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

09151

Distr.
LIMITED

ID/WG.307/6
16 August 1979

ENGLISH

United Nations Industrial Development Organization

First Consultation Meeting on the
Agricultural Machinery Industry
Stresa, Italy, 15-19 October 1979

ISSUES TO BE CONSIDERED BY THE CONSULTATION MEETING AND SUPPORTING BACKGROUND MATERIAL*

Prepared by the UNIDO Secretariat

* This document has been reproduced without formal editing.

id.79-6533

CONTENTS

INTRODUCTION

1. The origin of the System of Consultations is to be traced in the Lima Declaration and Plan of Action, adopted by the Second General Conference of UNIDO in Lima, Peru, in March 1975. This was consequently endorsed by the UN General Assembly in September 1975. Its overall objective is to assist the developing countries in achieving the maximum share in world industrial production by the year 2000 and as far as possible not less than 25 percent of that production. The Declaration stressed, inter alia, the development of efficient agriculture-related industries in order to achieve a high degree of integration between the expansion of agriculture and industry in the developing countries. In this context, the creation of integrated production units like agricultural machinery plants, appropriate engineering industries and repair and maintenance services was emphasized. Accordingly, the Industrial Development Board, the policy-making organ of UNIDO, authorized at its twelfth session in May 1978, preparations to convene the First Consultation Meeting on the Agricultural Machinery Industry. This is the sixth industrial sector to be covered by consultation meetings and is preceded by iron and steel, fertilizers, leather and leather products, vegetable oils and fats, and petrochemicals.

2. Agricultural machinery manufacture is a branch of industry which can make a major contribution to increased total industrial output in the developing countries. The present share of developing countries in the total world production of all types of agricultural equipment is estimated to be approximately 5%. However, this proportion varies considerably according to the type of equipment. 90% of hand tools, 20% of simple tractor drawn machines, 10% of conventional tractors and a very small proportion of highly specialized, sophisticated equipment are currently produced in developing countries.

3. There is nevertheless considerable scope for expansion in the production of agricultural equipment. In view of the balance of payment constraint on imports of production goods in many developing countries it is clearly to their advantage if the maximum feasible proportion of the requirement comes from local production rather than through imports. The urgency of the required expansion is further emphasized by the prospect of a doubling of the population and therefore also of increased food

requirements thoughout the developing countries during the next 25-35 years.

4. A wide range of difficulties faces the developing countries as they seek to achieve expansion in their vitally important agricultural sector through increasing the level of mechanization. Among the most serious are the limited capability to provide finance to both producers of machinery and equipment and to the farming operators, the limited skills available for production, repair and maintenance of equipment and sometimes insufficient knowledge of alternative technologies available.

5. While UNIDO is aware of these many difficulties, it was felt that the attention of the First Consultation Meeting on the agricultural machinery industry should be focussed in the first instance on the following:

(a) How to formulate a strategy for the development of the agricultural machinery industry in developing countries;

(b) What are the basic facilities which are required in the developing countries in order to implement the manufacturing policies established in accordance with the strategy;

(c) What are the practical forms of long-term international arrangements concerning imports, local assembly and manufacture of agricultural machinery.

6. These three issues have been selected by UNIDO as priority issues for inclusion in the provisional agenda of the Meeting. The selection was based on a world-wide study on this sector prepared by UNIDO and on the conclusions of two expert panel meetings and a regional meeting and a global preparatory meeting.

7. The issues and background information included in this working document for the Consultation Meeting are supplemented by information contained in:

Information Documents

Extract from the Ministerial Level Meeting dealing with Agricultural Machinery and Implements at the International Forum on Appropriate Industrial Technology, New Delhi, India, 20-30 November 1978, pages 50-57, ID/WG.282/124

Report of the Global Preparatory Meeting for a First Consultation Meeting on the Agricultural Machinery Industry, Vienna, 5-8 June 1979, ID/WG.297/2

8. Concerning the report of the Meeting, the Industrial Development Board at its eleventh session decided that "Final reports of the meetings should include such conclusions and recommendations as agreed upon by consensus among the participants. The reports should also include other significant views expressed during the discussion" (ID/B/193, para. 163).

9. The First Consultation Meeting is expected to discuss the three issues selected and to draw from these issues what practical actions should be taken both nationally and internationally to stimulate expansion of agricultural machinery production in developing countries. During the Consultation Meeting working groups may be established to plan practical and co-operative action to achieve rapid expansion of the industry in developing countries. The Consultation Meeting may also refer specific problems arising from the discussions for further study by the UNIDO secretariat and for further consideration by subsequent consultations.

CHAPTER I

ISSUE NO. I

How to formulate a strategy for the agricultural machinery industry in developing countries

I. The main features and priorities of the strategy

(a) Why is a strategy necessary ?

10. Agricultural machinery includes a wide variety of equipment ranging in its level of technology from the simple hand operated tools such as hoes and sickles through animal drawn implements and intermediate two and four wheeled simple tractor mechanization systems to sophisticated high powered tractors with matched machinery and highly specialized equipment 1/ such as combine harvesters. It also includes a wide range of fixed equipment for production of animal feed and for crop storage and handling. Without a strategy it would be difficult to decide at which level of technology, equipment should be produced and what volumes will be required of each product or product group. A proper strategy for the agricultural machinery industry should therefore include an

---

* 1/ See page 11, para 29 (1) to (4) for description of categories for discussion purposes.

assessment of projected demand facing the whole machinery indust same time horizon as that applied to planning the whole of the a industry.

11. It is clear that to be effective, such a strategy must b integrated with the planned development of the entire agricultur In this way, the requirement for agricultural machinery can be d related to the planned expansion of agricultural output, whether for the export market for agricultural products or for the growi market for food or the development of internal markets for agro-industrial production. Groups of agricultural producers who are benefit from market expansion in each of these three areas may b extent identifiable. Thus, established relative priorities for agricultural production in each area can help to determine prior machinery production. Naturally, the situation of the agricultu industry and agricultural policy will both vary considerably amo developing countries so that each country will need to establish strategy for its own agricultural machinery industry.

(b) Can the developing countries use the historical exp of the developed countries as a model basis for for their own mechanization strategy ?

12. Many developing countries have begun to introduce mechan into agricult e at a much earlier st e of development than was in the developed countries. In most of the developed countries mechanization was not introduced in agriculture until the late 1 By this time, a significant percentage of the working populatior 50%) were already engaged in largely urban-based employment outs agriculture. Furthermore, the urbanization data shown in Table I below suggest that 70-80% of the working population of d countries are currently engaged in agriculture. This means that pattern of mechanization in developing countries is likely to di from that which occurred historically in the developed countries differences will clearly be reflected in the mechanization strat to be formulated individually by the developing countries.

Table I.[1/]

Area	Percentage urban		
	1950	1975	2000
World.....	28.8	39.3	49.4
More developed regions...	53.6	69.8	81.8
Less developed regions...	15.8	27.2	40.4
Major areas:			
Africa.....	13.7	24.2	37.0
Northern America...	57.3	69.9	79.6
Latin America.....	42.3	62.8	77.1
East Asia.....	16.6	30.6	43.1
South Asia.....	15.6	22.7	34.5
Europe.....	55.4	68.5	79.8
Oceania.....	14.8	20.0	26.8
USSR.....	39.4	60.8	76.5

(c) How should the mechanization strategy take account of the requirement for increased food production?

13. Current agricultural output is insufficient to meet the domestic food requirements in a number of developing countries. It is also clear that mechanization can play an important part in enabling countries to achieve self-sufficiency in food production. Furthermore, substantial increases can be expected in the domestic demand for food, mainly arising from population increase which will at least double during the next 25-35 years and to a lesser extent from improvements in diet which can be expected as living standards improve. However, attention should be paid to the fact that different mechanization strategies may have very different implications. Whereas the use of sophisticated machinery could raise output by a significant high percentage on the largest 1-5% of farms, the use of simple intermediate technology equipment could in addition achieve a modest increase in production on 60% of the farms constituting the small to medium farm size group. The first will, therefore, contribute less to the overall industrialization process, while the second has a better effect on the production operation and consumption of a given country.

1/ See "Concise Report on the World Population Situation in 1977". U.N.

(d) How are the technological requirements of each group of producers to be assessed and integrated into the whole of the strategy ?

14. While it is clear from the data in Annex I that the overwhelming majority of producers in all developing countries are in the small and medium farm size groups up to 20 hectares and considering the data shown in Annex II which stresses the high proportion of the total agricultural land area which is accounted for by the smaller size categories in the developing countries, the main question to be answered is how to best use the land available. The contribution made by these small sized units can be seen to play an important part in total output. The mechanization strategy of all developing countries may include not only production capability in relatively simple technology defined as Categories 1 and 2 but also elements which belong to Categories 3 and 4 as appropriate. This means that the main types of hand operated tools, animal drawn implements and simple, intermediate technology, low H.P. tractor systems are capable of being produced in most, if not all developing countries and should therefore be obtainable by producers from local sources; to be followed later by more complex units.

15. In most developing countries the production volumes required to meet the need for machinery and equipment in Categories 1 and 2 are likely to be sufficient to enable unit costs of production to be brought down to levels which are likely to be fully competitive with the price of imported products. Even in those countries where production volumes are low and manufacturing costs high, the balance of advantage may still be with local production rather than importing, due to the social benefits arising from the establishment of a domestic manufacturing industry. These benefits arise from:

(a) The value of foreign exchange savings and

(b) The value of the early experience of entrepreneurship and skill development, as these provide essential prerequisites to more advanced industrial development at a later stage. It may, however, be necessary to pay due attention to quality control during the early stages of development.

16. Choice of the level of technology to be adopted in a machinery strategy may also be affected by many other factors, such as the existence of industrial infrastructure and inputs available from other industrial sectors. For these reasons some developing countries have already started to produce equipment in Categories 3 and 4. Whatever production is planned, attention has to be paid to adequate marketing facilities, credit facilities and extension advisory services.

II. What would the strategy be expected to contain ?

17. (a) An assessment of the structure of the agriculture

This needs to be carried out in the form of an analysis of the distribution of agricultural holdings by farm size and type. Machinery demand is closely related to the size of the farm in financial business terms rather than in terms of physical size. This analysis can produce a direct estimate of the demand for all types of agricultural machinery and equipment. It would provide a rational basis for planning the supply of agricultural machinery in terms of:

(i) Selection of the levels of technology which are to be manufactured locally keeping in mind what the developing countries are already producing, for example the small tractor; and the levels to be imported;

(ii) The levels of production volume which will be required from domestic manufacturing facilities.

18. (b) A programme of machinery manufacture

This would show which existing basic facilities need to be expanded and which new facilities need to be established. It would also show the extent to which vertical or horizontal integration would be encouraged in the locally installed machinery industry. The programme would include detailed plans for the production of all the types of complete equipment to be manufactured, based on local conditions and resources. It would also cover the range of components which are considered as common items for machinery in other industrial applications. Details of the form of production of this machinery and the relevant strategic factors to be considered are given in Chapter II .

(c) An assessment of the projected requirements for spare parts, servicing, repair and maintenance facilities

19. Planning the provision and distribution of spare parts is an essential element in any machinery production programme and should be included in the preparation of budgets at the project initiation stage. Particular attention should also be given at an early stage, to the likely requirement for repair and maintenance services, bearing in mind the harshness of local conditions in developing countries and the inexperience of operators.

(d) An assessment of the research, design and development needs

20. This might best be done by establishing a local agricultural machinery and equipment testing facility which could assess the performance of standard designs of equipment under local conditions and recommend appropriate design modifications. Close liaison should be encouraged with established machinery research and development organizations in developed and developing countries which are active in this field. This would enable major duplication of research and development effort to be avoided.

(e) Provision of adequate credit facilities for farmers

21. Even where equipment is supplied which matches the economic requirements of agricultural producers and thus represents for them a sound investment in their business, it is still necessary to ensure that adequate credit is available to them in order to secure effective demand for the products of the machinery industry. In many countries, such credit facilities are provided by Government agencies. In others, credit is available through agricultural co-operatives. A very effective system is operating in some countries, whereby savings bank facilities collect large numbers of small deposits which are then used to provide loans to farmers for agricultural inputs including machinery.

(f) Provision of monitoring facilities

22. Continuous monitoring of the effects of newly introduced policies is necessary in order to up-date the strategy so that the indigenous machinery industry can cater for the changing requirements of agriculture as the development process advances.

III. Training

What resources can be motilized to provide improved training?

23. There is an urgent need for training in all activities from the floor of the machine shop through business management to the training of farmers and farm machinery operators in order to promote production of equipment and increase its effective utilization. Governments, through bilateral programmes, large commercial organizations, through import agreements and international organizations through multilateral programmes are assisting and could assist more in the training effort through provision of scholarships and bursaries in order to make full use of training facilities which are available in both developing and developed countries, and could expand these programmes. Plans to further the provision of training should take account of the following important considerations:

1. Facilities for carrying out effective training programmes do exist throughout the developed and developing countries.

2. Developing countries engaging in agreements for the transfer of technology for use in agricultural machinery production must insist on the inclusion of adequate training assistance to be given by the organization supplying the technology.

3. The developing countries must provide a planned structure capable of properly organising the absorption and effective utilization of people once they have received specialist training.

IV. Implementation of the strategy

How can Governments co-ordinate the activity of a number of sectoral planners in order to implement the strategy for the agricultural machinery industry once that strategy has been formulated ?

24. Whatever the strategies chosen, a centralized body will need to be instituted and be equipped with adequate resources and authority to carry out the task. It will need to include, for example, representatives from the Ministries of Agriculture, Industry, Planning and Finance and have sufficient status to enable full interaction with these Ministries in the formulation of policy. It would work in close co-operation with expert services provided by locally established or outside research and development centres. One of the ways of dealing with the drafting of a co-ordinated strategy would be through the establishment of a Committee.

25. Some excellent work has been carried out in some centres in developing countries. Those countries at a comparatively early stage in the development of an indigenous agricultural machinery industry could do well to establish contact with organizations of this type and the respective Governments in developing countries where a considerable amount of experience has already been gained in the establishment and expansion of indigenous production.

V. Recommendations

26. The Consultation Meeting is invited to consider how the formulation of an effective agricultural mechanization strategy could be undertaken. In this context it is suggested, if the Consultation Meeting agrees, to establish a small working group to draft terms of reference for this purpose.

27. If the Consultation Meeting agrees, UNIDO is prepared to compile a report on the strategies formulated and adopted by individual countries and to submit it to the next Consultation Meeting.

28. UNIDO is also ready to prepare in co-operation with the concerned UN agencies information on the types of training available world-wide, which are directly related to the needs of manufacturing, repair personnel and machinery operators.

CHAPTER II. ISSUE NO. 2

What are the Basic Facilities which are required in the Developing Countries in order to implement the manufacturing policies established in accordance with the strategy ?

29. What Facilities are needed ?

The basic facilities which will be required in the developing countries will depend on what facilities exist, what capacities have been built up and what more will be desired in terms of manufacturing policies and strategies adopted in each developing country. The full range of products in the agricultural machinery sector may be divided into four Categories:

(1) Simple agricultural tools, implements and equipment

These items may be regarded as "simple" from the viewpoint of both design and manufacturing technology as well as in terms of their usage. They include hand tools such as hoes, picks and adzes, animal-drawn equipment such as mouldboard ploughs, cultivators, planters and small carts and also stationary equipment such as storage bins and silos.

(2) Intermediate machinery and equipment

Items in this category are of relatively more advanced design than those in Category 1 and require a higher level of manufacturing technology. They include :-

(i) Complete mechanization systems for small scale farming operations which may be based either on animal draft power or low-cost, low H.P. simple technology tractors.

(ii) Power tillers and small-scale powered harvesting and threshing machines.

(iii) Machinery and equipment for operation by medium H.P. conventional tractors including irrigation pumps and crop protection equipment.

(3) Conventional powered agricultural mechanization systems

These are based on the conventional tractor which provides power as a prime mover principally within the range 30-70 H.P. together

with supplementary hydraulic and shaft power for operating subsidiary systems. This unit forms the base of a complete mechanization system capable of performing the entire range of routine operations necessary for crop and animal production on medium to large scale farm units. A high degree of technical sophistication is necessary in the complete manufacture of this type of equipment.

(4) Specialized agricultural machinery and equipment

This category includes equipment which requires similar manufacturing technology to that in Category 3 but which is designed for a much more limited range of agricultural market applications. It includes combine harvesters, individual crop harvesters for root, forage, cotton, fruit and other commercial crops. High powered tractors with power output in the range 90-200 H.P. are also produced for highly specialized arable farming operations on very large land units. A wide range of specialized mechanical handling equipment is also available within this category including bulk storage, conditioning and transport systems for grain, lifting, loading and unloading facilities, animal production equipment and a wide range of drainage and construction equipment.

