extent. However, the problems here again are under-utilization of existing production capacity, continued production of old models, lack of local R and D facilities to develop own production lines and in many cases lack of foreign exchange.

In addition in many countries, too many manufacturing units were established for a limited domestic market, which resulted in a problem of achieving expanded production capacity for domestic needs. There ere no possibilities for bulk export, due to high cost, restrictions in licencing agreements and no possibility for supply of components to foreign parent companies. In many cases, the local product is out dated and there are restrictions in item procurement.

SECTION II

BASIC PREREQUISITES FOR LOCAL MANUFACTURE

(a) ANALYSIS OF THE NEEDS

11. It is interesting to note that most of the developing countries have not made an indepth analysis of their tractors, tractor drawn implements or equipment or other power machinery on a medium term basis. This is primarily due to lack of integrated agricultural mechanization policies. In otherwords a comprehensive analysis of the demand and more important market development (based on agriculture), agricultural mechanization policies together with rural development, rural finances, and infrastructure facilities such as training, repair and maintenance etc) is a basic must. An analysis should answer such basic questions as:

- what agricultural machinery is needed
- what are the specifications
- how many
- in what period
- what is the annual demand and annual growth demand for the next 5 years.

(b) MEETING THE NEEDS: Import V. Local Assembly/Production

12. The question of imports v. local production is a difficult one , which should take into account the national priorities, resources, social costs, foreign exchange availability, technical man power requirements, demand, investment return etc.

13. Basically the import vs. local production depends on the demand (and volume of production) and its techno economic viability. However, if the needs are to be met, either by importation or local production, the finer points must be considered in such agreements and are detailed in the next section.

SECTION III

MEDIUM/LONG TERM IMPORT AGREEMENTS LEADING TO LOCAL ASSEMBLY

A. Prerequisites

14. Medium/long term agreements could be initiated only if the developing country is fully aware of the product, its suitability, its past experience with the foreign company, and the degree of mutual trust. In addition a quick evaluation of tractors and allied equipment hitherto not imported, but which could be suitable from a local application point of view may be undertaker. The local agricultural machinery testing units will play an important role in technical rationalization of tractors and allied equipment with regard to their suitablity.

B. Items for inclusion (Basic)

15. It is very important to know that 'NOTHING IS GIVEN FREE'. Anything included in the agreement will cost money and it may be included in the unit price or as additional costs. In addition in drawing up a medium term (3-5 years) or long term (4-8 years) import contract, it is essential that the developing countries allocate necessary basic finances - especially foreign exchange - for the realization of the contract.

16. The following items/factors may be taken into consideration in the drawing up of such a contract:

(i) Price of basic unit and annual price escalation: a degree of firm committment based on volume and agreed upon industrial production cost index (in country of manufacture) or, on some other factor should be achieved.

(ii) Right to secure selected parts: an agreement may include securance by developing countries of selected components (eg. tyres, battery, wheel weight, head lamps, hardware and if possible selected propiertary items etc.) from elsewhere if necessary. (Note: the rebate given be the manufacturer of tractors should be higher than procurement cost.)

(iii) Guarantee: The one year guarantee, free services and modalities of settling disputes on guarantees should be specified.

(iv) Spare parts supply and training in spare parts handling:
(a) The question of correct spare parts in sufficient quantities is of great importance. Many a time the tractor exported may 'dump' unnecessary spare parts in large numbers or may supply 'seconds'. The higher cost due to 'original packing' and price escalation (when demand increased) should be carefully examined. In this context, the developing countries should be able to estimate the requirements of spare parts. One of the methods may be to analyse the spare parts required on 'replacement turn over factor (RTF)' which is based on the frequency of replacement of a component during the tractors/implements/machinery life perios. 'Annex A' gives a guide on RTF of tractors as well as allied automotive vehicals in a developing country (India). A similar specific RTF chart is to be worked out for each country and rationalization of figures for different models. This also gives an indication of needs for spareparts and local manufacturing potential, which should be discussed with the foreign partner.

(b) Training in spare parts inventory control, spare parts handling (central procurement and local distributions should be incorporated in the agreement.)

(v) Basic documents should be in local languages.

C. Items for Inclusion (optional)

17. Based on the developing countries' existing local capabilities the contract may include the following items. This may be under a series of supplementary contracts, with binding to the main contract. The cost for such supplementary contracts is subject to negotiations.

(i) Training of farmers/machinery operators: Training of machinery operators in tractor operation and safety, on the farm maintenance, field operations and implements usage, implements adjustment etc. is necessary. It is recommended that "operator training schools" are established. This could be done by the government or local dealers (or dealers associations) with government grants and supervision. The foreign tractor exporters should provide the experts to initiate this activity and train the local trainers and also provide all visual/ Literature aide with training syllabus. The governments of the developing countries should have a programme for batch training of farmers and provision of financial loans during training period.

(ii) Training of mechanics in repair and maintenance: An integrated programme incorporating the government, local dealers and foreign exporters should be initiated regarding training of mechanics in repair and maintenance activities. The foreign exporter should provide experts, visual aids, cut out models, training literature, syllabus and machinery for a workshop and initiate the first few training courses to train the local trainers. The Government, in co-operation with local dealers, should provide all other facilities and also financial loans to trainees.

(iii) Local Dealer Net Work: Marketing and After Sales Services
The foreign tractor exporter should assist the government of the developing country to establish a systematic net work of local dealers, either on a private or public sector basis. The draft terms and conditions, the physical facilities, rural financing system, warranty claim, service, spare parts supply, regular field evaluation etc. are some of the areas in which the exporter may guide the local government.

(iv) Central spare parts depot and training in inventory control
The foreign exporter should assist the government in establishing a central spreparts depot through provision of short term experts and also train the local personnel in maintaining and operating the central depot. A supplementary training programme for local dealers' spare parts personnel should be organized.

(v) Rural, Sub area and Central Repair and Maintenance Workshop Network
The foreign exporter should assist the developing countries in establishing such a network through provision of short term experts, systems and methodology, details and specifications on R and M physical facilities and technical personnel , R and M workshop/quality control machine tools/instruments and train the local technical/administrative personnel to continue the initiated activity.

(vi) Local Manufacture of feasible basic implements and attachments

The foreign companies should assist the developing countries through the provision of short t rm experts to conduct a techno-economic analysis on implements and attachments needed. If desirable the implement/attachment normally supplied by the exporter may have to be adapted. The foreign exporter should also assist in establishing demand volume and specifications.

Based on the above step the foreign exporter should assist the developing country in local manufacture of the Basic implement/attachment, on a phase basis. The modalities of technology transfer (licencing terms, the phased local manufacturing programme, training etc.) should be worked out separately.
(NOTE: The developing country should retain the right, wither to import or locally manufacture, implements/attachments with other appropriate licensor or locally develop when desirable.)

(vii) Local manufacture of appropriate and feasible spare parts

The foreign exporter should, assist the developing country in establishing a check list on possible spare parts that could be locally produced, conduct basic techno economic analysis. Based on the above, a separate agreement on local production should be worked out.

(viii) Technical literature + aids in local languages

The foreign exporter should assist the developing country in produ ing all technical literature and aids, instruction manual, spare parts catalogue, etc. in local languages.

(ix) Transformation into local assembly operations

Depending upon the annual import figures, the import agreement should include a clause to transform the total imports for local assemble (partially knocked down/completely knocked down). The developing countries should have the right to insist upon local assembly at an agreed upon basic annual import volume.

The physical facilities needed should be minimum (not grand schemes which will turn out to be white elephants) with emphasis on assembly operations and bare minimum office and administrative facilities. (Note: Often more money is spent on a showcase office than on assembly operations).

It should be noted that local assembly operations normally contribute around 3-5% of the total FOB cost of the imported built up tractor, and may increase to around 8-10% if full CKD operations plus painting and drying, local purchase of tyres, batteries, some hardware etc. is considered.

As a rough guide, (a) an annual demand of around 400-500 tractors may be economical for PKD component assembly operations. Thy physical facilities required are assembly line, small light machine shop, welding shop, parts depot, assembly and final quality control. This may give employment to around 25-30 local technical personnel. (b) Similarly around 800-1000 annual tractor demand figures may justify a CKD component assembly operation. The physical facilities are front axle assembly, electrical pre-assembly, gear box, rear axle and hydraulic lift assembly engine(if it is not a propiertary item), final assembly, paint shop,

welding shop, assembly quality control, parts depot, etc. The project may employ 120-160 technical personnel.