30. Examples of manufacturing production profiles in the Categories mentioned above are given in Annexures 3(a),(b),(c),(d) and basic facilities required are given in Annex 3(e). They cover the range of manufacturing from small hand tools to a 16 H.P. low-cost tractor mechanization system and also a 35 H.P. conventional tractor.

The Technical, Economic and Social Factors

31. Whatever category is considered, attention has to be paid to the following factors:

The degree of complexity of the product

This will determine the limits of the degree of dispersion or concentration of production and the extent of horizontal or vertical integration in the association between the necessary production facilities. For example, the manufacture of simple hand tools such as hoes and adzes requires only simple forging and elementary heat treatment. Thus, it could be carried out at relatively high volume using a centralized production facility or, alternatively, production could be highly disaggregated using widespread small-scale production at the village or grouped village level, where each production unit

serves only a small area or district. In countries where substantial surpluses of rural labour exist and opportunities for industrial employment are extremely limited, the advantages of highly dispersed production in disseminating new skills may outweigh the higher capital costs of providing multiple production facilities. The level of sophistication of the product and of the production processes required should be carefully considered in relation to the level of skills, experience and financial resources which are available locally and the level of current and projected demand for the product when compared with simpler alternatives which may be nearly as effective under local operating conditions.

32. The types of raw material required

These should be considered in relation to materials locally available or readily imported. The main emphasis will be on the use of the simplest materials obtainable wherever possible. Mild steel has many advantages for fabrication purposes being relatively easily worked, durable and capable of being welded. Better quality steels must be specified for the production of parts subject, for example, to wear and high temperature. The choice of steels and other materials will be influenced by the levels of skill to which the operatives in the engineering workshops have advanced.

33. The necessary level of quality control

In any new industrial manufacturing project the level of quality of the product is likely to be affected during the start-up and initial production period. However thorough the staff training prior to recruitment, there is always an important element of "learning on the job". Where the entire staff is new this process is bound to take time, during which a steady improvement in product quality can be expected. This can give rise to considerable market resistance to the product where local manufacture is instituted for import substitution purposes. In such cases adequate "infant industry" protection measures must be taken by Government in order that the long term benefits of a viable domestic industry can be realized.

34. The production volume

This is determined by local market demand and itself determines the unit cost of production in the long term. In the manufacture of simple hand and animal drawn tools and implements, resource requirements are relatively low and the long term viability of production is unlikely to be determined solely by unit costs of production. In the manufacture

of more complex equipment, however, long-term viability is vitally affected by local production cost compared with the cost of competing imported products. Thus, the accurate assessment of the level of market demand prior to making the decision to invest in local manufacture, is essential. In some countries where adequate financial resources are available, the social advantages of domestic manufacture may still override all other considerations.

35. "Backward" and "forward" linkages

These form both the necessary and potential interrelationships with ancillary and supporting industry. An examination of the scope for such linkages relating to any new product manufacture should form part of the initial appraisal of the expected pattern of development of the local economy.

36. Skill requirement

The various levels of skill required in the manufacturing labour force should be carefully considered in relation to those available locally. A certain amount of training can be built into current production activity so that a project which might be viable in all other respects should not necessarily be rejected on grounds of lack of available skills. On the other hand, if longer term expansion in the new industry can be expected, then new training programmes can be instituted in order to increase the supply of basic skills.

37. Market

For obvious reasons the size of the existing or future market region for the proposed product is extremely important in the planning or creation of new facilities. In that connection the importance of servicing and repair facilities is vital.

38. Financial requirements

The magnitude of the financial requirements of a manufacturing programme should be carefully considered in relation to the social economic benefit which can be expected to result from instituting the

programme. In the planning stage, therefore, there is a need to consider not only the capital and running costs of the plant, but also the requirement for credit facilities to the farmers, provision of extension services, training and allied facilities.

Scope in new technological design developments

39. The scope of development and adaptation in design to suit specific local conditions, it is very substantial in all the four Categories. For example, three new designs in developing countries of small, low-cost four-wheel tractors are now in substantial production with associated implement systems capable of performing all the main crop production and general haulage tasks of small farm units. Similar progress has been made in the design and production of rice-transplanting and harvesting equipment and further progress is expected in cotton picking mechanization.

40. There is,therefore, the necessity for concerted action at the national and international levels to initiate a systematic process of work in the area of development of designs in this field and to publicise the latest advances in design.

Advantages to other manufacturing industries

41. The strategic appraisal by developing countries will concentrate attention on production units within a size range starting at the simple rural family blacksmith business up t the level of the factories producing products in Categories 3 and 4. In this process, production capacities will be created which may be commonly used by a variety of industrial sectors (foundries, forges, heat treatment, etc.)

Recommendations

42. The Consultation Meeting is invited to comment and advise on the following:

(a) To what extent the basic facilities outlined in the preceding paragraphs and attachments,are comprehensive and practical in order to be considered by the developing countries for the promotion of the agricultural machinery industry;

(b) In what manner UNIDO could assist those developing countries wishing to establish contact on a project basis with small and medium sized establishments specializing in supplying equipment in Categories 2 and 3 wherever they are located, in developed and developing countries ;

(c) In what manner UNIDO could assist those developing countries which are interested in the production of equipment in Categories 3 and 4 in their discussions with those companies which are already producing such equipment.

CHAPTER III

ISSUE NO. III

What are the practical issues related to international arrangements concerning imports, local assembly and manufacture of agricultural machinery?

A. What are the prospects for international cooperation?

43. The majority of the developing countries, due to limited domestic market at present and also due to lack of fully developed and effective mechanisms for regional cooperation, may continue to import tractors and allied power machinery for some time to come. However, early initiation of rationalised import policies will facilitate possible local manufacturing potential at a later date. It is therefore essential that those developing countries which may continue to import this equipment (tractors and allied power machinery/specialized equipment etc.) initiate mutually beneficial long-term agreements on importation with international manufacturers.

44. In the case of developing countries where local manufacturing programmes have not yet been initiated, but which have a potential due to reasonable demand, there is a need for a co-operative effort between Governments of the developing countries and international manufacturers on formulation, development and implementation of local manufacturing programmes through judicious licensing agreements.

45. In the case of selected developing countries which have started local manufacturing programmes, there is a need to initiate discussions and an action programme with the collaborator on possible production expansion/higher local content/greater product mix, so that, in addition to vertical integration, broad based horizontal integration is achieved in the shortest possible period.

B. What are the basic principles in import agreements?

46. Most of the developing countries are currently meeting a large percentage of their needs through full importation of tractors and equipment.

47. The first step needed to develop a local assembly/production capacity is to rationalize import policies on a medium-term basis. Such a programme could be

initiated only if the developing country concerned is fully aware of its requirements and product specifications. Furthermore, it is felt desirable that before making a final decision on import agreements, the developing country concerned must pay full attention first to the possibilities and experiences of the different foreign partners and only afterwards to the price and long-term arrangements of it.

48. It is important to note that anything included in the agreement will cost money either within the unit price or as extra cost. 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 the necessary local and foreign financesto ensure the longest possible utilization of the imported equipment. The following basic factors are to 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 commitment based on volume and on industrial production cost index (in the country of manufacture) or on some other factor should be achieved.

(ii) Right of importers to secure parts from other sources: an agreement may include securing selected components by developing countries from elsewhere, if necessary, e.g. tyres batteries wheel (weights, head lamps, hardware, and if possible selected proprietary items. Note that the rebate given by the manufacturers of the tractors should be higher than the procurement cost.

(iii) Spare-parts supply and training in spare-part handling: the question of correct spare parts in sufficient quantities is of great importance. Often the tractor exporter 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 turnover factor (RTF)' which is based on the frequency of replacement of a component during the tractors/implements/machinery life period. This also gives an indication of needs for spare parts and local manufacturing potential, which should be discussed with the foreign partner.

(iv) Central spare parts organization including inventory control: spare parts handling central procurement and local distribution should be incorporated in the agreement.

(v) Basic documents should be issued in local languages.

(vi) Guarantee: the duration of the spare parts supply, after-sale services and methods of settling disputes on guarantees should be agreed upon.

49. Supplementary contracts may be negotiated to include the following:

(a) Training of farmers/machinery operators

(b) Training of mechanics in repair and maintenance

(c) Local dealer network: marketing and after-sales services

(d) Central spare parts depot and training in inventory control

(e) Rural, sub-area and central repair and maintenance workshop network.

C. What are the basic principles to be considered in local manufacture agreements

50. In principle, local manufacturing programmes may be divided into four categories: (a) assembly operations: 8-10% local content; (b) Phase I local manufacture: 20-30% local content; (c) Phase II local manufacture: 50-60% local content; and (d) Phase III local manufacture: above 60% local content. Due to the limitations of domestic and foreign exchange finances, technical manpower, manufacturing experience, infrastructure facilities, limited market and slow growth in demand, most of the developing countries may have to enter a manufacturing programme on a modest basis with a realistic local content target.

51. A manufacturing agreement is a complex matter. The developing countries will have to pay full attention to the following elements regardless of their manufacturing phase.

52. The critical elements of technology transfer should be analysed carefully in the following agreements:

53. (a) Founders agreements. Careful study is mainly required on: equity structure, composition of membership of Board of Directors, voting rights, policy decisions and veto power.

54. (b) Licence and technical assistance agreements. Examination by the Governments of developing countries is needed on:

(i) licensor's fee for start up;

(ii) procedures for valuation of CKD pricing and deletion values, so that pricing of CKD kit will not exceed the price of equivalent completely built units;

(iii) ensuring that prices include a fair margin on maintenance and warranty charges, as in the case of completely built tractor units (CBTU).

(iv) provision to develop local sub-contracting of specific items after an agreed period.

55. (c) Management assistance agreement. Consideration should be give to the appointment of the contractor and technical personnel for start-up.

56. (d) Supply agreement. Particular attention should be given to the restrictive clauses and their specification.

57. (e) Trade mark agreement. The duration and types of payment to be made need to be considered.

58. (f) Operational assistance agreements. The duration, fees and the training of the counterparts need to be considered.

59. (g) Continued technology transfer agreement. The duration and the types of services provided as against the fees requested are important considerations.

60. (h) Infrastructure development agreements. Attention should be paid to tractor operator training, 'on the farm' maintenance, repair and maintenance networks and local training facilities.

D. What assistance could be provided?

61. UNIDO is ready, in co-operation with other UN organizations concerned, to provide, at the request of developing countries, assistance in the following fields:

(a) conducting prefeasibility/feasibility studies;

(b) conducting in-depth analysis of alternatives in meeting the local needs;

(c) formulation of medium/long term agreements on import, leading to local assembly as well as agreements on local manufacture;

(d) providing advisory services to Government project team on negotiations and agreement; and

(e) assisting the developing countries to start up the project to implement and to evaluate it.

62. Furthermore, at the request of regional or sub-regional groupings, UNIDO is ready to assist in the promotion of regional co-operation through the undertaking of regional feasibility studies, analysis of possibilities for rationalization of products, production and market sharing. Wherever possible, advisory services could be provided to those countries requesting it on project negotiation and management.

E. Conclusions and recommendations

63. On the basis of a detailed analysis by the Secretariat on international arrangements for imports, local assembly and manufacture of agricultural machinery, the participants at the Global Preparatory Meeting for this Consultation Meeting suggested that UNIDO should prepare the following for the next Consultation Meeting:

(a) Model contracts to deal with import policies, licensing for local manufacture and joint ventures;

(b) An analysis of the experience of some developing countries (Algeria, Argentina and India) in manufacturing tractors through licenses.On the basis of this analysis,to develop a model manufacturing programme to serve as a guide to other developing countries covering governmental initiatives, incentives and horizontal integration.

(c) A study on the success stories in the developing countries on effective commercialization of locally developed low-cost small tractors, power tillers, engines, pumps and similar technology.

64. The Consultation Meeting is invited to endorse the above three recommendations. If the Consultation Meeting agrees, it is proposed that a Working Group be established on item (a) during the Consultation in order to indicate to the UNIDO Secretariat to what extent the basic principles proposed for the model contracts were sufficiently comprehensive, to enable the Secretariat to proceed with the drafting of such a model contracts for submission to the Second Consultation Meeting.

65. Finally, the Consultation Meeting is invited to endorse the convening of an investment promotion meeting in the agricultural machinery sector to assist developing countries to find finance for their projects.

ANNEX 1 Percent distribution of holdings by size of total area[1] 1970, 1960, 1950

	Years	Total No. holdings	Holdings without land	Under 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000h and over
								Percent						
WORLD	1970	100.0	0.4	44.6	18.3	18.7	8.3	4.4	2.7	1.1	0.7	0.5	0.1	0.1
	1960	100.0	0.8	38.3	19.0	20.3	9.4	5.4	3.3	1.6	0.9	0.5	0.2	0.2
	1950	100.0	...	45.4	----32.9----		8.6	5.0	3.9	2.1	1.0	0.6	0.2	0.1
AFRICA	1970	100.0	2.2	35.2	29.4	24.1	5.8	2.2	0.9	0.1	...	-	-	-
	1960	100.0	1.9	19.2	17.5	23.7	9.3	6.2	6.2	2.7	2.4	4.3	2.8	3.9
	1950	100.0	...	1.7	-----6.8----		6.0	4.3	6.0	6.0	11.1	23.9	16.2	17.9
Algeria	1973	100.0	18.9	18.0	12.0	20.0	14.2	9.9	5.5	1.1	0.3	0.1	...	-
Botswana[2]	1968/1969	100.0	19.5	10.1	14.6	29.6	25.6	-	0.5	...	-	-	-	-
Cameroon[3]	1972/1973	100.0	...	42.7	30.5	23.3	3.2	0.3	...	-	-	-	-	-
Central African Empire[3]	1973/1974	100.0	...	32.1	35.7	29.7	2.5	...	-	-	-	-	-	-
Chad[3]	1972/1973	100.0	...	19.7	24.0	45.4	10.1	0.8	...	-	-	-	-	-
Congo[3]	1972/1973	100.0	...	37.5	44.4	17.4	0.7	-	-	-	-	-	-	-
Gabon[3]	1974/1975	100.0	...	67.6	18.3	14.1	...	-	-	-	-	-	-	-
Ghana[3]	1970	100.0	...	37.7	24.2	24.0	8.8	3.5	1.8	...	-	-	-	-
Ivory Coast[3]	1974/1975	100.0	-	9.4	16.4	38.0	24.9	9.4	1.8	0.1	...	-	-	-
Lesotho[3]	1970	100.0	1.1	28.3	33.7	32.6	4.3	...	-	-	-	-	-	-
	1960	100.0	...	31.7	26.7	35.4	5.6	0.6	...	-	-	-	-	-
Liberia[3]	1971	100.0	...	52.4	23.8	16.4	3.3	1.7	1.7	0.4	0.1	...	-	-
Libya	1960	100.0	4.1	8.3	6.2	15.2	15.2	18.6	20.0	6.9	3.4	2.1	...	-
Malawi[3]	1968/1969	100.0	...	39.1	34.6	26.3	...	-	-	-	-	-	-	-
Reunion[4]	1972/1973	100.0	20.5	53.8	12.8	10.3	2.6	...	-	-	-	-	-	-
South Africa	1960	100.0	...	0.6	0.4	4.5	5.6	5.8	7.9	6.2	9.4	21.4	15.9	22.3
	1950	100.0	...	1.7	----6.8----		6.0	4.3	6.0	6.0	11.1	23.9	16.2	18.0
Sierra Leone[3]	1970/1971	100.0	...	37.8	26.9	29.7	5.6	...	-	-	-	-	-	-
Swaziland	1971/1972	100.0	...	25.6	28.2	33.4	12.8	...	-	-	-	-	-	-
Togo[3]	1970	100.0	...	54.1	25.8	16.7	3.4	...	-	-	-	-	-	-
	1961	100.0	...	30.0	26.7	30.4	10.1	2.3	0.5	...	-	-	-	-
Zaire[5]	1970	100.0	...	41.5	38.3	18.9	1.0	0.2	-	-	0.1	-	-	-

Main Features of changes in some major agricultural structural characteristics, 1950-1970 Statistics Division, FAO, Rome, April 1979.

ANNEX 1 - Percent distribution of holdings by size of total area[1], 1970, 1960, 1950 (Cont'd)

	Years	Total No. holdings	Holdings without land	Under 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
NORTH AND CENTRAL AMERICA	1970	100.0	2.6	18.6	8.8	9.9	6.8	7.5	14.0	13.1	9.8	6.4	1.4	1.1
	1960	100.0	...	13.4	6.7	10.9	7.5	9.5	17.9	16.2	10.4	5.0	1.4	1.1
	1950	100.0	...	9.2	----17.9----		9.6	11.6	21.3	16.4	8.5	3.7	1.5	0.4
Canada	1971	100.0	...	0.8	1.1	2.7	3.0	4.1	16.4	22.1	21.9	27.9	...	
	1961	100.0	...	0.8	1.2	1.9	2.3	4.4	23.7	23.5	25.2	13.5	2.7	0.8
	1951	100.0	...	0.3	----4.5----		3.0	5.6	25.8	26.5	20.5	11.7	1.9	...
Costa Rica	1973	100.0	6.1	17.1	9.8	15.9	11.0	11.0	14.6	7.3	3.7	2.5	0.6	0.4
	1963	100.0	...	6.2	10.8	20.6	15.4	13.8	18.5	9.2	3.1	1.5	0.6	0.3
	1950	100.0	...	4.6	----34.9----		16.3	14.0	18.6	7.0	2.3	1.6	0.5	0.2
Dominican Republic	1971	100.0	...	32.1	20.0	24.9	11.1	5.6	3.9	1.3	0.7	0.3	0.1	...
	1960	100.0	...	45.2	21.3	19.7	6.7	3.8	2.2	0.7	0.2	0.1	...	...
	1950	100.0	...	33.8	----42.5----		12.0	6.2	3.6	1.1	0.4	0.2	0.1	0.1
El Salvador	1971	100.0	14.8	41.8	18.6	13.5	5.0	2.8	2.2	0.6	0.3	0.2	0.1	...
	1961	100.0	...	47.3	21.4	16.5	6.2	4.0	2.7	0.9	0.4	0.3	0.1	...
	1950	100.0	...	40.2	----40.2----		8.0	5.2	4.0	1.1	0.6	0.4	0.1	0.1
Guadeloupe[4]	1969/1972	100.0	...	39.1	30.4	26.1	4.4	...	-	-	-	-	-	-
Haiti	1971	100.0	...	58.7	23.0	14.4	3.1	0.6	0.2	...	-	-	-	-
Honduras	1974	100.0	...	17.5	20.0	26.7	14.4	9.7	7.7	2.1	1.0	0.5	0.2	0.1
	1952	100.0	...	9.6	----46.8----		17.9	12.2	9.0	2.6	1.3	0.5	0.2	0.1
Jamaica	1968/1969	100.0	2.5	56.3	19.7	15.3	4.2	1.2	0.5	0.2	0.1	0.1	...	-
	1961	100.0	...	45.9	25.2	18.9	6.3	1.9	1.3	0.2	0.1	0.1	0.1	...
	1950	100.0	...	19.1	----61.8----		11.8	4.4	1.5	0.4	0.3	0.7	...	-
Mexico	1970	100.0	8.5	25.0	11.1	15.1	10.0	7.8	8.1	4.8	3.3	2.7	1.4	2.2
	1960	100.0	...	30.1	12.4	23.3	6.9	7.5	7.3	4.1	3.1	2.2	1.1	1.7
	1950	100.0	...	36.0	----36.6----		6.5	5.1	6.6	3.2	2.1	1.7	0.8	1.4
Panama	1971	100.0	8.7	17.4	13.0	16.5	12.2	12.2	12.2	5.2	1.7	0.9	0.2	...
	1960	100.0	...	5.3	13.7	27.4	18.9	15.8	12.6	4.2	2.1	...	-	-
	1950	100.0	...	...	----52.0----		19.7	14.3	9.6	2.8	1.0	0.4	0.1	0.1
Puerto Rico	1970	100.0	...	6.1	15.1	36.4	18.2	12.1	6.1	3.0	1.8	1.2	...	-
	1959	100.0	...	...	28.3	30.4	19.6	10.8	6.5	2.2	2.2	...	-	-
	1950	100.0	...	...	----60.4----		17.0	11.3	7.5	1.9	0.9	1.1	...	-
St. Lucia	1973/1974	100.0	...	63.6	9.1	9.1	9.1	9.1	...	-	-	-	-	-
United States	1969	100.0	...	2.6	1.4	3.3	5.8	10.1	23.2	23.2	16.9	9.2	2.6	1.7
	1959	100.0	...	2.1	1.3	5.0	8.1	12.0	24.8	23.8	13.8	6.3	1.6	1.2
	1950	100.0	...	1.2	----10.2----		10.6	14.5	26.9	21.0	9.9	3.8	1.9	...
Virgin Islands(U.S)	1969	100.0	...	50.0	-	50.0	...	-	-	-	-	-	-	
	1960	100.0	...	60.0	10.0	20.0	10.0	...	-	-	-	-	-	-
	1950	100.0	...	-	----50.0----		12.5	12.5	12.5	12.5	...	-	-	-

ANNEX 1 - Percent distribution of holdings by size of total area[1] 1970, 1960, 1950 (Cont'd)

	Years	Total No. holdings	Holdings without land	Under 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 h and over
							Percent							
SOUTH AMERICA	1970	100.0	0.5	15.2	12.5	20.5	13.7	12.7	12.6	5.3	3.2	2.3	0.8	0.6
	1960	100.0	0.5	12.8	12.1	20.9	13.4	12.8	14.1	5.9	3.4	2.5	0.9	0.8
	1950	100.0	...	8.9	----27.0----		13.0	14.1	17.9	8.3	4.9	3.6	1.4	1.2
Brazil[6]	1970	100.0	...	8.1	10.0	18.7	14.7	15.2	16.7	7.0	4.4	3.1	1.4	0.8
	1960	100.0	...	4.0	8.4	18.5	14.0	16.3	20.2	8.2	4.7	3.5	1.2	1.0
	1950	100.0	...	2.4	----19.5----		12.3	16.8	23.8	10.1	6.4	4.8	1.8	1.5
Colombia	1970/ 1971	100.0	...	22.9	15.1	21.6	13.6	10.0	8.5	4.1	2.2	1.4	0.4	0.3
	1960	100.0	...	24.6	15.8	22.1	14.0	9.4	7.2	3.4	1.8	1.2	0.1	0.2
	1954	100.0	...	17.6	----37.3----		15.6	11.0	9.3	4.2	2.5	1.6	0.4	0.3
Ecuador	1974	100.0	2.1	26.0	16.0	22.7	10.6	7.9	8.1	4.2	1.8	0.8	0.1	0.2
	1954	100.0	...	26.7	----46.2		10.5	6.4	5.8	2.3	1.2	0.6	0.1	0.2
Peru	1972	100.0	1.7	33.1	18.8	24.4	11.0	5.7	3.3	0.9	0.5	0.3	0.1	0.2
	1961	100.0	3.1	33.8	21.4	25.4	8.7	3.6	2.1	0.8	0.5	0.4	0.1	0.2
Suriname	1969	100.0	...	18.8	25.0	37.5	12.5	6.2	...	-	-	-	-	-
	1959	100.0	...	18.7	25.0	37.5	12.5	4.4	1.9	...	-	-	-	-
Uruguay	1970	100.0	...	-	3.9	10.4	15.6	15.6	16.9	10.3	9.1	9.1	3.9	3.2
	1961	100.0	...	-	----15.0----		15.0	16.1	18.4	10.3	8.0	8.0	4.6	4.6
	1951	100.0	...	-	----13.0----		12.9	16.5	20.0	11.8	9.4	8.2	3.5	4.7
Venezuela	1971	100.0	1.4	4.5	11.5	26.4	17.0	14.2	11.4	4.9	2.8	2.8	1.4	1.7
	1961	100.0	1.6	5.3	12.8	30.3	18.1	12.8	9.1	3.8	2.2	1.9	1.0	1.3

ANNEX 1 - Percent distribution of holdings by size of total area[1] 1970, 1960, 1950 (Cont'd)

	Years	Total No. holdings	Holdings without land	Under 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
ASIA	1970	100.0	0.1	52.3	19.3	17.9	6.7	2.8	0.8	0.1	...	-	-	-
	1960	100.0	1.1	46.6	21.5	19.8	7.1	3.1	0.7	0.1	...	-	-	-
	1950	100.0	...	56.2	——33.1——		6.7	2.9	1.0	0.1	...	-	-	-
Bahrain	1974	100.0	...	-	-	100.0	-	-	-	-	-	-	-	-
India	1970/1971	100.0	...	50.6	19.1	19.0	7.4	3.0	0.8	0.1	...	-	-	-
	1960	100.0	...	40.7	22.3	23.6	8.7	3.7	1.0	0.1	...	-	-	-
	1954	100.0	...	56.1	——32.5——		7.2	3.1	1.0	0.1	...	-	-	-
Indonesia	1973	100.0	...	70.4	18.1	9.4	1.5	0.6	-	-	-	-	-	-
	1963	100.0	...	70.1	18.2	9.2	1.8	0.6	0.2	-	-	-	-	-
Iraq	1971	100.0	8.8	11.3	11.2	18.1	21.5	18.6	9.0	1.0	0.3	0.2	...	-
	1958	100.0	...	28.8	11.9	16.2	12.2	12.2	11.9	3.6	1.6	0.8	0.4	0.4
	1952	100.0	...	19.2	——20.8——		12.8	15.2	19.2	6.4	3.2	1.6	0.8	0.7
Israel[7]	1971	100.0	7.5	12.5	17.5	30.0	27.5	2.5	-	2.5	...	-	-	-
	1950	100.0	...	11.8	——58.8——		17.6	11.8	...	-	-	-	-	-
Japan[8]	1970	100.0	...	68.0	24.0	6.5	1.3	0.2	...	...	-	-	-	-
	1960	100.0	...	64.6	26.2	7.5	1.1	0.5	0.1	...	-	-	-	-
	1950	100.0	...	67.1	——31.4——		1.0	0.4	0.1	...	-	-	-	-
Korea, Republic of[1]	1969/1970	100.0	0.8	66.1	26.4	6.7	...	-	-	-	-	-	-	-
	1961	100.0	...	71.0	24.1	4.9	...	-	-	-	-	-	-	-
Pakistan	1972	100.0	...	13.8	14.3	39.9	21.1	7.7	2.5	0.6	...	-	-	-
	1960	100.0	14.6	28.1	14.2	23.5	12.8	6.8	...	-	-	-	-	-
Philippines	1971	100.0	...	13.6	27.4	43.8	10.4	3.6	1.0	0.2	...	-	-	-
	1960	100.0	...	11.5	29.6	39.9	13.4	4.6	0.7	0.1	0.4	...	-	-
	1948	100.0	...	19.2	——65.2——		9.8	4.0	1.5	0.2	0.1	0.1	...	-
Saudi Arabia	1973/1974	100.0	...	38.1	21.0	18.2	9.9	6.6	3.9	1.1	1.1	...	-	-
Sri Lanka	1973	100.0	0.6	70.6	16.9	9.9	1.3	0.4	0.2	...	-	-	-	-
	1960	100.0	...	65.3	19.0	12.5	2.1	0.7	0.3	0.1	...	-	-	-
Syria	1970/1971	100.0	10.5	14.3	12.8	24.0	14.9	12.4	8.6	1.5	0.6	0.4	...	-

ANNEX 1 - Percent distribution of holdings by size of total area[1] 1970, 1960, 1950 (Cont'd)

	Years	Total No. Holdings	Holdings without land	Under 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 and over
							Percent							
EUROPE	1970	100.0	0.4	29.0	13.8	22.7	16.4	10.1	5.7	1.2	0.5	0.1	...	-
	1960	100.0	0.2	19.4	14.7	26.1	19.8	12.0	n.a	1.3	0.4	0.1	...	-
	1950	100.0	...	16.8	----46.1----		19.5	13.6	5.1	1.3	0.4	0.2	...	-
Austria[9]	1970	100.0	...	9.4	11.6	19.6	17.1	20.2	11.1	3.3	1.1	0.6	..	-
	1960	100.0	...	8.3	12.9	21.0	18.2	19.7	15.4	3.0	1.0	0.3	0.1	0.1
	1951	100.0	...	8.3	----38.2----		19.5	18.3	12.4	1.9	0.7	0.5	0.1	0.1
Belgium[4]	1970	100.0	2.7	26.6	8.2	15.8	18.5	11.9	9.2	1.1	...	-	-	-
	1959	100.0	0.4	27.2	14.2	30.5	19.4	13.1	4.5	0.7	0.1	...	-	-
	1950	100.0	...	4.5	----56.1----		22.0	12.1	4.2	0.8	0.1	...	-	-
Czecho-slovakia[10]	1970	100.0	...	91.2	3.2	3.3	1.5	0.1	0.1	...	0.1	0.2	0.2	0.1
	1949	100.0	...	15.9	----46.1----		21.1	13.1	2.9	0.9	...	-	-	-
Denmark[4]	1970	100.0	...	0.7	2.1	7.2	20.7	31.4	31.4	5.0	1.5	...	-	-
	1959	100.0	...	1.5	4.1	13.2	27.7	38.7	23.5	2.6	0.5	0.1	...	-
	1949	100.0	...	1.4	----20.8----		27.1	27.1	20.8	2.4	0.4	0.2	...	-
Finland[11]	1969	100.0	...	...	11.1	25.3	33.0	22.9	7.1	0.7	0.1	...	-	-
	1959	100.0	...	14.7	11.9	26.1	26.4	16.0	4.7	0.3	...	-	-	-
	1950	100.0	...	9.3	----42.4----		26.3	16.1	5.4	0.3	0.1	...	-	-
France[4]	1970	100.0	...	10.5	7.3	13.2	15.7	22.4	23.3	5.9	1.7	...	-	-
	1963	100.0	...	5.0	8.1	15.8	19.2	25.5	20.7	4.5	1.0	0.2	...	-
Germany, Federal Republic of	1971	100.0	0.4	4.9	12.8	20.9	19.8	23.5	15.5	1.7	0.3	0.1	...	-
	1960	100.0	...	18.6	13.6	22.8	20.1	16.8	7.1	0.8	0.1	...	-	-
	1949	100.0	...	14.5	----41.9----		19.9	13.8	7.9	1.4	0.4	0.3	...	-
Greece[4]	1971	100.0	1.1	21.6	22.3	34.5	15.7	4.1	0.9	...	-	-	-	-
	1950	100.0	...	28.5	----57.0----		11.1	2.6	0.5	0.1	...	-	-	-
Hungary	1972	100.0	4.9	85.9	6.0	2.5	0.4	...	-	-	-	-	-	0.2
	1949	100.0	...	9.1	----66.2----		23.2	8.2	1.2	0.1	...	-	-	-
Italy	1970	100.0	0.4	31.9	18.9	24.7	13.0	6.7	3.1	0.8	0.6	...	-	-
	1961	100.0	0.3	32.6	18.6	24.8	13.1	6.7	2.7	0.7	0.3	0.1	...	-
Luxembourg[4]	1970	100.0	...	12.5	-	12.5	12.5	37.5	12.5	...	-	-	-	-
	1950	100.0	...	5.5	----36.7----		20.1	25.6	13.0	1.0	0.1	-	-	-
Malta	1968/ 1969	100.0	...	54.5	18.2	18.2	9.1	...	-	-	-	-	-	-
	1960	100.0	...	50.0	25.0	-	25.0	...	-	-	-	-	-	-
	1950	100.0	...	42.9	----50.0----		7.1	...	-	-	-	-	-	-
Netherlands[4]	1969/ 1970	100.0	2.2	9.2	8.1	15.1	21.1	28.1	15.1	1.1	...	-	-	-
	1959	100.0	5.5	19.5	10.4	18.2	20.1	12.5	8.1	0.6	-	...	-	-
	1950	100.0	...	15.4	----35.8----		22.5	17.2	8.4	0.7	0.1	...	-	-
Norway[4]	1969	100.0	...	7.7	13.5	35.5	27.1	11.6	3.9	0.6	...	-	-	-
	1959	100.0	...	9.6	20.8	38.1	21.3	7.6	2.5	0.2	...	-	-	-
	1949	100.0	...	10.8	----59.2----		20.2	7.5	2.3	0.1	...	-	-	-
Poland[12]	1970	100.0	...	19.5	13.9	28.5	26.1	11.0	1.1	...	-	-	-	-
	1960	100.0	...	18.2	14.5	30.3	26.0	9.7	0.9	0.1	-	0.1	0.1	...
Portugal	1968	100.0	0.4	38.7	20.6	22.3	9.6	5.2	2.2	0.5	0.2	0.1	0.1	0.1
Sweden[13]	1971	100.0	...	1.9	4.9	19.1	24.1	22.8	20.4	4.9	1.9	...	-	-
	1961	100.0	...	0.4	11.4	25.5	28.5	20.2	11.4	1.9	0.8	...	-	-
	1951	100.0	...	11.9	----38.6----		23.8	15.9	7.7	1.6	0.5	...	-	-
Switzerland	1969	100.0	...	21.6	8.5	15.0	21.6	24.8	7.2	0.7	0.7	...	-	-
United Kingdom	1970	100.0	...	4.3	5.5	12.2	12.2	15.3	24.5	14.4	7.7	3.0	0.6	0.3
	1960	100.0	...	6.0	9.2	16.7	12.6	15.4	20.8	11.6	5.4	1.7	0.4	0.2
	1950	100.0	...	7.7	----26.5----		14.7	14.6	19.3	10.5	4.6	2.0	-	-
Yugoslavia	1969	100.0	...	21.5	17.8	35.0	19.5	4.9	0.9	...	-	-	-	-
	1960	100.0	...	17.9	17.0	36.2	21.5	5.9	1.3	...	-	-	-	-
	1951	100.0	...	27.0	----46.8----		17.8	6.3	1.5	0.6	...	-	-	-