(c) If the local operation remains only at PKD/CKD assembly, local manufacture of implements may be attached to the same plant. However, if assembly extends to Phase I or II local manufacture, it is desirable to have a separate implement factory.

SECTION IV

MEDIUM/LONG TERM AGREEMENTS: ASSEMBLY LEADING TO LOCAL MANUFACTURE (phase I and II)

(a) Local Manufacture without Foreign Collaboration: Present Situation

18. The present situation is that all developing countries (with the exception of 3-4) have to, at present, enter into licencing agreements with collaborators from industrialized countries for local manufacture of power tillers, tractors, pumps, engines, combine harvesters (pull type/self propelled). The developing countries do not yet have the capabilities in terms of applied R and D and transformation of domestic technology into commercialization.

19. The exceptional successful examples of such domestic technology commercialization are:

(i) Power tillers: China, India, Korea P.R. of, Philippines, Thailand, Vietnam and IRRI (International Rice Research Institute) power tillers - original design with technology transfer programme in Sri Lanka, Malaysia, Indonesta, Pakistan and Colombia.

(ii) Small Riding Tractors (less than 18 hp.): Thailand (Iron Buffalo and next model), China, India (Punjab Tractor Swaraj Model)

(iii) Small Riding Tractor (non-conventional): Swaziland (Tinkabi 18hp) with engine from India, hydraulic transmission from Italy.

(iv) Large Tractors (25hp)+ above): mostly based on original foreign collaborator model and indigenized after licence contract period. Korea P.R. of, China, India (good earth tractor originally from Germany, Escort tractor originally from Poland, Petit tractor originally from U.K.), and Yugoslavia (IMT originally from UK)

(v) Engines: (automotive type 15-30 hp) Korea (P.R. of), China, India, Thailand

(vi) Engines: (stationary 5-10hp) Korea P.R. of, China, India, Pakistan, Thailand

(vii) Pumps (centrifugal 3-8hp) Korea P.R. of, China, India, Pakistan, Thailand

(viii) Harvesters: (pull type/combine harvesters) None.

(NOTE: The above list of countries and products may not be exhaustive but certainly covers more than 75% of sucessful example cases.)

20. Many developing countries are manufacturing basic tractor drawn implements (ploughs, cultivators, Harrows, in some cases planters and seed drills) without foreign collaboration. Such products are mostly based on old imported models, but locally adapted. Some of the countries are: Bangladesh, Brazil, Sri Lanka, China, Colombia, India, Indonesia, Iran, Iraq, Kenya, Korea, Malaysia, Mexico, Nepal, Nigeria, Pakistan, Peru, Philippines, Senegal, Syria, Swaziland, Thailand, Turkey, Tanzania, Venezuela, Vietnam, Yugoslavia and Zambia. (Note: List not exhaustive, but covers more than 70% of actual countries).

21. Therefore, the following parts of this section deal with - as a guideline - factors to be considered by developing countries in entereing into a medium/long term agreement on local manufacture. A summary of salient points to be considered in this regard is given in Annex B.

B. Step No. 1: Basic Work to be done by Governments of Developing Countries

22. Developing countries should be in a position to negotiate with foreign potential partners from an equal position involving (a) knowing what you wand, (b) knowing basic techno-economic aspects of what you are asking for, (c) knowing what choices in technology one may procure, (d) knowing what different potential partners offer similar services and (e) knowing the implication of financial input and long-term bankability.

(i) Prefeasibility Study:

23. The first activity in step one would be that developing countries, through an integrated inter-ministerial working group (preferably with Directorate of Agricultural Machinery/Mechanization as the nucleus) conduct a prefeasibility study and highlight the product needs, specification and demand projection (within the framework of national agricultural mechanization policies - if any - and programmes for market development such as rural finance etc.)

(ii) Ascertaining the interest:

24. Developing countries should have a wide choice in potential foreign partners. Therefore, the developing countries should extend the invitation together with prefeasibility report to ascertain interest on a world wide basis, (not necessarity sticking to a few 'brand names' who are over burdened) setting a reasonable dead line for receipt of replies.

(iii) Preliminary Negotiations:

25. The developing countries should allocate a reasonable fixed period to conduct preliminary negotiations with interested parties and prepare a 'short list' of those who have shown earnest interest. This negotiation period shoud not be over-extended.

(iv) Memordandum of Understanding:

26. An inter-ministerial group with the Ministry of Industry as the nucleus, should negotiate with those foreign collaborators who have shown interest and, on a selective basis, establish a 'memorandum of understanding' with a view to premit the potential

collaborator to conduct a full study and submit project reports and tender.

(v) Appointment of a senior official by the Government of developing country as project co-ordinator

27. The above mentioned four steps could be taken by a 'Committee' with a senior person incharge, for the next and critical stages negotiations shoud be undertaken by a senior official who should be appointed as project co-ordinator (from the Ministry of Industry/Directorate of Technical Development/Technology-Licencing cell etc.) with full power to negotiate.
(NOTE: It is highly desirable that all direct negotiations should be through this project co-ordinator. It is also recommended that parallel negotiations at minister's level with foreign collaborator is avoided at all cost.)

(vi) Rationalized Tender Invitation

28. The developing countries, in order to be in a position to analyse the project reports/tenders on a comparative basis, should issue rationalized tender invitations so that selected potential foreign collaborators may submit inter-comparable project reports/tenders. A guideline in this aspect is detailed in Annex C.

C. Step No. 2: Project Report Preparation by Potential Foreign Collaborator and Submission of Tenders

29. A reasonably, but definite dead line for this phase of work should be established by the government. All assistance should be extended to foreign collaborator in conducting an indepth analysis in the country and in preparation of the project report and proposal.

D. Step No. 3: Comparative Analysis of Proposals

30. The developing countries should be in a position to critically examine the proposals and prepare a comparative analysis of the proposals. As a result the 'project co-ordinator' should be in a position to identify loopholes and be ready to negotiate further from a position of knowledge and authority. The critical elements to be examined are detailed in the next section.

E. Step No. 4: Further Negotiations and Signing of Contract

31. Based on further negotiations, taking into account critical elements, the signing of the contract should be undertaken.
(NOTE: The most important aspect here is the awareness of the developing country of the need to allocate required finances and a commitment on a long term (10 years) basis to provide required foreign exchange finances, and also establish a mechanism to fulfil all obligation on project start up and operation).

F. Step No. 5.: Project Start Up

32. This is the most crucial phase, the developing countries should - in association with the foreign partner, establish a 'project start up group' with sufficient technical manpower, finances and authority. It is very essential that most capable local persons should be deputed/hired. It is also most important that no quick changes in local senior management should be undertaken until the project has really started up and

pilot operations have begun.

G. Step No. 6: Project Operation, Control:

33. The day to day project operations should be completely left to the management of the factory and all assistance should be provided to achieve the objectives and targets.

H. Step No 7: Project Implementation Control + Evaluation:

34. The government of the developing country should, in association with top management of foreign collaboration, establish a high level 'project implementation control and evaluation team' which will supervise from a policy, financial and techno economic point of view, the progress of the project as per contract and take necessary steps to achieve the objectives.

SECTION V

A PRELIMINARY GUIDE LINE FOR PRODUCTION ANALYSIS FOR LOCAL MANUFACTURE PHASE I

a) Production Volume

36. As a guide line, one may state that around 1500-2000 tractors (50-70hp) plus 3000-6000 tractor drawn implements could be considered as an economic unit for Phase I manufacture (simple shift, 250 working days per year) achieving around 20-25% of local content, in a duration of around 5 years from start up, based on the existing infrastructure and capabilities in most of the developing countries.

b) Physical facilities:

37. The eventual required production physical facilities will depend upon 'ABC analysis of components' - those which can be procured locally (either through ancillary industry or local sales agent), those which should be imported and those which should be locally manufactured. Assuming very little of local purchase of components, under normal circumstances the physical facilities required are: (a) Light Machine Shop (parting off, drilling and milling, turning, grinding/boring/broaching etc, aemiautomatic truning) (B) Heavy machine shop (milling/drilling, tapping etc for heavy castings) (c) Press shop (d) Heat treatment (e) welding/fabrication shop (f) Tool room (g0 Fitters section (h) Metallurgical laboratory (i)Inspection and Quality control Unit (j) Sub assembly + (k) Main assembly shops (1) Print booth and drying (m)Mechanical handling (n) Stores (o) Rae material yard. The cost of equipment may be around $2.5-4.0 million.

c) Production Programme:

38. Tractors (at the end of 5 years)
- Local Purchase (mostly imported): tyres, tubes battery, fuel, paint
- Imports: Full engine, full hydraulics, bearings, all transmission components, instruments, rear axle system, clutch + brakes, fully finished hravy castings (gear box, hydraulic housing, rear axle housing and semi finished small/medium castings and semi finished small forgings.) Note: After 2 years of PKD, CKD operations may start.
- Local manufacture: machinery of small/medium semi finished castings, and forgings, local manufacture of around 30-40 small turned parts, sub assembly, assembly, quality control and inspection - propiertary items all imported.