ANNEX 1 - Percent distribution of holdings by size of total area 1/ 1970, 1960, 1950 (Cont'd)

	Years	Total No. holdings	Holdings without land	Under 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 h and over
							Percent							
OCEANIA	1970	100.0	...	3.1	2.6	7.4	7.1	6.8	12.5	13.1	12.8	15.9	8.5	10.2
	1960	100.0	...	1.5	1.5	3.6	5.4	6.3	13.3	15.6	14.7	17.1	8.7	10.2
	1950	100.0	...	0.6	——9.6——		6.0	6.3	13.9	15.5	13.8	15.9	7.8	8.7
American Samoa	1969	100.0	...	50.0	50.0	...	-	-	-	-	-	-	-	-
	1960	100.0	...	50.0	50.0	...	-	-	-	-	-	-	-	-
	1950	100.0	...	20.0	——66.6——		6.7	6.7	...	-	-	-	-	-
Australia	1970/ 1971	100.0	...	0.4	1.2	6.0	5.2	6.4	12.0	12.9	13.3	18.1	10.8	13.7
	1960	100.0	...	1.1	1.5	4.1	5.4	6.6	12.5	13.8	14.0	18.7	10.2	12.1
	1950	100.0	...	0.8	——7.3——		5.7	6.1	13.5	14.3	13.9	18.0	9.4	11.0
Fiji	1968/ 1969	100.0	...	24.2	9.1	24.2	12.1	6.1	...	-	-	-	-	-
Guam	1969	100.0	...	50.0	20.0	20.0	10.0	...	-	-	-	-	-	-
	1960	100.0	...	40.0	20.0	15.0	5.0	5.0	5.0	...	-	-	-	-
	1950	100.0	...	50.0	——50.0——		...	-	-	-	-	-	-	-
New Zealand	1972	100.0	...	...	1.6	3.2	4.8	4.8	19.0	22.2	19.0	11.5	4.8	3.2
	1960	100.0	...	...	...	2.6	5.2	6.5	24.7	22.1	18.2	13.0	3.9	3.9
	1950	100.0	...	3.3	——13.3——		6.7	6.7	22.2	18.9	13.3	10.0	3.3	2.2
Pacific Islands (Trust Territory)	1969	100.0	...	...	25.0	25.0	25.0	25.0	...	-	-	-	-	-

1/ Unless otherwise specified in footnotes.
2/ Classification by land under temporary crops.
3/ Classification by land under crops.
4/ Classification by land under agricultural area.
5/ Classification by land under crops for traditional sector and by total area for modern sector.
6/ Data for 1970 exclude 18 377 holdings of size not reported.
7/ Classification by cropland.
8/ Classification by cultivated land (land under crops and cultivated pastures) for 1970 census and by total area for 1960 and 1950 censuses.
9/ Classification by productive land (agricultural land and wood and forestland) for 1970 census and by total area for 1960 and 1950 censuses.
10/ Classification by land under agricultural area for 1970 census and by total area for 1950 census.
11/ Classification by land under agricultural area for 1970 and 1960 censuses and by total area for 1950 census.
12/ Data for 1970 refer to private sector only.
13/ Classification by arable land.
14/ Classification by productive land (agricultural land and wood and forest land).

Main Features of changes in some major agricultural structural characteristics, 1950-1970 Statistics Division, FAO, Rome, April 1979.

ANNEX 2 - Percent distribution of area of holdings by size of total area 1/, 1970,1960,1950

	Year	Total area	Less than 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
		. . . . .	. . . . .	. . . . .	Percent	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
WORLD	1970	100.0	1.4	2.0	4.6	4.6	4.6	6.0	5.9	7.4	10.9	6.3	46.3
	1960	100.0	1.1	1.6	3.8	4.0	4.5	5.8	6.2	7.2	9.2	6.8	49.8
	1950	100.0	0.7	—4.8—		3.7	4.1	6.8	8.3	8.6	9.6	15.9	37.5
Africa	1970	100.0	7.3	15.1	26.2	14.7	10.2	9.2	3.0	1.6	1.7	0.2	10.8
	1960	100.0	0.1	0.1	0.4	0.4	0.5	1.0	1.0	1.9	8.0	11.2	75.4
	1950	100.0	...	....	...	0.1	0.1	0.3	0.6	2.4	10.5	16.0	70.0
Algeria	1973	100.0	1.1	2.6	10.1	15.8	21.7	25.6	11.8	6.2	5.1	...	-
Botswana 2/	1968/69	100.0	1.3	4.8	20.2	68.9	-	4.8	...	-	-	-	-
Cameroon	1972/73	100.0	13.8	27.3	43.1	13.0	2.8	...	-	-	-	-	-
Central African Empire 3/	1973/74	100.0	10.8	29.8	49.9	8.8	0.8	...	-	-	-	-	-
Chad 3/	1972/73	100.0	4.4	13.7	54.0	23.8	4.1	...	-	-	-	-	-
Congo 3/	1972/73	100.0	18.3	46.2	33.5	2.0	...	-	-	-	-	-	-
Gabon 3/	1974/75	100.0	31.5	24.7	43.8	...	-	-	-	-	-	-	-
Ghana	1970	100.0	9.3	11.4	25.8	20.4	15.3	17.8	...	-	-	-	-
Ivory Coast 3/	1974/75	100.0	1.1	4.9	25.5	34.2	24.5	9.2	0.6	...	-	-	-
Lesotho 3/	1970	100.0	8.6	25.3	50.3	15.9	...	-	-	-	-	-	-
	1960/61	100.0	8.8	19.0	49.6	16.7	4.5	1.4	...	-	-	-	-
Liberia	1971	100.0	8.5	11.5	16.4	7.1	7.9	19.7	7.4	4.4	17.2	...	-
Libya	1959/60	100.0	0.1	0.3	1.7	3.9	9.2	21.7	16.4	15.9	30.8	...	-
Malawi 3/	1968/69	100.0	15.1	32.4	52.5	...	-	-	-	-	-	-	-
Reunion 4/	1972/73	100.0	16.0	10.7	24.0	49.3	...	-	-	-	-	-	-
South Africa	1959/60	100.0	...	...	...	...	0.1	0.3	0.5	1.4	7.2	11.7	78.8
	1950	100.0	...	...	...	0.1	0.1	0.3	0.6	2.4	10.5	16.0	70.0
Sierra Leone 3/	1970/71	100.0	8.8	22.1	49.1	20.0	...	-	-	-	-	-	-
Swaziland	1971/72	100.0	0.8	2.2	5.2	5.7	...	...	...	...	...	...	86.1
Togo 3/	1970	100.0	15.5	24.3	33.7	26.5	...	-	-	-	-	-	-
	1961	100.0	6.3	14.8	35.8	26.3	11.2	5.6	...	-	-	-	-
Zaire 5/	1970	100.0	11.6	24.6	24.0	3.4	1.2	0.1	0.2	0.5	0.9	0.9	32.6

ANNEX 2 - Percent distribution of area of holdings by size of total area [1], 1970, 1960, 1950 (cont'd)

	Year	Total area	Less than 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
								Percent					
NORTH AND CENTRAL AMERICA	1970	100.0	0.1	0.1	0.3	0.5	1.0	4.3	8.6	12.6	20.7	8.9	42.9
	1960	100.0	...	0.1	0.3	0.5	1.2	5.7	10.9	13.7	14.6	8.8	44.2
	1950	100.0	...	—0.5—		0.8	2.0	8.4	13.8	13.9	13.2	30.5	16.9
Canada	1971	100.0	...	...	...	0.1	0.4	2.8	8.8	16.5	71.4	...	—
	1961	100.0	...	...	...	0.1	0.5	6.0	11.9	26.0	29.6	12.7	13.2
	1951	100.0	...	—0.1—		0.2	0.7	8.0	16.6	25.3	30.4	18.7	...
Costa Rica	1973	100.0	0.2	0.3	1.4	2.1	3.9	12.4	12.7	12.6	18.4	10.9	25.1
	1962/63	100.0	0.1	0.3	1.5	2.5	5.1	14.1	13.9	11.8	15.2	9.4	26.1
	1950	100.0	0.1	—1.9—		2.7	5.0	14.6	11.9	10.2	11.0	7.2	35.4
Dominican Republic	1971	100.0	1.5	2.7	8.6	8.4	8.5	13.1	9.8	9.1	9.8	5.4	23.1
	1959/60	100.0	4.0	5.5	11.4	8.6	9.9	12.2	7.5	6.5	7.7	6.4	20.3
	1950	100.0	2.0	—11.6—		9.6	10.6	12.8	9.6	7.2	7.6	4.7	24.3
El Salvador	1971	100.0	4.8	5.6	9.1	7.6	8.8	14.8	10.6	10.5	13.2	6.5	8.5
	1961	100.0	3.5	4.1	7.3	6.5	8.2	13.5	10.7	8.5	13.7	8.2	15.8
	1950	100.0	2.3	—10.1—		6.5	8.0	13.5	9.7	9.6	12.9	7.5	15.9
Guadeloupe [1]	1969	100.0	8.1	14.5	25.6	9.7	3.2	3.2	3.2	32.3	...	—	—
Haiti	1971	100.0	21.4	24.5	31.6	14.0	5.7	2.8	...	—	—	—	—
Honduras	1974	100.0	0.8	2.1	6.2	7.6	10.2	17.5	11.5	10.2	11.9	7.0	15.0
	1952	100.0	0.4	—7.7—		8.1	10.3	16.6	10.6	8.3	9.7	7.7	20.6
Jamaica	1968/69	100.0	6.5	8.9	13.8	9.1	5.0	4.6	3.8	5.0	43.3	...	...
	1961	100.0	3.7	7.8	11.3	11.5	4.8	6.5	4.0	5.2	6.1	39.1	...
Mexico	1970	100.0	0.1	0.1	0.4	0.6	0.9	2.0	2.6	3.5	6.5	7.2	76.1
	1959/60	100.0	0.1	0.1	0.6	0.4	0.7	2.0	2.5	3.4	5.6	6.2	78.4
	1950	100.0	0.1	—0.8—		0.5	0.7	2.0	2.3	2.9	5.5	5.8	79.4
Panama	1971	100.0	0.3	0.8	2.6	4.3	8.7	19.8	17.3	12.0	11.3	6.6	16.3
	1960	100.0	0.1	0.9	4.3	6.5	10.6	19.7	15.8	11.1	10.5	4.8	15.7
	1950	100.0	...	—8.3—		9.1	13.2	20.4	13.5	8.9	8.6	5.3	12.7
Puerto Rico	1970	100.0	0.2	1.2	6.5	7.2	9.0	11.6	10.7	16.6	37.0	...	-
	1958/59	100.0	...	2.7	6.4	8.6	11.0	13.8	11.8	9.7	36.0	...	-
	1950	100.0	...	—10.3—		9.0	10.3	15.9	12.4	9.0	33.1	...	-
St. Lucia	1973/74	100.0	6.9	6.9	6.9	10.3	6.9	6.9	6.9	10.3	38.0	...	-
United States	1969	100.0	...	...	0.1	0.3	0.9	4.9	10.4	15.0	17.5	11.0	39.9
	1959	100.0	...	...	0.1	0.5	1.4	6.8	13.9	15.7	15.7	9.1	36.8
	1950	100.0	...	—0.3—		0.8	2.4	10.3	17.0	15.7	13.0	40.4	...
Virgin Islands	1969	100.0	0.1	0.4	1.1	1.1	3.5	7.0	4.7	11.7	70.1	...	-
	1960	100.0	0.1	0.5	2.8	2.8	3.3	8.7	7.7	10.9	21.6	41.6	...
	1950	100.0	...	—3.8—		3.9	3.9	7.7	11.5	19.2	50.0	...	-

ANNEX 2 - Percent distribution of [illegible] by [illegible] holdings 1/, 1970, 1960, 1950 (contd)

	Year	Total area	Less than 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
								Percent					
SOUTH AMERICA	1970	100.0	0.1	0.8	3.1	4.1	5.6	8.1	7.7	9.1	14.3	10.8	42.3
	1960	100.0	0.1	0.5	3.1	4.6	5.1	7.5	7.0	8.1	13.3	10.8	41.1
	1950	100.0	0.1	[illegible]		4.1	5.5	6.7	6.8	11.1	12.9	10.7	45.2
Brazil 6/	1970	100.0	0.1	0..	1.0	1.8	3.7	6.6	8.1	10.1	15.6	11.1	39.5
	1960	100.0	...	0.2	0.8	1.6	3.1	8.2	7.6	9.2	14.3	11.4	44.2
	1950	100.0	...	[illegible]		0.8	2.1	6.6	6.6	7.9	13.4	11.3	50.8
Colombia	1971	100.0	0.4	0.7	2.5	3.9	5.2	9.9	10.3	11.4	15.2	10.4	30.4
	1960	100.0	0.5	1.0	3.1	4..	5.7	9.6	9.8	11.9	14.6	10.0	30.4
	1954	100.0	0.3	[illegible]		3.4	5.0	9.3	9.3	12.4	16.9	1..9	26.7
Ecuador	1974	100.0	0.8	1.4	4.6	4.8	7.0	16.5	11.0	8.6	12.5	6.8	20.0
	1954	100.0	0.8	[illegible]		4.7	4.9	9.9	9.1	7.7	11.6	7.7	37.4
Peru	1972	100.0	0.9	1..	4..	4..	4.3	5.3	3.6	3.9	5.3	4.6	61.7
	1960/61	100.0	0.2	1.4	3.7	2.6	2..	2.9	2.5	3.1	5.7	5.8	59.2
Suriname	1969	100.0	2.1	9..	19..	12.8	7.4	7.4	3.1	2.1	6.4	9.6	24.5
	1958/59	100.0	1.9	9..	19..	12.3	8..	6.6	3.8	3.8	10.4	13.2	17.9
Uruguay	1970	100.0	...	...	3..	[illegible]	1.0	2.5	3.4	5.6	12.3	15.5	58.4
	1961	100.0	...	...	3..	[illegible]	1..	2.3	4.0	6.1	12.8	15.4	56.9
	1951	100.0	...	...	[illegible]	[illegible]	1.1	3.1	4.3	90.8	...	-	-
Venezula	1971	100.0	..	0..	1..	[illegible]	1..	3.5	3.5	4.0	8.7	9.6	66.7
	1960/61	100.0	[illegible]	0..	1..	[illegible]	1..	3.1	2.8	3.6	6.8	7.1	71.7

ANNEX 2 - Percent distribution of area of holdings by size of total area 1/, 1970,1960,1950(Cont'd)

	Year	Total area	Less than 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
								Percent					
ASIA	1970	100.0	9.7	12.1	24.7	20.7	16.4	9.6	4.6	0.5	0.4	0.3	1.0
	1960	100.0	9.4	12.9	25.2	20.0	18.3	7.5	2.3	0.4	0.9	0.5	2.6
	1950	100.0	6.5	—35.9—		21.7	18.7	12.7	3.7	0.2	0.4	0.1	0.1
Bahrain	1974	100.0	2.5	7.5	25.0	25.0	25.0	12.5	2.5	...	-	-	-
India	1970/71	100.0	9.0	11.9	25.8	22.4	17.6	9.6	3.7	...	-	-	-
	1960/61	100.0	6.7	12.1	27.8	22.7	18.5	9.4	2.8	...	-	-	-
	1954	100.0	5.6	—35.2—		22.3	19.5	13.2	3.9	...	-	-	-
Indonesia	1973	100.0	25.0	20.7	23.0	8.3	8.9	...	...	...	...	...	13.6
	1962/63	100.0	25.2	20.1	21.8	9.9	6.1	4.9	...	0.1	0.6	0.9	10.3
Iraq	1971	100.0	0.6	1.5	5.7	15.1	24.8	26.0	6.5	4.5	5.3	10.0	...
	1957/58	100.0	0.3	0.5	1.5	2.6	5.4	11.0	7.3	6.2	10.0	11.2	44.0
Israel 2/	1971	100.0	1.1	2.6	8.2	23.3	4.7	2.2	2.0	4.5	16.2	23.5	11.7
	1950	100.0	0.8	—8.4—		7.3	8.8	5.0	2.3	4.6	19.5	29.1	14.2
Japan 3/	1970	100.0	32.1	33.2	17.8	14.4	2.5	...	-	-	-	-	-
	1960	100.0	30.6	33.8	19.5	7.1	6.0	3.0	...	-	-	-	-
	1950	100.0	32.3	—52.0—		6.7	5.4	3.6	...	-	-	-	-
Jordan	1953	100.0	10.9	—14.0—		20.1	24.6	10.6	5.2	4.9	2.7	7.0	...
Korea, Republic of 4/	1969/70	100.0	38.4	40.5	21.1	...	-	-	-	-	-	-	-
	1961	100.0	53.1	33.4	13.5	...	-	-	-	-	-	-	-
Kuwait	1970	100.0	3.4	3.4	6.9	10.4	20.7	17.3	31.0	6.9	...	-	-
Pakistan	1970	100.0	1.3	3.9	25.1	26.5	18.7	13.1	11.4	...	-	-	-
	1959/60	100.0	3.4	6.0	22.3	25.8	42.7	...	-	-	-	-	-
Philippines	1971	100.0	1.9	9.4	36.5	18.3	12.8	7.2	13.9	...	-	-	-
	1959/60	100.0	1.6	10.2	31.2	23.7	15.3	5.7	2.1	2.0	8.2	...	-
	1948	100.0	2.9	—40.4—		17.5	14.7	11.1	2.9	2.7	7.8	...	-
Saudi Arabia	1973/74	100.0	2.1	4.2	8.2	9.3	13.7	15.3	10.8	35.5	...	-	-
Sri Lanka	1973	100.0	22.4	24.1	28.4	9.4	6.1	9.6	...	-	-	-	-
	1961/62	100.0	15.4	16.4	21.0	8.6	5.6	5.4	4.0	4.8	18.8	...	-
Syria	1970/71	100.0	0.8	1.9	8.1	11.2	18.5	27.3	11.1	7.6	13.5	...	-

ANNEX 2 - Percent distribution of area of holdings by size of total area [1], 1970,1960,1950 (cont'd)

	Year	Total area	Less than 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
EUROPE	1970	100.0	1.7	3.5	11.3	15.3	16.0	17.8	9.0	10.5	4.2	2.3	8.4
	1960	100.0	1.5	2.9	11.9	18.1	19.6	19.3	8.8	5.7	4.3	2.4	5.5
	1950	100.0	1.5	—17.7—		17.9	16.7	15.0	14.7	5.1	9.3	0.3	1.8
Austria [2]	1970	100.0	0.3	0.9	3.3	6.2	14.8	25.7	11.4	7.4	30.0	...	-
	1960	100.0	0.3	0.9	3.6	6.8	14.7	23.2	10.2	7.7	5.9	4.2	22.5
	1951	100.0	0.3	— 5.5—		7.6	14.3	19.6	7.0	6.0	7.2	5.1	27.4
Belgium [4]	1970	100.0	1.9	1.5	6.5	15.7	30.5	31.2	9.5	3.2	...	-	-
	1959	100.0	1.8	3.4	10.8	21.9	29.2	22.2	7.6	3.1	...	-	-
	1950	100.0	0.3	—22.3—		23.9	25.7	18.6	6.9	2.3	...	-	-
Czechoslovakia [10]	1970	100.0	5.0	0.7	1.6	1.6	1.4	2.0	6.9	11.9	18.0	19.8	31.1
	1949	100.0	1.3	—13.4—		16.1	19.0	8.9	41.3	...	-	-	-
Denmark [4]	1970	100.0	-	0.2	1.2	7.3	21.2	44.4	15.5	10.2	...	-	-
	1959	100.0	0.1	0.4	3.0	12.6	25.9	39.7	10.9	4.5	2.9	...	-
	1949	100.0	0.1	— 4.2—		13.0	25.0	41.3	9.6	3.5	3.3	...	-
Finland [11]	1969	100.0	3.3	16.6	33.2	29.1	14.0	2.5	1.3	...	-	-	-
	1959/60	100.0	3.9	4.5	20.9	29.6	25.5	13.1	2.3	1.2	...	-	-
	1950	100.0	1.6	—27.2—		27.0	25.2	15.3	2.4	1.3	...	-	-
France	1970	100.0	0.7	0.9	3.0	7.1	18.0	36.8	19.7	13.8	...	-	-
	1963	100.0	0.2	0.8	3.5	8.9	21.9	36.0	17.1	7.7	3.9	...	-
Germany, Federal Republic of [11]	1971	100.0	0.6	1.8	6.1	12.2	28.3	36.9	9.3	3.0	1.8	...	-
	1960	100.0	3.5	3.2	9.9	17.3	28.0	25.8	7.2	2.8	2.3	-	-
	1949	100.0	1.1	—10.1—		13.1	17.8	21.4	8.8	5.2	22.6	...	-
Greece	1971	100.0	3.1	9.2	32.5	30.5	15.4	6.8	2.5	...	-	-	-
	1950	100.0	6.4	—43.4—		22.1	10.1	4.7	1.7	1.8	2.2	1.8	5.8
Hungary	1972	100.0	3.2	0.9	0.8	0.2	...	...	0.1	0.2	0.6	3.4	90.6
	1949	100.0	1.3	—25.4—		23.8	12.4	6.5	30.6	...	-	-	-
Italy	1970	100.0	2.4	4.1	11.7	13.3	13.4	13.4	8.1	33.6	...	-	-
	1960/61	100.0	2.7	4.5	13.2	15.0	15.1	13.1	7.3	6.1	6.5	4.6	11.9
Luxembourg [4]	1970	100.0	0.2	0.5	2.2	5.2	17.0	60.7	14.2	...	-	-	-
	1950	100.0	0.2	— 9.1—		15.0	33.5	35.6	5.7	0.7	...	-	-
Malta	1968/69	100.0	12.8	19.2	44.9	19.2	3.2	0.7	...	-	-	-	-
	1959/60	100.0	11.0	22.0	43.9	16.5	5.5	1.1	...	-	-	-	-
Netherlands [4]	1969/70	100.0	0.5	0.9	4.4	13.5	34.4	37.0	6.7	2.6	...	-	-
	1959	100.0	1.5	2.3	8.3	18.8	31.0	29.1	5.2	3.8	...	-	-
	1950	100.0	0.9	—11.3—		20.1	29.4	30.4	5.3	2.6	...	-	-
Norway [4]	1969	100.0	1.3	4.5	28.0	36.2	19.5	8.6	1.9	...	-	-	-
	1959	100.0	1.6	6.6	33.4	32.5	16.4	7.5	1.7	0.3	...	-	-
	1949	100.0	1.6	—35.7—		31.4	19.6	9.5	1.9	0.4	...	-	-
Poland [12]	1970	100.0	1.9	4.2	19.8	38.5	29.6	5.6	0.4	...	-	-	-
	1960	100.0	1.5	3.9	18.6	33.9	22.9	4.5	0.8	0.6	4.1	6.2	3.2
Portugal	1968	100.0	2.5	4.2	10.8	9.6	11.6	10.1	6.0	5.7	9.2	8.9	21.4
Sweden [13] [14]	1971	100.0	0.5	2.1	13.2	20.6	20.5	22.4	9.7	11.0	...	-	-
	1961	100.0	...	1.5	8.4	18.0	23.5	26.6	10.7	11.3	...	-	-
	1951	100.0	2.6	—28.8—		27.2	18.7	11.7	4.7	6.2	...	-	-
Switzerland [15]	1969	100.0	1.1	1.6	6.2	19.9	41.6	24.3	3.6	0.9	0.8	...	-
United Kingdom	1970	100.0	...	0.1	0.8	1.6	4.0	14.6	18.5	18.8	16.8	7.1	17.7
	1960	100.0	0.1	0.3	1.3	2.2	5.6	16.6	19.8	17.8	12.8	6.0	17.5
	1950	100.0	0.1	— 1.8—		2.9	5.6	17.6	20.5	18.3	33.2	...	-
Yugoslavia	1969	100.0	2.2	5.7	25.0	28.9	13.0	6.2	0.1	0.3	0.8	1.2	16.6
	1960	100.0	1.8	5.4	25.6	31.6	16.3	8.8	0.4	0.7	1.5	1.7	6.2
	1951	100.0	3.1	—23.2—		21.9	15.1	8.0	28.7	...	-	-	-

ANNEX 2 Percent distribution of area of holdings by size of total area 1/ 1970, 1960, 1950 (cont'd)

	Year	Total area	Less than 1 ha	1 ha and under 2	2 ha and under 5	5 ha and under 10	10 ha and under 20	20 ha and under 50	50 ha and under 100	100 ha and under 200	200 ha and under 500	500 ha and under 1000	1000 ha and over
		Percent											
OCEANIA	1970	100.0	...	...	...	...	0.1	0.3	0.7	1.3	3.5	4.1	90..
	1960	100.0	...	...	...	...	0.1	0.4	0.8	1.4	3.8	4.2	89.
	1950	100.0	...	...	...	...	0.1	0.5	0.9	1.7	4.4	4.8	87.6
American Samoa	1969	100.0	10.0	20.0	33.0	12.5	15.0	17.5	...	-	-	-	-
	1960	100.0	7.4	18.5	33.3	18.5	7.4	3.7	7.4	...	-	-	-
	1950	100.0	1.9	---37.0---		18.5	18.5	18.5	-	5.6	...	-	-
Australia	1970/71	100.0	...	...	...	...	...	0.2	0.5	1.0	3.0	3.9	91.4
	1959/60	100.0	...	...	...	...	0.1	0.2	0.6	1.1	3.3	3.9	90.8
	1950	100.0	...	...	...	...	0.1	0.3	0.7	1.3	3.9	4.4	89.3
Fiji	1968/69	100.0	1.2	2.1	9.6	21.6	19.6	45.7	...	-	-	-	-
Guam	1969	100.0	0.9	2.6	8.9	3.5	4.4	8.9	70.8	...	-	-	-
	1960	100.0	0.7	3.0	14.9	6.7	7.5	14.9	52.2	...	-	-	-
	1950	100.0	1.0	---19.8---		9.9	19.8	19.8	29.7	...	-	-	-
New Zealand	1972	100.0	...	...	...	0.1	0.3	2.7	5.3	9.4	17.3	11.8	3.7
	1959/60	100.0	...	...	...	0.2	0.5	3.7	7.0	11.0	17.1	12.0	48.5
	1950	100.0	...	---	0.2---	0.2	0.5	4.0	6.8	10.1	16.4	11.9	49.9
Pacific Islands (Trust Territory)	1969	100.0	0.3	2.5	12.4	12.5	10.1	14.9	47.3	...	-	-	-

1/ Unless otherwise specified in footnotes.
2/ Classification by land under temporary crops.
3/ Classification by land under crops.
4/ Classification by land under agricultural areas.
5/ Classification by land under crops for traditional sector and by total area for modern sector.
6/ Data for 1970 exclude 16 477 holdings of size not reported.
7/ Classification by cropland.
8/ Classification by cultivated land (land under crops and cultivated pastures) for 1970 census and by total area for 1960 and 1950 censuses.
9/ Classification by productive land (agricultural land and wood and forest land) for 1970 census and by total area for 1960 and 1950 censuses.
10/ Classification by land under agricultural area for 1970 census and by total area for 1950 census.
11/ Classification by land under agricultural area for 1970 and 1960 censuses and by total area for 1950 census.
12/ Data for 1970 relate to private sector only.
13/ Classification by arable land.
14/ Data on area for 1961 relate to arable land only.
15/ Classification by productive land (agricultural land and wood and forest land).

Main Features of changes in some major agricultural structural characteristics, 1950-1970
Statistics Division, FAO, Rome, April 1971.

ANNEX 3(a)

A PROFILE OF 'SIMPLE AGRICULTURAL TOOLS, IMPLEMENTS AND EQUIPMENT' AT RURAL FAMILY WORKER/OWNERSHIP PRODUCTION LEVEL

Product Description

Hand Tools - selected products e.g. spade, hoe, fork, sickle (Note: could be expanded to animal drawn implements)

Market Aspect

1. Users: Small farmers holding less than 2 hectare or for garden work.

2. Method of sales: Can be sold directly to the farmers or through wholesale distributor.

3. Market potential: Home - for local markets within the country
   Export - very limited.

4. Requirement of Feasibility study: may not be necessary.

5. Expert Assistance: May be required if modern machinery is used. Expert advice on heat treatment can improve on product quality.

6. Joint venture: Not recommended.

7. Linkage with other industry: Woodworking industries or local carpenters.

DETAILS OF THE MANUFACTURING PROFILE

1. Product

Manufacture of spade, hoe, fork, sickle

2. Product specification (selected four product mix)

Product	Specification
Spade	Blade and shank size- overall length 20", blade size - 8" x 6" weight - 1.5 kg.
Hoe (tined)	Maximum length of tine - 10", width - 6", tine diameter - ½" weight 1 kg.
Fork	Weeding fork - 3 prongs, length 14", width 7" dia of prong 5/8", tang bore - ¾" dia min.- 2½" max. weight 2 kg.
Sickle	Length - 9", max width 1", heel dia - 5", weight - ½ kg.

3. Material Specification

Material specification for hand tools will be as follows:

SAE - 1078, Carbon - 0.72 to 0.85
Manganese - 0.30 to 0.60

The material is suitable for forging and heat treatment.

4. Production Volume

	Manually operated machine tools No. Electric power available		Electric power operated machine tools - supply 30 kw, 50/c/s single phase 220/24 Gv AC	
	Prod./day/shift	*Annual Prod.	Prod./day/shift	*Annual Prod.
Spade	4	1,000	12	3,000
Hoe	4	1,000	12	3,000
Fork	4	1,000	12	3,000
Sickle	4	1,000	12	3,000
	16	4,000 units	48	12,000 units

5. Manpower Requirement - Direct labour:

Item	Category	Shop without electrical power	Shop with electrical power
1.	Skilled	3 (including owner)	5 (including owner)
2.	Semi-skilled	-	2
3.	Unskilled	1	1
		-Indirect Labour:	
1.	Skilled	-	1(Accounts clerk)
2.	Semi-skilled	-	-
3.	Unskilled	-	-
Total	Manpower	4	9

6. Floor Area

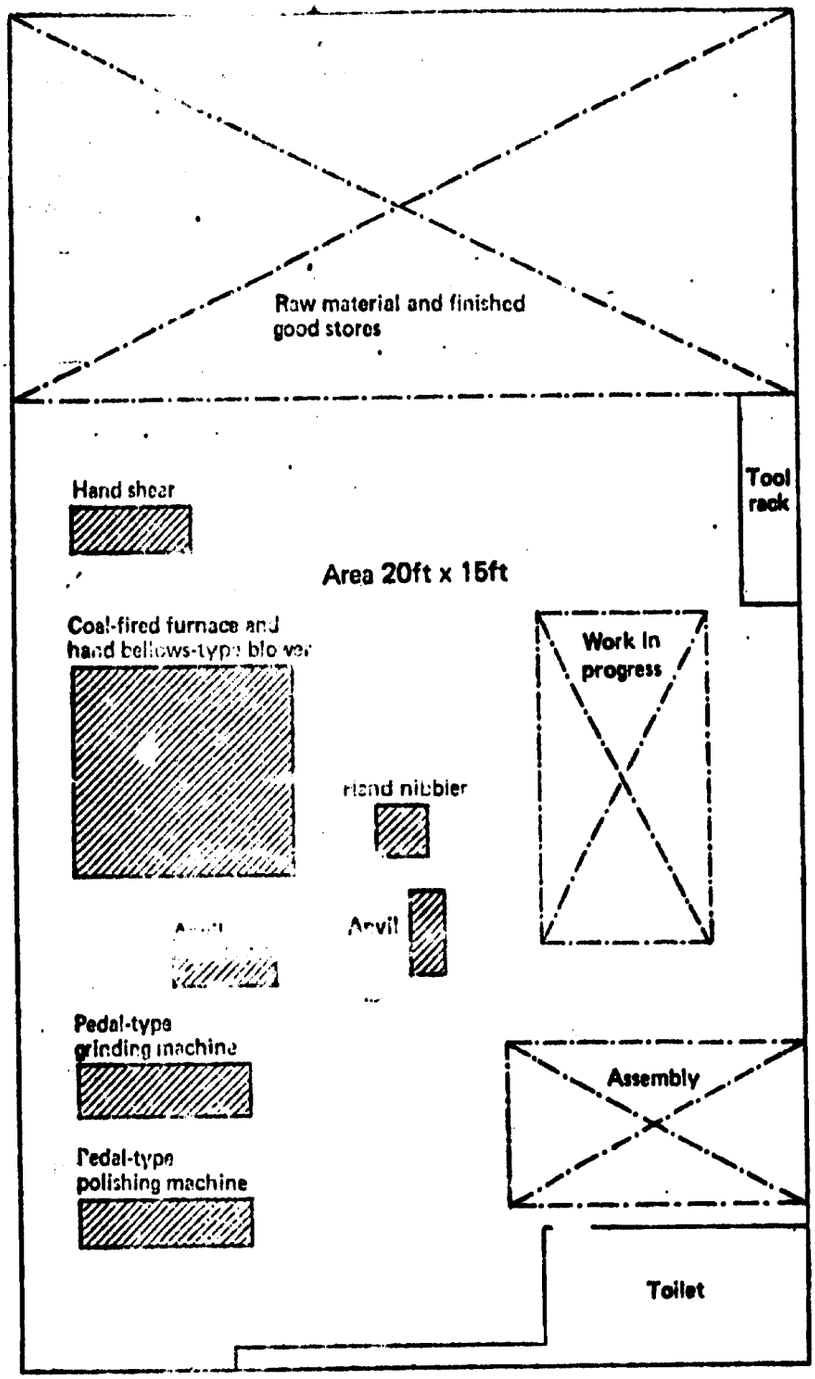
Shop without electrical supply	Shop with electrical supply
20ft x 15 ft = 300 sq. ft.	40ft. x 30ft. = 1,200 sq. ft.