39. Implements
- Local purchase: hardware
- Imported: high carbon steel components, springs, medium carbon steel shanks, discs.
- Local production: frame, assembly and painting, quality control. (Note: for around 4000 implements per year, a separate implement factory with forging facilities for tyres, plough shares, shanks, discs and a spring manufacturing unit may be justified, utilizing tractor factory facilities as supplementary facilities.

d) Man power requirement (tractor plant phase I only)

40. Total around 300-400 of which

Management staff	20/30
Administrative	50/70
Technical/supervisory	40-80
Skilled Workers	120-200
Semi/unskilled workers	70-100

e) Financial investment (not adjusted:) (tractor plant I phase only)

41.

Land	$ 0.5 million
Building	$ 1.5 "
Machinery + equipment	$ 3.5 "
Contingencies	$1.5 "
Total fixed capital	$7.0 "
CKD (2000 tractors 3 months)	4.0 million
Labour 3 months	0.2 million
Contingencies	0.3 million
Total working capital	$ 4.5 "

Total minimum investment required around $26.0 million.

f) Local ancillary industry development possibilities (Phase I and I to II)

42. The transformation from Phase I to Phase II will be smooth and effective if the Governments of the developing countries during Phase I seriously consider promotion of ancillary and supporting industries. Some of the components of the tractor and implements in Phase I will be the nucleus 'bread and butter line' for ancillary industries to operate with possibilities of extension to cover the automotive sector requirement and include allied general engineering products. However, this will require close co-operation of the foreign tractor/implement partner regarding parts or components to original specifications and for introduction of appropriate quality control measures.

43. In addition some of the components may be 'propiertary items' and will require separate licencing agreements with original manufacturer.

44. Such ancillary industry should be promoted within the country by the Government, preferably promotion of small/medium scale entrepreneurship and establishment of industrial estates.

45. Some of the non propiertary items which could be locally manufactured are:
(i) Tractor parts: hardware, radiator, complete muffler, sheet metal, driver sear, rubber parts, plastic parts, springs, wiring harness, gear plant etc.

(ii) Implement parts: springs, high carbon parts such as tyres, share point, hardware, agricultural dies, mouldboard, hitch pins etc.

46. Some of 'propiertary items' which may be considered for study, negotiations and local manufacture are:

(i) Tractor parts: Air filter, fuel filter, brake lining, clutch disc, tyres, batteries, dash board instruments, head lamp + lights, steering sheel, paint, engine components such as spark plug/fuel injection pump, cylinder lining, pistons, hydraulic seamless pipes, fuel pipes etc.

47. The question of establishing a foundry and forge shop either as a part of the factory or as a separate entity require careful examination.

SECTION VI

A PRELIMINARY GUIDELINE FOR PRODUCTION ANALYSIS FOR LOCAL MANUFACTURE - PHASE II

a) Production Volume

48. As a guideline, one may state that around 3,000-4,000 tractors per year, on a single shift basis, (which could be expanded to 6000 tractors per year with 2 shifts plus supplementary production facilities) achieves around 40-50% local content in a duration of around 3 years after the Ist phase has been fully accomplished (total duration around 8-10 years from original project start up).
Note. A separate implements factory should produce around 8000-12000 units/year.

b) Physical facilities

49. Phase I + additional heavy machinery, foundry, forge shop, heavy sheet metal ppess shop, special component production unit, tractor special component production unit and power station.

c) Production Programme (tractors)

50. Strictly speaking this depends upon how much the local ancillary industry has developed and additionally what physical facilities will be established. In general, as per Item B, the following production programme may be anticipated.

- Local purchase : (mostly imported) - tyres, tubes, battery, fuel, paint; (locally made) - some hardware, some rubber/plastic parts, some sheet metal parts.
- Imports: either fully built up engine or all major components, high tensile hardware, springs, instruments, hydraulic system, semi finished gears, shafts, semi finished transmission housing, and clutch housing, steering box, etc.
- Local manufacture: machinery of gear housing, clutch housing, manufacture of selected medium weight foundry items (rear axle housing, hydraulic seat cover etc), simple castings, sheet metal items, additional around 30-40 turned parts, simple forgings, three point linkage.

d) Manpower requirement (tractor plant at the end of phase II)

51. A total of around 900-1200 of which:

management staff	50-75
administrative	100-150
technician/supervisory	150-200
skilled	400-500
semi/unskilled	200-275

(e) Financial investment (tractor plant at end of phase II including phase I) (Not adjusted)

52. Total Fixed Capital

Phase I	$7.0 million
Additional	
Building	$1.0 million
Expanded machine shop	$4.0 million
Medium foundry	$10.0 million
Medium forge	$8.0 million
Basic gear shop	$3.0 million
Power station	$1.0 million
Total additional	27.0 Million
Total fixed cost Phases I + II	34.0 million

Working capital

Additional

CKD (3000 tractors/plus raw material + inventory 4 months)	$9.0 million
Labour (3 months)	0.5 million
Contingencies	1.5 million
total	11.0 million

Total investment required $45.0 million

SECTION VII

A PRELIMINARY GUIDELINE ON PRODUCTION ANALYSIS FOR LOCAL MANUFACTURE - PHASE III (expanded phase II)

(a) Production volume

53. Around 6000-7000 tractors per year on singleshift which could be expanded to 10,000 (2 shifts + additional equipment) with a local content of around 60-80% in a duration of around 3 years after Phase II has been fully accotmplished.

(b) Physical facilities

54. Phase II plus gear plant, engine plant, tractor special component production, expanded forge shop and foundry and heat treatment, tool room, full quality control nd laboratory.

(c) Production programme

55. Imports to consist of special hardware, bearings, some propriertary items etc.

(d) Manpower requirement

56. Around 2500-3000 of which:

management staff	50 - 75
administrative	150 - 175
technical/supervisory	500-650
skilled	1000-1200
semiskilled/unskilled	700-900

(e) Financial investment
(not adjusted)

57. Total fixed capital

	Phase I and II	$ 34.0	million
Additional:	Building	2.0	"
	full forge shop	5.0	"
	complete foundry	8.0	"
	complete gear shop	10.0	"
	engine special components	15.0	"
	tractor special components	6.0	"
	power house	10.0	"
	Total additional	56.0	million
	Total investment min. phase I,II+III	$90.0	million

Working Capital

CKD (6000 Tractors) plus raw material + inventory 4 months	$16.0	million
Salary (4 months)	1.5	"
Contingencies	3.5	"
Total	20.0	million

Total minimum investment required $110.0 million (Phases I, II and III)

SECTION VIII

MAJOR BASIC FACILITIES FOR PRODUCTION

1. General Facilities

58. If we take around 2000-2500 tractors per year plus around 4000-5000 implements/year as a basis for a production programme, with a target of around 20-30% local content in around 5 years from start up, it is recommended that sufficient land is aquired to facilitate rational expansion at a later date. Around 15-20 hectares would be desirable.

The covered area to be built depends upon planned production programme. For light machine shop, assembly, painting, drying and other simple facilities, covered area of around 20000 - 25,000 sqm is required (approximate cost around $200-250 per sqm.)

59. In order to provide a preliminary guideline on physical facilities, duration, finances and man power required for the 6 alternatives, the following table has been presented with approximate figures.