Ref. Figure 1 and 2 for Layout and Plan.

LAYOUT OF RURAL FAMILY WORKER/OWNERSHIP PRODUCTION UNIT

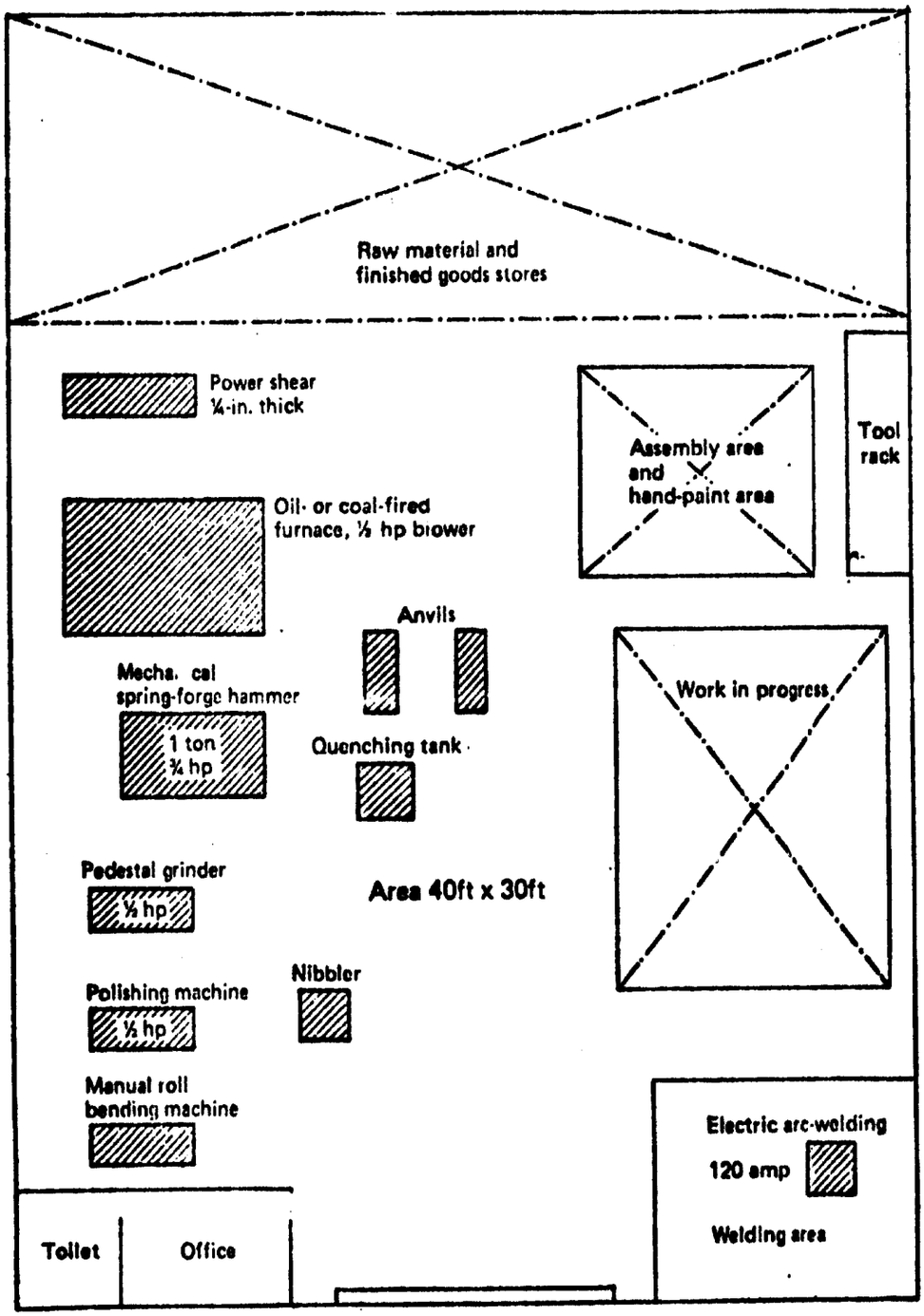
(WITHOUT ELECTRICITY SUPPLY)

FIGURE 1



LAYOUT OF RURAL FAMILY WORKER/OWNERSHIP PRODUCTION UNIT (ELECTRICITY SUPPLY AVAILABLE)

FIGURE 2



7. Machinery and Equipment - Estimated cost

Power Supply	Hand operated Machine Tools (electricity not available)			Electrically operated machine tools		
	Nil			30kw, 50c/s single phase 220/240v AC		
Item	Description	No. Off.	Price US $ estimated	Description	No. Off.	Price US $ estimated
1	Hand shear 12"	1	200	Power shear ¼"	1	500
2	Coal fired furnace with hand bellow type blower 24" x 24" x 18"	1	2200	Oil fired or coal fired furnace ½hp 24.24.18"	1	5000
3	Anvil with pedestal 200 kg	2	200	Mechanical spring forge hammer 1ton 3/4 hp	1	4000
4	Quenching tank 24"x24".24"	1	300	Quenching tank 36"x36"x36"	1	500
5	Pedal type grinding machine 12" wheel	1	100	Anvils with pedestal 200kg	2	200
6	Pedal type polishing machine	1	100	Double ended pedestal grinder ½hp 12" wheel	1	400
7	Hand nibbler - ¼"	1	200	Double ended polishing machine ½hp	1	400
8	Blacksmith's tools and conventional tools	set	600	Manual roll bending machine	1	200
9	Miscellanous	-	300	Electric arc welding machine 120ampc	set	600
10	-	-	-	Blacksmith's tools, ½" portable drill, paint can and brushes	set	600
11	-	-		Miscellenous	-	500
Total cost US $			4000	Total cost US $		12,500

8. Investment Requirement

	Basic Investment	Shop with no elect. supp.	Shop with elect. supp.
(A)	Fixed Capital	US $	US $
(a)	Land	-	-
(b)	Building cost	..	.
	US$5.00/sq. ft. - 300sq.ft.	1,500	-
	US$5.00/sq. ft. - 1200 "	-	6,000
(c)	Furniture fittings, racks etc.	300	600
(d)	Machinery and equipment	4,000	12,500
(e)	Electrical installation	-	1,000
(f)	Erection	50	300
(g)	Transport (cart or trolley)	100	500
(h)	Contingencies	150	300
	Fixed capital total US $	6,100	21,200
(B)	Working Capital		
(a)	Direct material (3 months)	815	2,370
(b)	Labour (3 months)	950	2,875
(c)	Indirect costs	300	600
(d)	Training costs	-	500
(e)	Contingencies	35	155
	Working capital total US $	2,100	6,500
(C)	Total Investment required (excluding cost of Land) C= (A + B) US $	8,200	27,700

9. Annual Manufacturing Cost

9 A9.A Direct Material Cost

MOW - Manufactured own shop

BOF - Bought out finished

IMP - Imported Steel price = US$ 300/metric ton

Item	MOW	BOF	IMP	Weight of blade Sizekg	Unit Raw Material Cost 30c/kg	Shop without Electric Supply			Shop with electrical supply		
						Prod/ Year	Tot. Mat.	Cost US $	Prod/ Year	Tot. Mat.	Cost US $
Spade	X	-	-	1.5	30c	1,000	1,500	450	3,000	4,500	1,350
Hoe	X	-	-	1.0	30c	1,000	1,000	330	3,000	3,000	900
Fork	X	-	-	2.0	30c	1,000	2,000	600	3,000	6,000	1,800
Sickle	X	-	-	0.5	30c	1,000	500	150	3,000	1,500	450
Wooden handle	-	X	-	-	40c	3,000	-	1200	9,000	-	3,600
Handle (sickle)	-	X	-	-	10c	1,000	-	100	3,000	-	300
Nails + furrels	-	X	-	-	-	-	-	200	-	-	400
15% Scrap for steel								230			675
Total direct material cost US$								3,260			9,475

9B Indirect Material Cost

Indirect items	4000 Units/year Cost US$	12000 Units/year Cost US$
Lubricants, coolants, etc	30	50
Maintenance and spare parts	200	1,000
Paints, office supplies	200	500
Total indirect costs	430	1,550

9C Power, Fuel and Water Cost

Item	Shop without electricity supply Cost US$/Year	Shop with electricity supply Cost US$/Year
Power 30kw, at 60,000kwh	-	2,500
Fuel + coal/oil	550	1,000
Water	50	100
Total	600	3,600

9D Transport Cost

External transport	200 US$/year	500 US$/Year

9E Labour Cost

Category		Shop without elc tric supply			Sho with electric supply		
		No. Off.	Rate/year US$	Total wage per year US$	No. Off.	Rate/year US$	Total wage /year US$
Direct Labour	Skilled	3	1000	3000	5	1500	7500
	Semi-skilled	-	-	-	2	1000	2000
	Un-skilled	1	800	800	1	800	800
Sub-total		4		3800	8		10300
Indirect labour	-	-	-	-	1	1200	1200
	-	-	-	-	-	-	-
Sub-total		4		3800	9		11500

9F Summary - Annual Manufacturing Cost

Costs		Shop without elect.	Shop with electricity
		Costs US $	Costs US $
9-A	Direct material	3,260	9,475
9-B	Indirect material	430	1,550
9-C	Power, fuel, water	600	3,600
9-D	Transport	200	500
9-E	Labour Cost	3800	11,500
Total annual manufacturing cost		8,290	26,625

10. Annual Sales Turnover

Product	Unit Selling Price US$	Shop without electric.		Shop with electric.	
		Units/year	Sales/year US $	Units/year	Sales/year US $
Spade	2.50	1000	2500	3000	7500
Hoe	3.00	1000	3000	3000	9000
Fork	3.00	1000	3000	3000	9000
Sickle	1.50	1000	1500	3000	4500

11. Total Annual Manufacturing Cost

	Shop without electric.	Shop with electric.
	Annual costs US $	Annual Costs US $
(a) Total manufacturing cost (refer 9-F)	8,290	26,625
(b) Total sales cost	200	1,000
(c) Depreciation of fixed capital 10%	400	1,250
Total annual cost	US$ 8,890	28,875

12. Profit

	Shop without elec. supply US $	Shop with Electric. supply US $
Annual sales turnover	10,000	30,000
Total Annual Costs	8,890	28,875
Profit (before tax)	1,110	1,125

ANNEX 3 (b)

A PROFILE OF 'INTERMEDIATE IMPLEMENTS AND EQUIPMENT' AT SMALL SCALE INDUSTRY/INDUSTRIAL ESTATE LEVEL

Product Description

Single hand wheels hoe, animal drawn disc harrow, animal drawn mould board plough (Note: Could expand to produce tractor drawn implements).

Market Aspects

1. Users: Small Medium farmers - with 2 to 5 hectares of land.
2. Method of sales: Prefereably to appoint selling agents both at village and national level. Attention will have to be given to spare parts supply. Agents or distributors can stock parts. Thereby the annual turnover can be increased.
3. Market potential: Home - in local and national markets within the country.
   Export - good possibility, can offer the products to exporting houses in the country.
4. Requirement of feasibility study: necessary before investment.
5. Expert Assistance: required in the following areas:
   1. Feasibility study
   2. Training
   3. Product design and product development
   4. Marketing
   5. Heat treatment and process.
6. Joint venture: recommended
7. Linkage with other industries: - Foundry, forge, stockist hardware industry.

DETAILS OF THE MANUFACTURING DETAIL

1. Product

(a) Manufacture of single hand wheel hoe
(b) Manufacture of animal drawndiso harrow
(c) Manufacture of animal drawn mould board plough

2. Product specifications (selected three product mixes)

Product	Specification
Single - hand wheel hoe	Weight 12kg, (option - 3 hoeblades or 3 cultivator tines or 3 ploughs)
Animal drawn disc harrow	Weight 50kg, Discs - 6 (No. of discs can be from 6-12) working width - 36" working depth - 3" (can be from $2\frac{1}{2}$ - 5") Output 0.25 hectare/hour
Animal drawn mouldboard plough	Weight - 35kg Furrow width - 5"-8" Furrow depth - $2\frac{1}{2}$" - 7"

3. Material Specifications

Agricultural Components	SAE No.	Carbon C	Manganes M
Implement Frame (Mildsteel)	1006-1008 -1010-1015	0.08-0.18	0.25-0.60
Springs	1065	0.60-0.70	0.60-0.90
Plough beam or tool bar	1070	0.65-0.75	0.60-0.90
Plough mares, sheetmetal	1074	0.70-0.80	0.50-0.80
Rake teeth	1078	0.72-0.85	0.30-0.60

Agricultural Components	SAE No.	Carbon C	Manganes M
Scraper, blades, discs, Spring tooth harrow	1035	0.80-0.93	0.70-1.00
Mower + binder section twine holders, knotter discs	1086 + 1090	0.82-0.95 0.85-0.98	0.30-0.50 0.60-0.90

4. Production Volume

Item	Product Description	Production/day 1 shift=8hours	Production/year 250workingdays
(a)	Single hand wheel hoe	24	6000
(b)	Animal drawn disc harrow	8	2000
(c)	Animal drawn plough	8	2000

5. Labour Requirement - Direct Labour

Item	Area	Skilled	Semi-Skilled	Unskilled
1	Cutting off	-	1	-
2	Inspection	2	-	-
3	Forging + heat treatment	2	-	-
4	Toolroom + maintenance	3	1	-
5	Machine shop	9	2	1
6	Welding + fabrication	6	4	2
7	Sub assembly	2	4	1
8	Assembly	4	2	1
9	Paintshop	1	-	-
	Total direct	29	14	5

-Indirect Labour

Item	Area	Skilled	Semi-Skilled	Unskilled
10	Manager	1	-	-
11	Accountant	1	-	-
12	Sales executive	1	-	-
13	Development engineer/ designer	1	-	-
14	Superintendent	1	-	-
15	Jig + Tool designer	1	-	-
16	Foremen	3	-	-
17	Secretary	1	-	-
18	Charge hand	1	-	-
19	Stores + tool keeper	3	-	-
20	Security	1	-	-
21	Clerk	-	2	-
	Total Indirect	16	2	-

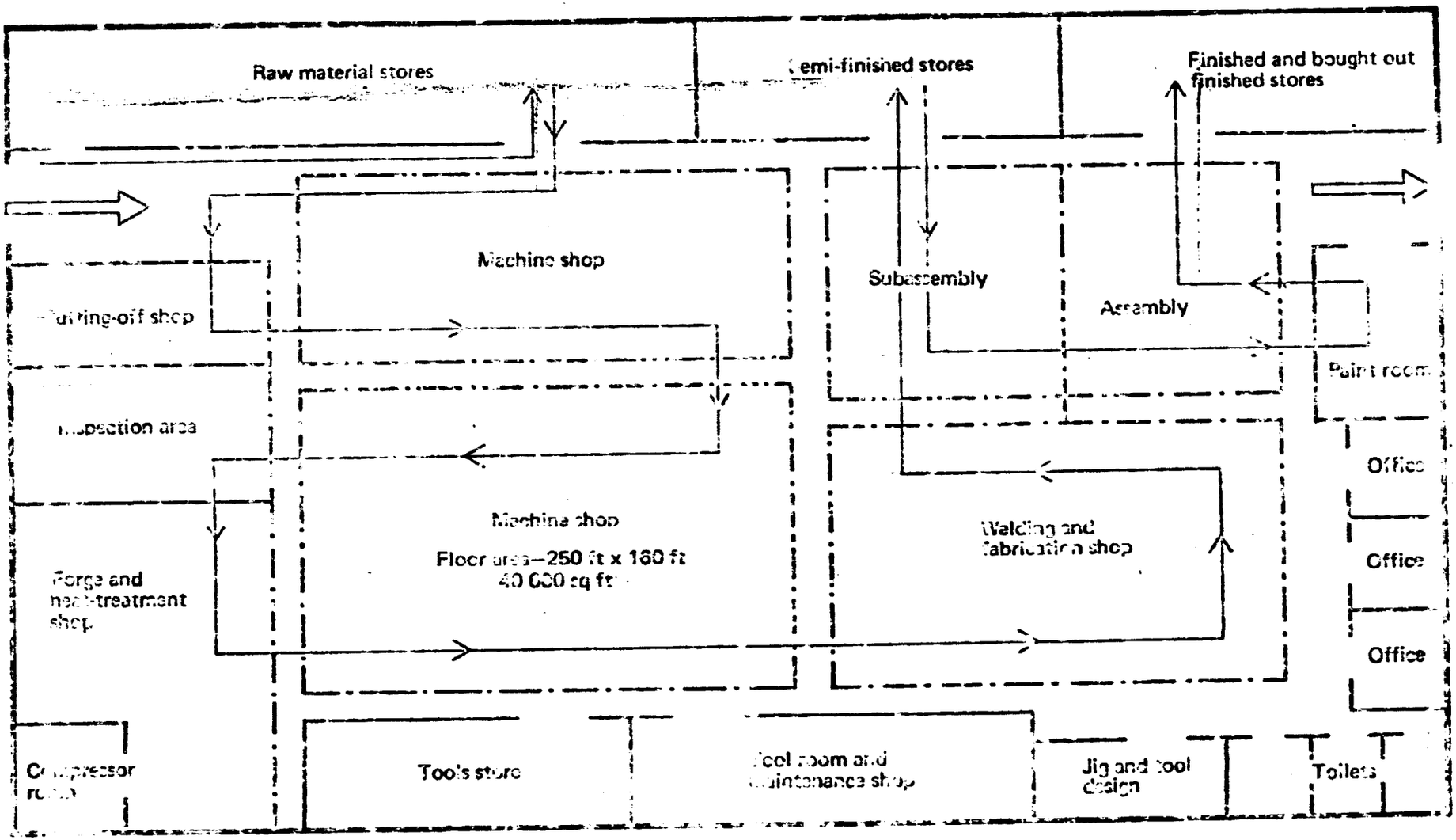
Therefore total manpower =

Direct Manpower	48
Indirect manpower	18
total	66

6. Floor Area

Administrative Area - 2000 sq ft.