TABLE

Preliminary guideline figures on major basic facilities and finances on the six alternatives (singleshift)
(Not including implement production)

		Import			Local Manufacture		
		Built Up	PKD Assembly	CKD Assembly	Phase I	Phase II	Phase III
1.	Tractor/year No.	300	500	1000	2000	4000	7000
2.	Local content %	0	3-5	7-10	20-25	40-50	60-80
3.	Duration from contract signature to start up (years)	0.5	0.8	1.0	2.0	2.5	4.0
4.	Duration from start up to achieve. max. local content (years)	0	0.5-1.0	1.5-2.0	3-4	5-8	10-12
5.	Factory cov. area (ooosqm)	1.0	2-3	3-5	20-25	30-35	40-50
6.	Office area (ooo sqm)	0.2	0.5	0.75	1-2	2-3	3-7
7.	Outside non-covered store area (000sqm)	0.75-1.5	1.5-2.5	3-4	6-8	10-12	23-50
8.	Outside covered area store(000sqm)	0.85	0.5	1-1.5	2-2.5	3-4	6-10
9.	No of employees	15	25-30	120-160	300-400	900-1200	2500-3000

	Import			Local Manufacture		
	Built up	PKD Assembly	CKD Assembly	Phase I	Phase II	Phase III
10. Land cost rough fig. ($ million)	0.05	0.05	0.05	0.1	0.1	0.15
11. Building cost ($ million)	0.5	0.75	1.0	1.5	2.5	4.5
12. Workshop machinery + equip. ($ million)	0.25	0.5	1.0	3.5	7.5	11.5
13. Contingencies (inc. office, store yard etc)	0.25	0.75	1.5	2.0	3.0	4.0
14. Foundry (build. +equip.) $ million	-	-	-	3.0	10.0	18.0
15. Forgeshop (build.+equip.) $ million	-	-	-	2.0	8.0	15.0
16. Gearshop ($ million)	-	-	-	-	3.0	13.0
17. Powerstation ($ million)	-	-	-	-	1.0	12.0
18. Misc. (inc. tool room etc.) ($ million)	-	-	-	2.0	3.0	7.0
19. Engine special comps. ($ million)	-	-	-	-	-	15.0
20. Tractor special comps. ($ million)	-	-	-	-	-	6.0
21. Total engine plant ($million)	-	-	-	-	-	40.0

2. Basic Casting and Steel Requirements

60. In most of the developing countries th special castings and steels have to be imported for local production. Appendix E and F give the details of requirement of castings and steels per tractor and selected implements. Therefore, when a developing country considers the establishment of basic production facilities, careful consideration should be given to the continued import needs of basic raw materials and the foreign exchange requirement.

3. Foundry

61. The tractor and implements production requires grey cast iron, malleable, and cast steel. In addition a small aluminium die cast foundry is also required. In planning a foundry, around 15% rejection and 65% utilization may be the basis for installed capacity. The following components may be considered as major items (weights approximate) based on degree of physical facilities required.

I TRACTOR PARTS

A Simple parts (castings)

1.	Wheel weights (front 2 units)	60kg.
2.	Pulleys	10kg
3.	Front axle housing	60kg
4.	Exhaust manifold	1kg
5.	Other simple castings	20kg
		151kg

B Difficult Parts (castings)

6.	Oil pump	20kg
7.	Rear axle trumpet housing (2)	150kg
8.	Clutch housing	30kg
9.	Final drive housing (2)	80kg
10.	Other parts	120kg
		410kg

C. Specialized Parts

11.	Differential transmission housing	80kg
12.	Gear Box Block	200kg
13.	Hydraulic housing	100kg
14.	Hydraulic housing cover	20kg
15.	Engine block	200kg
16.	Cylinder head cover	20kg
17.	Other parts	100kg
		720kg

II IMPLEMENT PARTS

	malleable casting	iron casting
mould board plough	30kg	-
disc plough	60kg	55kg
disc harrow	-	85kg
simple harvesting equipment	50kg	25kg
simple thresher	-	30kg
trailer	20kg	80kg
	160kg	275kg

62. A basic simple foundry (for phase I) could only meet grey cast iron requirements (wheel weights and simple grey cast iron parts for implements) with basic pattern making, moulding, maintenance shop and inspection and quality control as well as basic machine shop. Around 400 tons/year which could be expanded to around 800 tons/year (singleshift) in 3-4 years will require an investment around $3-4 million plus fees for technological, managerial, operational, training and organizational assistance.

63. An intermediate foundry (for phase II) with grey iron and malleable casting plus small aluminum casting facilities to locally produce both simple and difficult parts will require a capacity of around 3000-4000 tons/year assuming all simple and selected castings are locally produced, of which 800-1000 tons may be for outside requirement. This will require melting device, two crucible furnaces for medium frequency induction, heating, with sprarate generator and out put of around 1.0-1.5 tons per hour each, aluminum melting furnace, casting moulds, ladles, core shop, moulding shop, casting cleaning, annealing, sand blasting, paint shop, casting store, vehicles for internal transport and conveyors. This will require an investment of around $10-12 million for building and equipment excluding technology transfer and allied fees. If gas is not available, electricity generating installation and equipment of around $1.0 million is required for phase I forge and foundry.

64. A full foundry (for phase III) for all major components (except complete engine) will require around 8000-10000 tons per year of which around 2000-3000 tons may be for outside requirement. A medium aluminium die cast foundry of 200-250tons/year is necessary. It should be noted that maximum care is required in planning such a foundry as it will involve heavy investment. A total investment of around $15-18 million for foundry equipment and building plus $3-5 million for foundation and roads will be required. Such a foundry may employ around 200-250 persons. A separate power station of around 2000kw/hr costing around $8-10 million is also necessary.

4. FORGE SHOP

65. A simple forge shop (phase I)with around 20 tons/month capacity with equipment and building will require an investment of around $2.0-$2.5 million for building and equipment excluding technology transfer and allied fees. (Around 10 tons per month of the above production may be for outside requirements.) The equipment necessary will be metal cutters, hammers, annealing, blasting, heat treatment and grinding shop.

66. An intermediate forge shop (phase II) producing around 50-70 tons/year (25% for out side-requirement) will require around $5-7 million investment and will require a power station of around 3000 kwh capacity.

67. A full forge shop (phase III) requires careful examination due to its magnitude and financial requirement, as well as organizational/operational problems. A capacity of around 100-125 tons/year at 60% utilization on a single shift with around 20% production for outside requirements will involve an investment of around $8-10 million with around $3.0 million for building and $2.0-$3.0 million for foundation and infrastructure. An additional $2.0 million may be required for installation and jigs. A power house of around 600kwh and water consumption of 15-18 cum/hr is required. The forge shop may employ around 125-150 persons.

5. OTHER FACILITIES

68. Other facilities such as:
(i) tool room for manufacture of jigs, fixtures, tools and dies with precision machines and jig boring machines.

(ii) Central electro plating, galvanising and phosphating plant

(iii) Central heat treatment plant for carburising, induction hardening, cynide and natural salt hardening, and tempering

(iv) Quality control and inspection shop and system

(v) Repair and maintenance workshop,

are very necessary especially in Phase II and III operations.

SECTION IX

CRITICAL ELEMENTS OF LICENCING AGREEMENTS AND TECHNOLOGY TRANSFER

a) Different Negotiation Agreements

69. A tractor and allied equipment manufacturing project appraisal includes not only techno economic and socio-economic viability but also the implication of various technology transfer agreements.

70. The overall evaluation of the project (or inter-comparison of various project proposals) should include an indepth analysis of project scope and location, evaluation of the market, economic effects of the project, project cost, financing plan and return.

71. The techno-economic analysis should include alternatives in production technology, specification of product, phased manufacturing programme, products/components for local purchase, import and local manufacture, proprietary items and their implications, scale of production, production facilities, local content, ways and means of increasing local content and time schedule, unit cost of production, training, man power requirement, fixed asset cost, magnitude and type of raw material requirement, employment, interlinkage and ancillary industry development etc.

72. The financial analysis includes project cost, unit cost of production, financing plan and return, fixed capital, price escalation, working capital, annual foreign exchange requirement, domestic capital, annual foreign exchange saving, credit draw down and repayment schedule, peak credit repayment schedule, amortization, break even point, utilization capacity of licensed/installed capacity, CKD prices and deleting value, spare part prices etc.

73. The critical elements of technology transfer should be analysed carefully in the following various agreements:
- founders agreement
- licence and technical assistance agreement
- management assistance agreement
- supply agreement
- trade mark agreement
- operational assistance agreement
- continued technology transfer agreement
- infrastructure development agreement

b) Founders Agreement:

74. Careful study is required on: equity structure, composition of membership of board of directors, voting rights, veto power, and policy decisions.
- Provision of all managerial, technical, marketing, administrative and financial services by Licensor (normally detailed through separate agreements).
- Licensor's right to supply (i) the contracting authority (ii) managing agent (iii) procurement agent (iv) supervisor of construction (v) operating managers of the company in all major aspects (organizational, financial, personnel, production, marketing, financial planning, recruitment, training) including duration, renumeration, local counter part authority and transissional period of taking over.
- sale of products through Licensor's own local distributors, sale of other similar products, import of similar products by the Government.

- Duration of tax free dividends.

75. In principle, care should be taken:

- not to allow numerous routine management decisions to be subject to Licensor's veto through minority vote of their directors.

- Payment by the developing countries of substantive management and technical fees without project sucess.
- Licensor's restriction on components and markets.
- Restriction on product diversification (other products) by developing countries using the same physical facilities.
- Guarantee to train and handover management to local counterparts.
- Status of proprietary items.

(c) Licence and Technical Assistance Agreement:

76. The following critical areas require careful examination by the governments of developing countries:

77. Licensor's fee for start up: (if a lumpsum is charged to Licensee for start up activities including training of personnel, production workers, plant set up, activities for increase of plant output and increase of local added value), details of actual services, duration, evaluation of services and time of payment (on signature of contract of phased payment).

78. CKD pricing and deletion values - Economic viability of the project depends upon importing a CKD kit for less than the cost of an equivalent completely assembled unit, and assembling the unit for less than the difference. In theory, the potential profit is supposed to increase as sub-assembly and components for tractors and allied equipment are deleted from the imported kit and produced locally for less than their 'deletion value'. However, this depends upon the Licensor's pricing of the CKD kit and his setting of the deletion value for assembly and components. Therefore, an acceptable procedure for determining CKD prices to protect the interest of the joint venture as well as the economy.

79. In addition, as in the case of completely built tractor unit (CBTU), prices include a fair margin to cover maintenance and warranty services, the Licensor normally includes the similar provision in CKD kits. In calculating a 'deletion value' as a deduction from the price of CBTU, however, the Licensor may also charge an additional warranty fee per tractor to cover the contingent warranty expenditure. The developing countries should check this factor carefully.

80. Local content increase: careful study of the Licensors presented methodology of increased local content is necessary. Often, the Licensor may state increased local content through (a) Local Purchase of Components (mostly imported) such as battery, tyres, electrical items, paints, hardware and some proprietary items which, from a national point of view do not result in foreign exchange savings, (b) Local Purchase of Components for which neither the government no licensor has any plans to develop appropriate local ancillary industry (example: plastic and rubber parts, hardware, intermediate castings, sheet metal items such as driver seat, muffler, (c) Local Purchase of Components which may be partially proprietary items; such as radiators, head lamps, tail lights, filters, brake lining, disc plates etc. for which no special licencing agreement has been undertaken by Licensor or foreign collaborator and (d) Local Purchase/Manufacture of components such as heavy castings,

, special tractor components eg. forgings, hydraulic lift, gears, engine components, steering sheel etc. which require additional heavy investments and training programmes which have not yet been analysed by the Licensor and collaborators. Therefore, the usual presented local content achievement should be taken by the developing countries with a 'pinch of salt' and should carefully analyse the proposals and be sure that action programmes required to achieve such a local content percentage is agreed upon between the partner and necessary finance, policy and administrative mechanisms of the Government and are committed to the same.
In addition the government should carefully study the possible development of local subcontracting facilities. Especially in simple machinery, grey iron casting, simple forgings, sheet metal parts, selected hardware and the government should undertake an analysis of existing mechanical and metallurgical engineering faciiities within the country and identify specific possibilities for sub contracting; local manufacture of selected components.

81. Training: the training of the Licensee personnel by Licensor should be defined in terms of training ares, duration, place and time schedule. In addition establishment of implant training programmes should be specified. During planning perios, a mechanic/supervisory staff training school should start functioning. In case 'training' is not a part of technical assistance agreement, a separate training agreement will have to be worked out.

82. Technical documentation should be provided in local languages also and any additional fee involved should be clearly specified. In addition, 'technical documentation' should be defined in specific terms with a list and outline of contents.

83. Right to amend specifications by the licensor should include a clause to give the Licensee on agreed upon notice period for any amendment and guarantee parts supply during the agreed upon period.

84. Restriction on export of products by Licensee outside the territory should be examined and negotiated to allow export to neighbouring countries.

85. Payment for the Licence Rights by the Licensee (developing country) to Licensor should be included in the Project Cost. Normally around $0.6 million to $1.2 million technical planning fee for the tractor factory, (Phase I) $2-3.5 million (Phase II) and $4-5 million (Phase III) is charged. It should be noted that foundry and forgeshops (especally for Phases II and III) are under a different licence agreement involving know how, documentation, technical assistance, organization, engineering aspects, training, start up and total fee is subject to negotiation.

86. Deletion fee: In addition to above payments for the licensing rights, continued licensing fee of 3-4% on ex-works prices minus CKD imports and 3-4% on spare parts manufactured, procured or sold by Licensee for a duration of 8-10 years requires careful negotiation.

d) Management Assistance Agreement

87. The Licensor may propose a lumpsum (between $500,000 to $1.0 million) plus a fee equal to 1.5-2.5% of the ex-works company (Licensee of the developing country) selling fee of all licenced products and spare parts for 5-7 years duration. This should be carefully examined by the developing countries.

88. The question of appointment of a 'contractor' by the Licensor or by the Licensee in consultation with Licensor in assisting project/factory/ equipment planning, procurement, erection and installation should be examined carefully and the mode of appointing the contractor should be checked. Procurement of equipment through international sub-con tracting should be examined.

89. The question of management assistance from Licensor to Licensee through provision of foreign managerial/technical staff, the fee/salary involved, duration and obligation towards training local counterparts requires an indepth analysis.

e) Supply agreement

90. The duration of supply agreement (normally 7-10 years) may restrict the Licensee (developing country) in procurement/ manufacture of the product through sub-contractor within the territory (country) only. Negotiations should also include appropriate subcontractors from neighbouring countries.

91. Any restriction made by Licensor, on Licensee (developing country) producing locally replacement parts for licensed products should be carefully examined.

(f) Trade mark agreement

92. The continued fee per tractor, or payment of lump sum fee and duration of trade mark agreement requires careful negotiation.

(g) Operational Assistance Agreement

93. In addition to 'start up' agreement and fee, the question of operational assistance from the start up period to a period achieving the desired local content plus satisfactory training of counterparts should be carefully negotiated. The type of foreign personnel, the qualification, duration, training of counterparts, progressive joint decision making mechanism and fees should be carefully analysed and negotiated.

(h) Continued Technology Transfer agreement

94. Either separately or as a part of the other above mentioned contracts, the Licensor should guarantee transfer of new technologies (relating to the licensed product) free of cost.

95. In addition to local manufacture of licensed products, the agreement should include assistance to strengthen or establish new facilities for engineering development, adaptation, and testing of agricultural machinery and implements. this programme should aim at development of products suited to the local needs and should be incorporated in the manufacturing programme.

(i) Infrastructure Development Agreements

96. The developing countries should also explore the possibilities of including agreements in strengthening the existing or establishing new facilities for:
- tractor operator training and 'on the farm' maintenance
- repair and maintenance network and training mechanics
- dealers network, marketing organizations, after sales service and field performance analysis programme
- central spare parts depot, inventory control and spare parts handling training.

- Rural financing system

97. The above agreements may require provision of experts, training aids, training programme and some equipment from the Licensor to Licensee and a programme to train local trainers and supervision of their training of other operational personnel. The fee involved will have to be negotiated.

(j) Summary of some of the major fees (approximate)

98. The following are some approximations of major fees:

(a) payment for the license rights $1.0 million lumpsum.
plus
(i) License fee of around 3-4% on ex-works prices minus CKD imports
(ii) Spareparts fee of around 3-4% on all spare parts manufactured, procured and sold by Licensee for a duration of 8-10 years.

(b) Managerial Assistance fee $0.75 million - $1.0 million (lumpsum)
plus
Additional fee equal to 2.0-2.5% of the ex-works company (licensee) selling price of all licensed products and spare parts for a duration of 5-7 years.

(c) Payment of start up $2.0 million lumpsum

(d) Training Agreement fees ?

(e) Trade mark fee ?

(f) Technical licensing fee for foundry and forge ?
(Gear shop, special heat treatment shop, power station etc.)

(g) Infrastructure development fee

SECTION X

MAGNITUDE OF FINANCES, PROBLEMS OF FINANCES AND INVESTMENT PROMOTION

99. Types of financial need

(a) The total investment including fixed assets and working capital for the project, (b) foreign exchange needed for fixed assets and set up, (c) foreign exchange needed for continuous full operation of the plant, and (d) domestic finances for items b and c are the most important factors to be considered.