Manufacturing area - 40,000 sq. ft.



Layout of small scale agricultural machine and implements manufacturing plant

LAYOUT OF A SMALL-SCALE INDUSTRY MANUFACTURING PLANT.
FIGURE 3

Annex 3
page 15

7. Machinery and Equipment (Estimated)

Ref: Fig (6) for layout information

Item	Area	Description	No.	Estimated cost US $
1.	Cutting shop	Power hacksaw Max round bar up to 3" dia.	1	1,000
2.		Abrasive cutter/grinder ½hp - 8" wheel	1	800
3.		Hand shear - 12"dia	1	200
4	Forge and heat treatment shop	Mechanical hammer forge 50ton (for hot forge)	1	14,000
5		Oil fired furnace with blower 30"x30"x15"	1	5,000
6		Water quenching tank 3'x3'x3'	1	500
7		Oil quenching tank 3'x3'x3'	1	300
8		Anvils	2	200
9	Blacksmith's	tools	net	400
10	Machine shop	Pedestal grinder 12" wheel - double ended	2	800
11		Upright drilling machine 1"diain MS	1	5,000
12		Radial drilling machine 3'arm - 1½" dia in MS	1	8,000
13		Lathe- Max bore 3" Swing - 18" Max length -36"		6,000
14		Capstan lathe with hex turret + attachment Swing 6" Gap 24"	1	9,000
15		Jigs and fixtures for parts	set	6,000

Item	Area	Description	No	Estimated Cost US $
16	Tool Room + Maintenance	Universal milling machine Arbour size - 1"dia Table size 3ftx1ft	1	8,000
17		Universal cutter grinder up to 12" milling cutter	1	9,000
18		Surface table	1	800
19		Gauges + tools	set	1,500
20		Maintenance equipment	set	1,500
21	Inspection	Inspection tools, table etc.	set	2,000
22	Welding + Fabrication Shop	Electric arc welding 250 amps	2	1,000
23		Press brake - 10ft long 5 ton	1	6,000
24		Eccentric press, 35 ton gap 4"	1	8,000
25		Welding fixture and jigs	set	2,000
26		Manual roll bending machine up to 1" dia rod cold.	1	150
27	Sub assembly	Drilling machine upright - up to 1"dia in MS	1	2,500
28		Portable grinder 6" dia wheel	2	300
29		Portable drill gun ½HP	2	600
30		Sub assembly fixtures	set	500
31	Paint room	Pneumatic spray, paint equipment etc.	set	300
32	Compressor	Motor compressor set c complete 300cuft/min,linc pressure 80 psi	set	10,000
33	Stores	Racks, stillage, pallets	set	8,000
34	Mechanical Handling Equipment	Forklift truck- 1 ton	1	8,000
35		½ ton hoists	6	6,000
36		Hydraulic pallet truck	2	800
		Total machinery + equipment cost		134,150

8. Investment Requirement - Basic investment

A	Fixed Capital	Cost US $
a	Land	-
b	Building cost: (i) administrative block 2000sqft at $5/sqft.	10,000
	(ii) factory building - 40000sqft at $5/sqft.	200,000
c	Furniture + fittings including drawing office equipment and office equipment	20,000
d	Machinery and equipment	134,150
e	Electrical Installations	10,000
f	Erection	5,000
g	Transport car + van (1 ton)	8,000
h	Contingencies	1,050
A	Total	388,200
B	Working Capital	
a	Direct material (3 months)	97,500
b	Direct labour (3 months)	20,275
c	Indirect costs (3 months)	3,500
d	Training cost	5,000
e	Contingencies	1,225
B	Total	127,500
C	Total Investment Required excluding Land (C = A + B) US $	515,700

9. Annual Manufacturing Cost

MOW – Manufactured own shop

BOF – Bought out finished

IMP – Import

Steel price estimated at US$ 500 per metric ton

9.A Direct Material cost

Description	Parts group	MOW	BOF	IMP	Units Cost US $	Total Unit cost	Annual Quantity	Total Material cost US$
1 Single wheel hand hoe	MS handles	X	–	–	2.00	–	–	–
	MS fork	X	–	–	1.00	–	–	–
	Hoe frame	X	–	–	1.50	–	–	–
	Shovel	X	–	–	2.50	–	–	–
	Toeing hook	X	–	–	0.50	–	–	–
	Y-bracket	X	–	–	0.50	–	–	–
	Axel shaft	X	–	–	2.00	–	–	–
	CI wheel	X	X	–	5.00	–	–	–
	Wooden grip	–	X	–	0.50	–	–	–
	Bolts, Nuts,	–	X	X	0.50	16	6,000	96,000
2 Animal drawn disc harrow	Beam frame	X	–	–	8.00	–	–	–
	Disc axelshaft	X	–	–	8.00	–	–	–
	Middle tin shovel	X	–	–	9.00	–	–	–
	Gang angle mechanism	X	–	–	10.00	–	–	–
	Seat arrang.	X	–	–	5.00	–	–	–
	Disc hub	X	X	–	5.00	–	–	–
	Hub bracket	X	X	–	5.00	–	–	–
	CI wheel + back rest				3.00	–	–	–
	Disc-3/16"x18" or 1/4" x18"or inside bevel 7/32" x 18"	–	X	–	20.00	–	–	–
	Bearings	–	–	X	20.00	–	–	–
	Bolts/nuts/ washer	–	–	X	5.00	93	2,000	196,000

Description	Parts Group	MOW	BOP	IMP	Units Cost US $	Total Unit Cost	Annual Quant-ity	Total Material CostUS$
3 Animal drawn mouldboard plough	MS handle	X	-	-	3.00	-	-	-
	Steel beam	X	-	-	3.00	-	-	-
	Steel mould-board + share	X	-	-	10.00	-	-	-
	Bracket	X	-	-	2.00	-	-	-
	Landside	X	-	-	1.00	-	-	-
	chain ring + shackle	X	X	-	1.00	-	-	-
	Ridging body	X	-	-	4.00	-	-	-
	CI Gauge wheel	X	X	-	5.00	-	-	-
	Bearing			X	4.00	-	-	-
	Bolts/nuts/ washers			X	2.00	35	2,000	70,000
	Total US $							362,000
	Scrap allowance US $							18,000
	Raw material cost (annual) US $							380,000

9.B Indirect Material cost

Indirect costs	Yearly Cost US $
1 Lubricants, coolant	400
2 Maintenance, spareparts	2,000
3 Paints	8,000
4 Office supplies, telephone etc.	3,000
5 Sundries	600
Total indirect costs	14,000

9.C Power, Fuel + Water cost

Item	Cost US$
Power - 80hp + light 3,000 kwh	5,000
Fuel Oil	2,000
Water	500

9. D. Transport

Item	Cost US $
Operating cost of Car and 1 ton van	2,000

9. E. Labour Cost

	Category	No. Off.	Pay out/year US $	Total wage US $
Direct labour	Skilled	29	1,000	29,000
	Semi-skilled	14	800	11,200
	Unskilled	5	500	2,500
Indirect labour	Manager	1	5,000	5,000
	Accountant	1	4,000	4,000
	Sales exec.	1	4,000	4,000
	Development Eng./Designer	1	4,000	4,000
	Superintendant	1	3,000	3,000
	Jig + Tool Designer	1	3,000	3,000
	Foreman	3	2,000	6,000
	Secretary	1	1,000	1,000
	Charge hand	2	1,500	3,000
	Clerk	2	1,000	2,000
	Store + tools	3	800	2,400
	Security	1	1,000	1,000
Total annual labour cost US$				81,100

9. F. Summary Annual Manufacturing Cost

9. A Direct Material Cost	390,000
9. B Indirect Material cost	14,000
9. C Power, Fuel, Water	7,500
9. D Transport cost	2,000
9. E Labour cost	81,000
Total manufacturing cost US$	494,500

10 Annual Sales Turnover

	Product	Unit Selling Price Exworks	Annual Product.	Total Sales (exfactory) US $
1.	Single hand wheel hoe	US$ 30	6000	180,000
2.	Animal drawn disc harrow	US$150	2000	300,000
3.	Animal drawn mouldboard plough	US$ 80	2000	160,000
			Gross Annual Sales	640,000

11. Total Annual Cost (excluding profit)

		US $
1.	Total Manufacturing cost refer 9F	494,500
2.	Total sales cost	20,000
3.	Depreciation of fixed capital 10% per Annum	39,000
	Total annual cost US $	553,500

12. Profit

Annual sales turnover	US$ 640,000
Total Annual Cost	US$ 553,500
Profit (before tax)	US$ 86,500

A PROFILE OF 'SMALL LOW-COST TRACTOR MECHANIZATION SYSTEM' AT INDUSTRIAL ESTATE LEVEL

Product Description

Small low-cost tractor with matching implements for small-scale arable from work. The 16 H.P. air-cooled diesel engine is imported from a developing country and the hydraulic components for the hydrostatic transmission system are imported from developed countries. Other components including the implements are fabricated and built into sub-assemblies which are then assembled into a complete unit.

Market Aspects

1. Users: Small-medium farmers with 5-20 hectares land.

2. Method of Sale: Through four year loans supplied through local Savings/Investment Bank with Government involvement. Applicants to be carefully vetted by Agricultural Credit Advisors appointed by the Bank. Servicing contract for 4 years is included in the loan and work is to be carried out from the factory base.

3. Market Potential: Home-Market includes the predominant size group of farmers in most developing countries.
   Export - There is good export market potential where production is planned on a broad regional rather than narrow national basis.

4. Requirement of feasibility study: This is advisable and a project can be established in stages starting with a pilot scheme in some cases.

5. Expert Assistance: Government financial involvement is essential. Assistance with training, product design and development and quality control will be provided under the term of a licence agreement.

6. Joint Venture: Essential in order that the new manufacturing organization benefits from the development experience of the parent design and planned manufacturing performance is achieved at an early stage.

7. Linkage with other industries: Backward linkages with suppliers of components. Forward linkages with other industrial applications of manufactured assemblies.

Building and Plant

1. BUILDING:

1(a)	Workspace approximately	1550 square metres	
i.	Metal forming	100 square metres	10 x 10
ii.	Small parts fabrication	100 square metres	8 x 12½
iii.	Main fabrication	400 square metres	8 x 50
iv.	Sub assembly	400 square metres	8 x 50
v.	Painting	40 square metres	10 x 4
vi.	Assembly	150 square metres	3 x 50
vii.	Engine/Hydraulic repair	70 square metres	7 x 10
viii.	Machine tools	70 square metres	7 x 10
ix.	Repairs/service	70 square metres	7 x 10
x.	Stores	140 square metres	7 x 20

1(b) Uncovered area for storage of steel, boxed components - approx 1800 square metres

1(c) Administration offices
Approx 70 square metres

The building should be constructed so as to exclude direct sunlight and rain, but be as open as possible. Height of building from floor level to eaves should be at least 4 metres. Combined into the building should be change rooms, including toilets, basins and shower for workmen as well as canteen facilities. The latter depending upon number of persons. A smooth concrete floor is essential for all areas except 1(b). In areas (vii) and (vi) where the floor should be oil proof and be able to be washed out. In area (vi) a drainage channel is required at fuel and oil filling area.

Electricity supply should be three phase 340/550 V. with a minimum of 100 AMP input. Lighting and ventilation should conform with local building regulations.

COSTS

1(a)	1550 square metres @ U.S. $ 120 per m^2	186,000.00
1(b)	1800 square metres @ U.S. $ 40 per m^2	72,000.00
1(c)	70 square metres @ U.S. $ 180 per m^2	12,000.00
		270,000.00

N.B. This area is sufficient for up to a production level of 3000 units per year.

Plant Equipment Required

U.S. DOLLARS

Metal Forming	Quantity Reqd.	New f. o. b.	Reconditioned f. o. b.
Shear cropping machine (180 x 16)	1	27,000	8,600
Guillotine 2500 x 6	1	27,000	13,000
Bending Press 2000 x 8	1	50,000	13,000
Band saw cap. 300	1	2,800	2,800
Power saw cap. 250	2	2,800	2,800
Profile cutting machine	1	2,000	2,000
Pedestal drill capacity 75	1	6,300	3,500
Pedestal drill capacity 25	2	9,000	6,000
Multi spindle drill 4 x 16	1	3,600	1,500
Overhead crane 5 tonne	1	20,000	20,000
Small parts Fabrication			
Welding machines 250A	4	2,400	2,400
MIG Welders	2	4,000	4,000
Main Fabrication Lines and Assembly			
Welding machines 250A	8	4,800	3,400
Electric hoist 1 tonne	2	6,000	6,000
Painting			
Compressor 60 CFM	1	10,000	10,000
Spray gun and bulk tank	4	3,000	3,000
Extractor fan	1	3,000	3,000
		183,700	105,000

Assembly	Quantity Reqd.	U.S. DOLLARS New f. o. b.	Reconditioned f. o. b.
Brought forward		183,700	105,000
Hoist capacity 1 tonne	1	200	200
Hoist electric capacity 1 tonne	2	3,000	3,000
Engine/Hydraulic repairs			
Hoist hand capacity 1 tonne	1	100	100
Hydraulic test unit	1	2,500	2,500
Repair Shop			
Welders 250A	1	700	700
Grinding Machine	1	700	700
Drill capacity 30mm	1	4,500	3,000
Sundry Equipment			
Grinding Machine 300 Ø H.D.	3	1,500	1,500
Grinding Machine 300 Ø	3	700	700
Tool grinders	1	1,500	1,500
Oxy-acetylene cutting/ welding	3	1,500	1,500
Machine Shop			
Lapping machine capacity 200 mm	1	6,000	6,000
Centre lathe capacity 60 Ø x 1000	1	14,000	2,400
Capstan Size 7	2	44,000	18,000
Universal milling machine	1	19,000	10,000
Sundry small tools including portable grinding drills, socket sets, torque wrenches, taps and dies, vices, benches, storage bins, boxes, pallet trucks		40,000	40,000
		323,600	196,800

Motor Vehicles

2 Flat bed diesel trucks 5 tonne	U.S. $	20,000
3 Open backed trucks (pickup) 1 tonne	U.S. $	17,000
2 Cars	U.S. $	10,000
Motor Vehicle Total	U.S. $	47,000

Manpower requirements

Administration	Number			Salary U.S. $ p. a.
Manager	1			14,400
Production Manager	1			12,000
R/d Engineer	1			12,000
Secretary	1			6,000
Financial Controller	1			8,000
Clerk	1			2,400
Stores Controller	1			6,000
Administration Salary Total				60,000
Skilled artisans	12	@	6500	78,000
Semi skilled	15	@	3250	48,750
Unskilled	50	@	1600	80,000
Workshop Salaries Total				206,750
	Total Salaries			267,550

Overhead expenses

Running workshop and administration inclusive of rental, electrical and water services, office and administration service vehicle, fuel and repairs - approximately ..... United States Dollars 100,000 p. a.