100. Magnitude of total investment

The following table gives an approximation of minimum total investment needed for tractor (60-70hp) imports, local assembly and local manufacture under 6 categories. The figures are taken to be a guide only. The price escalation, is not taken into account and it will require upwards adjustment. The developing countries should seriously consider the variety in financial magnitudes and the need for raising the domestic and foreign exchange finances. The role of international financial institutions is of paramount importance in this field.

TABLE

Magnitude of Total Investment For Tractor Import, Assembly and Local Manufacture
($ Million)

A. Imports	Units/Yr.	Local Content %	Fixed Asset $ Mil.	Working Capital $ Mill. (4 months)	Total Investment $ Mill.
1. Fully Built Tractors	300	0	1.0	1.0	2.0
2. PCK assembly	500	3-5	1.5	1.5	3.0
3. CKD assembly	1000	7-10	2.5	2.5	5.0
B. Local Manufacture (singleshift)- tractors					
1. Phase I	2000	20-25	7.0	4.5	11.5
2. Phase II	4000	40-50	34.0	11.0	45.0
3. Phase III	7000	60-80	90.0	20.0	110.0

Note: These figures do not include additional total investment necessary for local manufacture of implements. Around 8-10% extra for 'assembly' and 15-20% extra for 'local operations' of above total investment should be added for implements.

101. Foreign exchange needs: fixed assets and start up capital.

The following table gives minimum foreign exchange needs under six categories. It does not include needed finances for implement factory. The question is which category operations the developing country will choose and how they will secure the foreign exchange finances? What is the role of foreign collaborators; international financial institutions, bilateral and multilateral aid programmes?

TABLE

Foreign Exchange Needs: Initial Fixed Allocation

A.	Imports	Units/ Year	Fixed Asset (70% of Total Asset)	Start up Technology Transfer Fee)	Total Initial Fixed Allocation
1.	Fully Built Tractor	300	1.0	-	1.0
2.	PKD Assembly	500	1.5	0.2	2.7
3.	CKD Assembly	1000	2.0	0.5	3.0
B.	Local Manufacture				
1.	Phase I	2000	5.0	1.0	6.5
2.	Phase II	4000	23.0	2.5	25.5
3.	Phase III	7000	63.0	5.0	68.0

Note: If an appropriate local tractor drawn implement production factory is included around 25% extra 'Import' and around 20% extra 'local manufacture' should be calculated to the total initial fixed allocation at the similar local content level.

102. Continued Annual foreign exchange needs for import/assembly/ production operations.

The following table gives an estimate on annual foreign exchange needs to be met by developing countries for import, assembly and production operations in 6 categories:
These preliminary figures are for the end of the stage, and do not include (a) price escalation (b) continued royalties and fees (c) spare parts import, (d) some special raw materialimport and (e) import of components/raw materials by local ancillary industries. Therefore adjusted figures may be 25% higher.

103. In addition the above figures do not include the foreign exchange finances required for operation of appropriate local tractor drawn implement factory. Assuming 2-3 implements per tractor, the annual foreign exchange requirement may increase by 50% for"assembly" and around 20-25% for phase I to II local production.

104. It is highly essential to note that unlike total import of built up tractors and assembly with insignificant local content, the local manufacturing operations require continued committment on the part of the government of developing countries to allocate annual foreign exchange 9-14 months in advance, every year for at least 10-15 years.
Although foreign exchange content per unit may reduce as local content increases, the total amount will remain significant due to larger production numbers.

TABLE

Annual operational foreign exchange requirements for import/assembly/production operations ($ Million)
(at the end of the stage)

A. Import	Units/year	Annual operational foreign exchange requirement ($ million)
1) Fully built tractor	300	2.5
2) PKD assembly	500	4.0
3) CKD assembly	1000	8.0
B. Local Manufacture: Tractor (CKD + Raw material + other technology transfer fees)		
1) Phase I	2000	14.0
2) Phase II	4000	18.0
3) Phase III	7000	28.0

105 The developing countries should note that annual foreign exchange saving through local production is to be conceptually and quantatively achieved on a national scale, the country should develop capabilities to expend sufficient foreign currency resources for achieving full production capacity. An analysis of computed foreign exchange savings and peak credit build up, credit draw-down and replacement schedule should be undertaken in depth. The project's recurrent foreign exchange needs must, therefore, be recognized and accepted by the Government before the investment decision is made.
The question is how can the developing countries meet this recurrent expenditure? What is the role of foreign collaborator and international financial institution?

106. Domestic finances
The developing countries should also take into account the ways and means of raising the necessary domestic finances. It is highly desirable that foreign collaborators are kept completely out of this field. Domestic finances include manufacturing finances as well as rural marketing/credit finances.

107. Financial implications: Failure to achieve installed capacity and sucessful operations
The foreign exchange requirement for annual operation, technical problems, management problems, some regulations and procedures of the government may be drawbacks for the foreign collaborator/local partner and may result in failure to achieve sucessful operations and installed capacity as per plans. This will only result in a 'white elephant', - burden on national economy. Therefore, it is highly recommended that the government in co-operation with the foreign collaborator establish a high level 'project implementation advisory and evaluation committee' which will direct the project to achieve the desired objectives.

108. A guideline on a '15 year five phase tractor manufacturing programme' is given in annex D.

,109. IMPORTANT NOTE: For all the investment figures mentioned in the previous sections, it is desirable to consider the same with a 40-60% minimum increase if the contract is signed by 1980-81, start up is in 1985-86 and actual achievement of planned, production and maximum local content by 1991-93.

SECTION XI

POSSIBLE INTERNATIONAL ASSISTANCE AND ROLE OF UNIDO

(a) At the request of the Developing Countries (Governments. National and Sub-regional levels)

(i) Prefeasibility/Feasibility Study:

110. Assistance in conducting prefeasibility/feasibility studies regarding the overall medium and long term potential for tractors, allied power equipment and implements, (including product specification, demand and market development) within the framework of the Governments policy/plans on agricultural mechanization and industrial development.

(ii) Import vs. Local Assembly/manufacture decision

111. Assist in the analysis of implications of import vs. local assembly/manufacture and provide techno-economically viable alternatives and advise on an appropriate decision.

(iii) Medium/longterm Import agreement Leading to Local Assembly

112. (a) In case the volume does not justify local manufacture, assist the government in analysing product choice, product specification and drawing up of a judicious and fair import agreement with foreign collaborator.

113. (b) In addition assist in the negotiation and drawing up of contractual agreements on transformation of total imports to local PKD/CKD assembly operations.

114. (c) Also assist in analysing foreign exchange requirement and advising on ways and means of fulfilling the continued committments.

115. (d) Advise on start up and operation, with due regard to contractual obligations and evaluate the progress.

(iv) Medium/Long term agreements: Assembly leading to local manufacture (Phase I, II and III)

116. (a) Assist in drawing up of extended list of potential invitees (foreign manufacturers), submit letters (with prefeasibility report) to ascertain the interest of potential invitees, preliminary screening of replies and establishment of a list for preliminary negotiations, assistance in preliminary negotiations and drawing up of memorandum of understanding to prepare project report and proposal.

117. (b) Assisting the government in establishing a 'Governmental Project Team for Negotiations and Agreement' Such a team should consist of senior officials of different relevant ministries with participation by local senior technical, financial, legal personnel.

118. (c) Assisting the above 'Governmental Team' in an inde th comparative techno-economic analysis of various project reports/proposals, detailing 'pros and cons', highlighting the points for further negotiation, establishment of a short list for next round of negotiations, assist in negotiations and advise on most suitable proposals thro gh detailed appraisal of the project.

119. (d) Assist and advise the above 'Governmental Team' in selecting joint partner and complete final negotiations with special reference to:

- definition of project scope and broad engineering specifications;
- agreement with foreign collaborator for technology and management transfer;
- broad agreement on external and domestic financing;
- appointment of engineering contractor;
- appointment of general contractor, and as necessary civil, mechanical, and electrical contractors;
- finalisation of external financing;
- international procurement of equipment;
- project contrruction and
- proving and take-over of plant.

(v) Project Start up and Implementation (Phase I, II and III)

120 (a) Assist the government in establishing a 'Project Team for Management and implementation' consiting of a project director, technical manager, financial manager, legal manager, procurement manager, personnel manager and administration manager.
Note: The Government's project team for negotiations and Agreement' - reference item iv (b) may be expanded if necessary.

121 (b) Assist and advise the 'Governments Project Management and Implementation Team' in construction and project start up with special reference to:
- selecting general contractor
- equipment procurement
- monitoring construction and installation
- selection and training of staff
+ start-up and initial operation
- project implementation

122. (c) Assist in analysing expansion, physical facilities, ancillary industry development with due consideration o techno-economic implications with reference to:
- increased production volume
- increased product mix
- increased local content
concerning advancement from phase I to II and eventually to III or II to III or direct III phase as the case may be.

(iv) Project Implementation and Evaluation (Phase I, II and III)

123. (a) Assist and advise the government in establishing a 'Project Implementation and evaluation Team' consisting of senior local official of the project, foreign collaborator and selected high level officials of the government to follow up the implementation, analyse major draw backs (including major plant level difficulties, collaborators non fulfillment of contractual obligations and problems due to government policies/ proceedure) and take action to achieve the planned target in production volume and local content in the scheduled time period.

(b) At The Request Of Inter-Governmental Institutions (sub-regional and regional

124. (i) Regional Feasibility Study: Assistance in conducting a regional feasibility study, rationalization of products and product specification.

(ii) Rationalization of Products/Components: Production and market sharing

(a) Assisting in judicious and fair sharing of production facilties, co-operative final production and market sharing - drawing up of basic documents and project details.

(b) Assisting the regional institution in negotiationswith foreign collaborator.

(c) Role of UNIDO

(i) Overall assistance: UNIDO at the request of the government/s of the developing countries shall assist in the above detailed areas, subject to availability and allocation of appropriate finances (UNDP/IPF, UNIDO/UNIDF and project cost). The assistance may be primarily through provision of short term experts and training programmes.

125. (ii) Specific long term advisory assistance: UNIDO shall also assist the Government's
(a) Project Negotiation and Agreement Team
(b) Project Management and Implementation Team
(c) Project follow up and Evaluation Team,
through provision of senior team of experts for long term duration (subject to availability and allocation of finances.)

126. (iii) Owner's Representative: UNIDO, may undertake the role of 'Owners'Representative' and assist on a contin ous basis from negotiation to project implementation evaluation.

127. (iv) Consultation tours among developing countries: UNIDO may at the request of concerned developing countries (planning to establish a factory) organize a consultation tour for 5-6 officials of that country to selected developing countries which have achieved local production and have experience so that the developing country may share such experience.

128. (v) Investment Promotion Meetings: UNIDO could organize investment promotion meetings bringing together interested developing countries, potential foreign partners and financial institutions.

129. (vi) Technology Transfer documentation and information dissimination

UNIDO could prepare appropriate technology transfer documents on product specification, production technology and alternatives, model contracts, directory of manufacturers etc.

ANNEX A

A Guide on Spare Parts Requirements

REPLACEMENT TURNOVER FACTOR (RTF)

(Frequency of replacement of a Component during a Vehicle's road-worthy life.)

(case study - India)

(Each country has to adjust these figures as per local conditions and models.)

Sl. No.	Nomenclature	Commercial Vehicles Heavy & Medium	Commercial Vehicles Light	Cars & Jeeps	Scooters, Motorcycles & 3-Wheelers.	Tractors
1	2	3	4	5	6	7
1.	Pistons	3	2	2	3	2
2.	Piston Pins	3	2	2	3	2
3.	Piston Rings	6	4	4	6	4
4.	Gaskets	10	6	6	10	10
5.	Inlet & Exhaust Valves	4	3	3	3	4
6.	Valve Guides	3	2	2	2	3
7.	Valve Springs	1	1	1	1	1
8.	Valve Tappets	1	1	1	1	1
9.	Push Rods	1	1	1	1	1
10.	Timing Chains	3	1	½	2	4
11.	Carburettors	1/10	1/10	1/10	1/10	-
12.	Fuel Pump (petrol)	1/10	1/10	1/10	-	-
13.	Fuel Injection Pump (multicylinder)	1/20	-	-	-	1/20
14.	Fuel Injection Pump (single cylinder)	-	-	-	-	-
15.	Fuel Injection Pump Nozzles	6	-	-	-	6
16.	Fuel Injection Pump Nozzle Holders	1/20	-	-	-	1/20
17.	Fuel Injection Pump Elements	4	-	-	-	4

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1	2	3	4	5	6	7
18.	Fuel Injection Pump Delivery Valves	4	-	-	-	4
19.	Filters (Air, Oil and Fuel)	1/100	1/100	1/100	1/100	1/100
20.	Filter Elements/Inserts/Cartridge	15	8	8	-	15
21.	Flywheel Ring Gear	1/20	1/20	1/20	-	1
22.	Water Pump	1/100	1/100	1/100	-	1
23.	Water Pump Repair Kit	8	3	3	-	4
24.	Radiator and Cores	1	1/20	1/20	-	1
25.	Silencer Muffler	4	1	1	1/10	3
26.	Thinwall Bearings	3	2	2	-	3
27.	Starter Motors	1/2	1/100	1/100	-	1/2
28.	Generators	1/2	1/100	1/100	-	1/2
29.	Voltage Regulators	3	3	1/10	-	4
30.	Distributor Assembly	1/2	1/100	1/100	-	-
31.	Condenser, Contact Point, Distributor Rotor	6	6	4	-	-
32.	Ignition Coil	4	2	1	1	-
33.	Flywheel Magneto	-	-	-	1/100	-
34.	Spark Plugs	15	8	6	8	-
35.	Steering Wheels	1/20	1/20	1/40	-	1/100
36.	Steering Gear	1	1/10	1/10	-	1
37.	Tie Rod End	5	3	2	-	3
38.	Drag Link	3	3	-	-	3
39.	King Pins	8	6	-	-	2
40.	Wheels	1/100	1/100	1/100	1/100	1/100

1	2	3	4	5	6	7
41.	Clutch Assembly	1/10	1/10	1/10	1/10	2
42.	Clutch Plates	8	3	3	2	2
43.	Clutch Linings	6	3	3	-	4
44.	Gear	2	1/2	1/10	1/4	1
45.	Propeller Shafts	1/10	1/20	1/20	-	-
46.	U. J. Cross	6	3	2	-	-
47.	Crown Wheel & Pinion	3	2	1/4	-	1
48.	Rear Axle Shaft	3	1	1/10	-	1
49.	Oil Seals	6	3	3	3	4
50.	Leaf Springs	2	1	1	-	-
51.	Coil Springs	-	-	1	2	-
52.	Shock Absorbers	6	2	2	2	-
53.	Hydraulic Brake Assembly	-	-	-	-	-
54.	Master Cylinder Assembly	1	1/20	1/20	-	-
55.	Master Cylinder Repair Kits	10	6	4	-	-
56.	Wheel Cylinder Assembly	2	1/20	1/20	-	-
57.	Wheel Cylinder Repair Kit	10	6	4	-	-
58.	Air Brake	1/100	-	-	-	-
59.	Brake Linings	8	4	4	6	6
60.	Brake Hose	3	2	1	-	-
61.	Brake Drum	2	1/20	1/100	-	1/20
62.	Hubs	1	1/100	1/100	-	1/100
63.	Electric Horns	1/2	1/10	1/10	1/10	1/100
64.	Horn Relay	3	2	2	-	-

1	2	3	4	5	6	7
65.	Wiper Motor	2	1/20	1/20	-	-
66.	Wiper Arms & Blades	4	4	4	-	-
67.	Head Lamps	1/10	1/10	1/10	1/10	1/10
68.	Flasher Units	6	6	6	-	-
69.	Control Cables	2	1	1/2	1	2
70.	Speedometer	1/10	1/10	1/10	1/20	-
71.	Panel Instrument	1/10	1/10	1/10	-	1/10
72.	Battery	6	4	3	4	4
73.	Tyres	10	6	3	6	4

ANNEX B

Summary of Factors to be Considered for Medium/Long term Agreements on Local Manufacture

In general, the technology transfer from industrialized countries to developing countries is either on a Government to Government level, or at institutional exchange or enterprise to enterprise level. However in most of the cases, the technology transfer involves legal and financial aspects and the capacity of the developing countries to bargain. Licencing and subcontracting are one of the most common modes of technology transfer. The following factors are to be analyzed in detail for any decision to be taken on imported technology transfer through subcontracting and licencing. An "Industrial Technology Cell" may be in a position to assist in such an analysis.

(i) "REAL COSTS" of acquiring Imported Technology:

- (a) Direct and indirect payments: patents and licencing rights.
- (b) Hidden costs: restrictive clauses - restricted exports, long term import of raw materials, components, proprietory items and managerial skills.
- (c) Royalties and technical fees.
- (d) "Positive gains" in co-operative component manufacture, sub-contracting and exports.
- (e) "Social costs".

(ii) Know how: Patents and Non-Patents:

- (a) International patents - obligations and restrictions.
- (b) Economics of the import of patented knowhow against licencing of unpatented knowhow.

(iii) The Modes, Systems and Patterns of Agreements:

- (a) Degree of ownership.
- (b) Level and sophistication of technology.
- (c) Duration and foreign exchange payments.
- (d) Duration and local currency payments.

(iv) Duration of the Agreements:

(a) Intermediate term agreements (around ten years).
(b) Long term agreements (around 15 years).
(c) Repetitive short term agreements. (5 years each)
(d) Advantages of repetitive over intermediate/long term agreements in terms of transfer of technological progress.

(v) Payment of Royalties:

(a) Rate of royalty.
(b) Economics of lower royalty against higher technical fees (drawings, specifications, designs).
(c) Sealing down royalty.

(vi) Restrictive clauses:

(a) Purchase of raw materials, components and proprietary items from approved sources.
(b) Restrictions on production patterns, exports and sales procedures.
(c) Imported management.
(d) Restrictions on inplant R and D and domestic transfer of technology.
(e) Stipulation on machinery, selection, process planning and sub-contracting.
(f) Restrictions on local technical manpower development.
(g) Restrictions on exports - prior committment of licencee in other countries. Global ban of exports.

(vii) Secrecy clauses:

(a) Inter-firm transfer of technology
(b) Restriction on domestic transfer

(viii) Repetitive Imports of Technology

(a) Inter-relationship between foreign exchange committments and repetitive imports of technology.
(b) Import of obsolete technology.

(ix) Duplicated Imports of Technology:

(a) Effects on foreign exchange.

(b) Under-utilization of domestic technology, physical facilities and resources.

(c) Inter-relationship between time factors and continuous import of latest technology.

(x) Adaptation and absorption of Imported Technology:

(a) Inplant and domestic institutional assistance.

(b) Economic size of production, process planning, selection of machinery, plant layout, production technology and technical manpower training.

(xi) Factory level and institutional domestic research and development:

(a) Adequate physical facilities and finances.

(b) Technical manpower availability.

(c) Industry orientated R and D programmes.

(d) Invention promotion and incentives.

(e) Domestic technology transfer.

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15/5/79

ANNEX C

A guide for preparation of tender invitation by developing countries and rationalized project report preparation by foreign collaborator

I OVERALL SUMMARY OF PROJECT PROPOSALS

1. Project Scope and Location
2. Evaluation of the Market
3. Economic Effects of the Project
4. Project cost
5. Financing Plan and Return

II DEMAND FOR TRACTORS AND AGRICULTURAL MACHINERY

1. Past Imports and Usage
2. Servicing and Maintenance of Tractor and Machinery
3. Future Pattern and Volume of Agricultural Production
4. Scope for Mechanized Farming
5. Projections of Demand for Tractors, and Agricultural Machinery
6. New Requirements for Servicing and Maintenance
7. Development, Adaptation and Testing
8. Marketing Organization

III PROJECT DETAILS

1. Number of Complexes/Choice of Alternatives
2. Specification of Products
3. Products for Local Assembly/Manufacture
4. Scale of Production
5. Location
6. Phasing of Assembly and Manufacture
7. Unit Cost of Production
8. Increasing local content
9. Manpower Requirement
10. Fixed Asset Cost
11. Transfer of Technology
12. Training
13. Project Implementation
14. Cost of Production on different phases.

Annex 1 - Fixed Assets and Working Capital Requirements
Annex 2 - Financing Plan
Annex 3 - Comparison of financial performance in different stages
Annex 4 - Progression of Deletion Values and Incremental Deletion Values
Annex 5 - Annual Foreign Exchange Savings

ANNEX D

- - -

A guideline on -

A 15-Year Five Phase Manufacturing Programme

It must be remembered that a factory is not just a physical facility. A successful factory incorporates a dynamic manufacturing programme with a phased development and with special emphasis on (a) increased physical facilities for production, (b) increased local content, (c) training of local personnel, (d) expansion of production, (e) quality control and (f) management techniques. Therefore, it is recommended that the governments of developing countries consider a phased manufacturing programme with emphasis on phase A to start with, with continued activities on phases B, C, D and E.

A production programme may involve the following phases:

Phase A: Assembly/manufacturing phase (1980 - 1985)

(five years, with two years planning and three years operational)

(a) With physical facilities: light machine shop, assembly, light press shop, fabrication shop, heat treatment, assembly and painting.

(b) Utilization and expansion of existing foundry, forge shops and ancillary industries within the country.

Phase B: Analysis of manufacturing intensification (1982 - 83)

(a) Possible establishment of a separate foundry

(b) Possible establishment of a separate forge shop

(c) Possible establishment of a gear plant;

(d) Possible establishment of a heavy press shop;

(e) Possible establishment of an engine assembly plant;

(f) Possible establishment of an advanced heat treatment unit;

(g) Possible establishment of advanced quality control and inspection unit;

(h) Possible establishment of a separate implement factory;

(i) Development of ancillary industry manufacturing programme.

(Note: The analysis and study for selected above items may start in 1982/1983).

Phase C: Manufacturing expansion and intensification programme (1985 - 1987)

(a) Expansion of phase A production facilities to produce a larger number of tractors, and appropriately increased number of other products through second shift and provision of balancing equipment;

(b) Establishment of selected manufacturing intensification facilities as detailed in Phase B.

Phase D: Achieving highest degree of local content (1987 - 1992)

(a) Stabilization of phase C manufacturing programme;

(b) Operational phase of established and intensified physical facilities;

(c) Establishing/expanding ancillary industry facilities;

(d) Establishing remaining intensified physical facilities as detailed in phase B, but not realized in phase C.

Phase E: Stabilized manufacturing phase with possible product diversification (1992 - 1995)

(a) Achieving a maximum local content level and maximum utilization of production capacity, quality of products and organizational/management maturity;

(b) Possible product diversification.

ANNEX E

Casting and Steel Requirement per Tractor (Approx. in Kg.)

Sr. No.	Description	A 20-30 HP	B 30-40 HP	C about 40 HP
1.	Hot rolled carbon steel	13.8	21.3	37.3
2.	Hot rolled alloy steel	5.3	8.2	14.4
3.	Cold drawn carbon steel	34.8	53.5	93.6
4.	Cold drawn alloy steel	6.3	10.4	12.2
5.	Hot rolled plates	24.8	38.1	66.7
6.	Hot rooled sheets	3.2	5.0	8.8
7.	Cold rolled sheets	53.7	82.6	144.6
8.	Hot rooled strips	0.9	1.4	2.4
9.	Special steel	2.3	3.6	6.3
10.	Grey iron castings	447.3	688.1	1204.2
11.	Malleable castings	15.3	23.6	41.3
12.	Steel forgings	162.4	249.9	437.3
	Total ..	770.6	1185.7	2075.0

Note: 1. Average weight of tractors
20-30 HP - 1500 kgs., 30-40 HP - 2700 kgs., above 40 HP - 3500 kgs.

ANNEX F

ESTIMATED APPROXIMATE TOTAL WEIGHT + REQUIREMENT OF STEEL FOR FARM IMPLEMENTS + EQUIPMENT

(Weight in kg.)

Sr. No.	Item	Total Average weight kg.	Mild steel	Med.carbon steel	High carbon steel	Malleable castings	Grey iron Castings
1.	Mould Board Plow	300	150	90	30	30	-
2.	Disc plow	325	120	40	50	60	55
3.	Cultivatore	225	100	100	25	-	-
4.	Disc Harrow	400	175	5	135	-	85
5.	Sowing Eqpt.	300	250	15	25	10	-
6.	Levelling Eqpt.	350	200	75	50	25	-
7.	Plant Protection Eqpt.	125	85	25	15	-	-
8.	Harvesting Eqpt.	600	100	125	200	50	25
9.	Special Harvesting Eqpt.	250	100	85	50	15	-
10.	Grinding Eqpt.	175	75	50	50	-	-
11.	Threshers	300	200	50	25	-	25
12.	Processing Eqpt.	300	125	35	25	-	5
13.	Transport	1000	650	50	-	-	100
14.	Loaders	500	200	150	100	50	-
15.	Turning set tractors	75	75	-	-	-	-