Materials and Costs per Production Unit

	Cost per unit U.S. Dollars C.I.F. Location in developing countries	F.O.B. ex works U.S. Dollars
1 x Diesel engine 12KW	756	630
1 x Hydraulic pump 90 LPM @ 2000	258	241
2 x Hydraulic motor wheel mounted	515	471
1 x Steering	63	55
350 kgs Steel (M.S.)	122	
4 x tyres (2 x 14" - 2 x 15")	82	
4 x rims (2 x 14" - 2 x 15")	64	
Oil 50 litres SAE 20	29	
Bearing and fastners	30	
Sundry items	20	
	1,939	
Implement material costs	120	
Fastners and sundries	20	
(N.B.) per set implements	140	

(N.B.) Each basic set of implements consists of plough, planter, ridger, harrow and cultivator.

Cost to produce the Tractor on the basis of 1200 units per year.

1. (a) Fixed assets, buildings depreciated at a rate of 8% per annum i.e. ₦23,000 per annum.

   (b) Machine tools depreciated at a rate of 8% per annum capital costs ₦ 323,600 i.e. ₦ 25,888.

   (c) Motor vehicles depreciated at a rate of 20% per annum capital costs ₦ 47,000 i.e. ₦ 9,400 per annum.

Cost per unit

1.	Fixed assets buildings	19.16
2.	Fixed assets machine tools	21.57
3.	Fixed assets motor vehicles	7.83
	Cost per unit fixed assets	48.56
4.	Administration	50.66
5.	Direct labour	172.30
6.	Overheads	83.33
	Cost per unit	306.29
7.	Material costs	1,939.00
8.	Implement costs	140.00
	Material costs per unit	2,079.00
	Cost of production of 1 unit	2,433.85

ANNEX 3 (d)

A PROFILE OF POWERED AGRICULTURAL MACHINERY AT MEDIUM/LARGE SCALE INDUSTRY LEVEL

Product Description

Medium size 4-wheel tractor powered by direct injection diesel engine capable of producing 40HP at 2500rpm.

Overall Evaluation

This product is used by farmers having 10-15 ha of land or more, for all purpose agricultural operations in developing countries. It is possible for plants of this size to export their products.

The successful operation of a plant of this size requires:

(a) Support of ancilliary industries e.g. foundry, forging, sheet metal fabrication industry and many others

(b) Comprehensive training of management and workers (skilled) at various levels

(c) Systematic marketing and distribution network

The viability prospects of this size product depends on potential demand within the country or neighbouring countries and country wide marketing possibilities should be carefully examined and surveyed.

Market Aspect

1. Users:- Farmers, for agricultural operation
Industries for transport with trailers
Forestry, and many others

2. Method of sales:- The sales and marketing should be carried out through authorised distributors of dealers with sales and after sales facilities such as, stocking of spare parts, servicing facilities, training facilities etc.

3. Market potential:- Home: in local and national markets within the country.

Export: good possibilities within the neighbouring developing countries.

4. Requirement for feasibility studies:- Thorough pre-feasibility studies are necessary before investment decisions are made.

5. Expert Assistance:- Required in the following areas:-

- Preparation of marketing and feasibility study
- Product design and development

- Training on heat treatment and metallurgy.
- In actual operation and installation of machinery and process sheet preparation.
- Marketing.

6. Joint Venture: Highly recommended.

7. Linkage with other industries: In order to procure semi-finished and bought out finished parts and components the following supporting industries are needed.

(a) Foundry - Grey cast iron, malleable cast iron, spheroidal cast iron.

(b) Forging and die casting.

(c) Tyres, wheels and rims manufacturing unit.

(d) Sheetmetal and presswork industries

(e) Gear cutting and transmission equipment manufacturing industries.

(f) Electrical and instrumental manufacturing industries.

(g) Steering wheel and automotive parts manufacturing industries.

(h) Brake shoe and clutch manufacturing industries.

(i) Spring and hardware manufacturing industries.

(j) Paint manufacturing industires.

(k) Rubber manufacturing industries.

THE DETAILS OF MANUFACTURING PROFILE

1. Product:- Medium size tractor capable of producing 40hp at 2500rpm (Note: Phase I around 20-25% local content)

2. Product specification:- (The specification is only indicative and does not conform to any manufacturer) Refer Figure - 7

Make - joint collaboration with a tractor company

No. of cylinder - 3

Engine - direct injection diesel engine

Maximum HP of engine- 40hp at 2500rpm

Compression ratio - 17.5:1

Road speed - 1 mph to 17.21mph.

Power take off - 6 spline shaft - $1\frac{3}{8}$" dia.

Hydraulic system - with pressure control from 155 psi to 2400 psi

Working load (max) - 3000 lbs.

Dimension - overall width - 64"
overall length-110"
Overall height - 75"

Weight (without fuel and water) - 2800lbs

Fuel tank - 8 gallons, 36 liters.

3. Material Specification

There is wide application of various types of material in manufacture of tractors. The important materials used are (weightwise)

Castings- Malleable or grade 17 castings with mehenite specification

Steel - EN1(a), EI 8, EN6, EN24T, EN32(c), EX-42-46 round and various sections

Steel - castings according to BS specification

Steel sheet matal - 18 - 20 SWG

Most of these types of steel require hardening, case hardening and tempering.

Hardness - varies from 50 to 64 rockell 'c'

4. Production Volume

	Product Description	Production/day	Production/year
1	Tractor 40 hp	14	3,500

5. Manpower requirement - Organisation and Manpower Requirement

A Indirect Manpower - Management (Head Office)

	Board of Directors	No.Off	Total
1	Managing Director + Staff	1 + 3	4
2	Sales and marketing manager + staff	1 + 15	16
3	Chief Accountant + staff	1 + 9	10
4	Internal auditor	1	1
5	Manufacturing manager (to be inc. in factory indirect)	(1)	(1)
6	Chief product development engineer + Designer + Asst. Engineer + staff	1+2+3	6
7	Chief product training officer + staff	1 + 3	4
	Total Head Office Staff		41

	Management (Factory)	No. Off	Total
1.	Manufacturing Manager + Staff	1 + 3	4
2.	Chief Personnel Officer + staff	1 + 4	5
3.	Factory Accountant + staff	1 + 6	7
4.	Chief purchase Officer + Buyers + Clerks	1 +6+ 2	9
5.	Security Officer + Guards	1 + 5	6
6.	Chief Metallurgist + staff	1 + 2	3
7.	Chief Quality Controller + inspectors/clerk	1+12+1	14
8.	Chief Industrial Engineer + Method engineer + time study engineer + jig + tool designer + estimators + clerks	1+4+6+ 6+2+2	21
9.	Chief Planning Engineer + Asst. engineers/ process planners + estimators + clerk	1 +8+ 1	10
10.	Chief Production Controller + production supervisors + chasers + clerk + recorders	1+6+10 +2+6	25
11.	Chief Maintenance engineer + asst. engineer Mechanical + elec., skilled + semiskilled + unskilled labour + clerk	1+3+6 + 1	11
12	Chief training officer + staff	1 + 3	4

	Superintendent Machine Shop No. I (see fig. [illegible]) + clerk	1+2	3
a	Asst. Engineer + foreman + chargehand for section (A+B)	1+1+1	3
b	Asst. Engineer + foreman + chargehand for section (C+D)	1+1+1	3
c	Asst. Engineer + foreman + chargehand for section (E+F)	1+1+1	3
d	Asst. Engineer + foreman + chargehand for section (G+H)	1+1+1	3
e	Chargehand tool crib	1	1
	Superintendent Machine Shop Plant No. II (see fig. 10) + clerk	1+2	3
a	Asst. Engineer + foreman + chargehand section (J+K)	1+1+1	3
b	Asst. Engineer + foreman + chargehand section (L)	1+1+2	4
	Superintendent Assembly + Stores Plant III (see fig. 11) + clerk	1+3	4
a	Asst. Engineer + foreman + chargehand sub assembly + assembly	2+2+2	6
b	Chargehand Paint Booth	1	1
c	Asst. Engineer + foreman + chargehand + recorder of stores	1+3+7+4	15
d	Supervisor (packing + shipping) + clerk	1+1	2
	Cleaners, cook, canteen staff, welfare staff, drivers, mechanic	10	10
	Direct Manpower | Total Indirect Manpower →		223
1	Machine Shop I - operating 66 machines		
a	Skilled	66	66
b	Semi-skilled	40	40
c	Un-skilled	20	20
	Sub-total	126	126
2	Machine Shop II		
a	Skilled	40	40
b	Semi-skilled	40	40
c	Un-skilled	20	20
	Sub-total	100	100
3	Assembly Shop I		
a	Skilled	25	25
b	Semi-skilled	20	20
c	Un-skilled	20	20
	Sub-total	65	65

Total direct labour	291
Total Indirect manpower	223
Total manpower	514

6. Floor Area (ref Fig 8 .)

Administrative area	4,000 sq.ft.	4,000 sq. ft.
Manufacturing area		
a Machine shop plant I	60,000 "	
b Machine shop plant II	40,000 "	
c Assembly shop plant III	40,000 "	140,000 "
d Substation	500 "	500 "
	Total-	145,000 "
For raw material castings and finished tractor stores additional open area		100,000 "
Total area		245,000 sq. ft.

7. Machinery and Equipment (Estimated cost) Ref. Fig. 9, 10, 11 for layout information

Item	Description of Machine	No.	Est. Total Price CIF in US $
A	Parting Off section A		
1	Automatic Hack Sawing- machine up to 6" dia in MS	1	1,000
2	Circular cutter saw upto 15" dia	2	2,000
3	Abrasive cutter 12" dia wheel	1	800
4	Belt abrasive grinder 8" width belt	1	300
5	Pedestal grinder (double ended) 12" dia wheel	2	800
6	Polishing machine (double ended)	2	200
B	Drilling + Milling Section (B)		
7	Upright drilling machine upto 2" in MS	2	10,000
8	Gang drilling machine with table size 60" x 15" 6 spindle head - 1" dia in MS	1	15,000

Item	Description of Machine	No.	Est Total Max CIF in US$
9	Automatic drill with tapping machine 1"dia in MS	1	10,000
10	Radial Arm Drill 36" head traverse 3" dia in MS	3	20,000
11	Turret Head Type drill with 5 turret position 1½" in MS	1	15,000
12	Universal milling machine with attachments 12" cutter dia table size 36"x18"	1	25,000
13	Knee type milling machine with attachments - 8" dia cutter - table size 30" x 12"	3	20,000
14	Keyway slot milling machine width of spline 5/8" surface table 40" x 10"	1	25,000
15	Spline shaft milling machine programming arrangements for odd an evensplines and both internal and external splines table size 24" x 6"	1	33,000
C	Turning Section		
16	Lathe - spindle dia 3", swing 24", centre gap - 30"	1	15,000
17	Lathe spindle dia 1", swing 15" centre gap - 18"	1	12,000
18	Capstan Lathe with attachments - spindle hole 2" dia, capstan slide 9"	3	30,000
19	Chucking capstan with all attachments max dia workpiece 12"- turret slide 9"	3	35,000
20	Double ended parting and centering machine spindle gap - 40"	1	8,000
D	Grinding, Boring, Broaching, Lapping + Honning Section		
21	Vertical surface grinding machine with rotary magnetic table max. grinding area - 6" grinding height 20" dia of wheel 30"	1	35,000
22	Surface grinding machine dia of wheel 24" Table size 30" x 24"		25,000
23	Centreless grinding machine wheel dia 24" max dia of work 2"	1	25,000
24	Cylindrical grinding machine- max workpiece 6" dia x 18" long	1	30,000
25	Internal cylindrical grinding machine - with face grinding attachment max bore - 13" max length - 12"	1	40,000
26	Spline shaft grinding machine - grinding length 30" grinding dia 6"	2	50,000
27	Special purpose automatic fine boring machine (duplex) max bore dia 4" bore depth - 6"	2	120,000

Item	Description of Machine	No	Est. Total Price CIF US $
28	Horizontal boring machine - max bore 18" dia length 30"	1	60,000
29	Broaching machine - push type - max dia - 6" length 12"	1	30,000
30	Horizontal lapping machine table size 18 x 12" accuracy - 0.00004"	1	60,000
31	Vertical honningmachine max dia 6" hone depth 12"	1	35,000
E	Automatic Machines (turning)		
32	Single spindle bar automatic with automatic indexing - workpiece dia 2" length 4"	2	60,000
33	Single spindle bar automatic with automatic indexing workpiece dia 1" length 5"	8	320,000
34	Single spindle bar automatic with automatic indexing workpiece dia 1" length 6"	2	90,000
35	Single spindle bar automatic with automatic indexing workpiece ½" length 8"	2	55,000
36	Single spindle chuck automatic with automatic indexing max.work dia 6"	-	40,000
37	Single spindle chuck automatic with automatic index max.work dia 3"	1	40,000
F	Automatic Profile - Turning Machines		
38	Automatic copying lathes with three cut recycling system max. dia 6" length 30"	2	70,000
39	Automatic copy milling machine max. table size 30" x 18"	1	60,000
G	Machines for Gearbox housing, Centre housing + lift cover housing		
40	Horizontal duplex milling machine- adjustable milling heads, with automatic quill retraction system for rough, semi-finish and finished cut surface worktable -100" x 20" longitudinal table travel - 80"	2	300,000
41	Portal frame milling machine with 3 adjustable millingheads with automatic quill retraction system and adjustable heads Table size 100" x 80" Longitudinal travel - 80	1	200,000
42	Multispindle drilling machine with bolster plate - 24 spindle tablesize 100" x 80" 1" dia in MS for each spindle	1	50,000
43	Automatic multispindle tapping machine 12 spindles up to 1½" tap size		50,000

Item	Description of Machine	No	Estimated Total Price CIF US$
44	Horizontal deephole drilling machine up to 1½" dia in 15" length of hole 20"	1	35,000
45	Tunnel type washing machine for centre housing, gear box axel housing	1	20,000
H	Machines for Rear Axel Housing (LH + RH)		
46	Duplex multispindle drilling, facing machine with rotary indexing table – 24 spindles in each head. Table dia 75"	1	120,000
47	Duplex boring and facing machine Table size 72" x 36"	1	100,000
48	Jigs, tools, fixtures for heavy castings	set	150,000
49	Jigs, tools, fixtures for light parts	set	80,000
I	Heat Treatment	Galvanising, Electroplating	
50	25kw Induction hardening machine	1	30,000
51	150kw induction hardening machine	1	45,000
52	Heat treatment furnace oilfired with automatic control, thermostat	1	60,000
53	Cynide bath	1	1,000
54	Degreasing plant	1	
55	Quenching tanks	2	1,000
56	Galvanising plant/Electroplant	option	can be obtained from sub-contracting
57	Phosphating plant	1	10,000
J	Welding + Fabrication Section		
58	But welding machine 500 amps	1	5,000
59	Spot welding machine 800 amps	1	5,000
60	Arc welding machine 500 amps	2	4,000
61	Roll bending machine	1	1,000
62	2.5 ton press	1	10,000
63	10 ton press	1	20,000
64	Welding fixtures	set	5,000
K	Tool room		
65	High precision jig boring machine. Working table 40"x30" drilling 1 5/8" boring 3½" in steel accuracy 0.00005" accuracy of setting 0.00002"	1	120,000
66	Universal cutter grinder cutter dia 9" work table 12"x12"	2	50,000

Item	Description of Machine	No.	Estimated Price CIF in US $
67	Precision internal grinder - bore up to 4" dia max chucking dia 13"	1	40,000
68	Twist drill grinder both LH + RH inc. steel and carbide tip up to 2½" dia	2	5,000
69	1 Ton ram type hydraulic press	1	5,000
70	Tap grinding machine upto 1" tap	1	15,000
71	Universal broach sharpeneing machine (internal + surface broach) up to lenght 80"	1	35,000
72	Precision bench lathe up to 2" dia workpiece centregap - 15"	1	15,000
73	Universal milling machine with all indexing attachemnts and accessories max cutter dia 8" table size 36" x 24"	1	35,000
74	Circular band saw (steel band) width of steel blade band 3/4" work table 24" x 24"	1	5,000
75	Suface table 36"x36" 1ton weight	1	2,000
76	Slip gauge set	2	4,000
77	Wide range of measuring tools	set	5,000
78	5 ton air conditioner	1	4,000
79	Universal vice etc.	3	1,000
80	Special tools and cutters	set	5,000
81	Precision surface grinding machine dia of wheel 8" work table 18" x 12"	1	20,000
82	Precision cylindrical grinding machine max workpieces - 2"dia 24" long	1	45,000
L	Fitters Bench and Maintenancy Section		
83	Maintenance equipment	set	8,000
84	Welding set portable 250 amps	1	2,000
85	Oxyaceteline weldingset	3	2,000
86	Soldering + brasing equipment	6	590
87	Fitters benches with vice	6	1,000
88	Tools, equipment including carpentry.	set	4,000
89	Furnace oilfired	1	3,000
90	Electrical and water (pumping) maintenance equipment	set	1,500
M	Metallurgical Laboratory		
91	Spectrophotometer wave-length 8.80" to 36", tungsten + deuterous lamp absorption cell - fused quartz sensitivity better than ±0.0002 at 0.00% absorbance	1	6,000

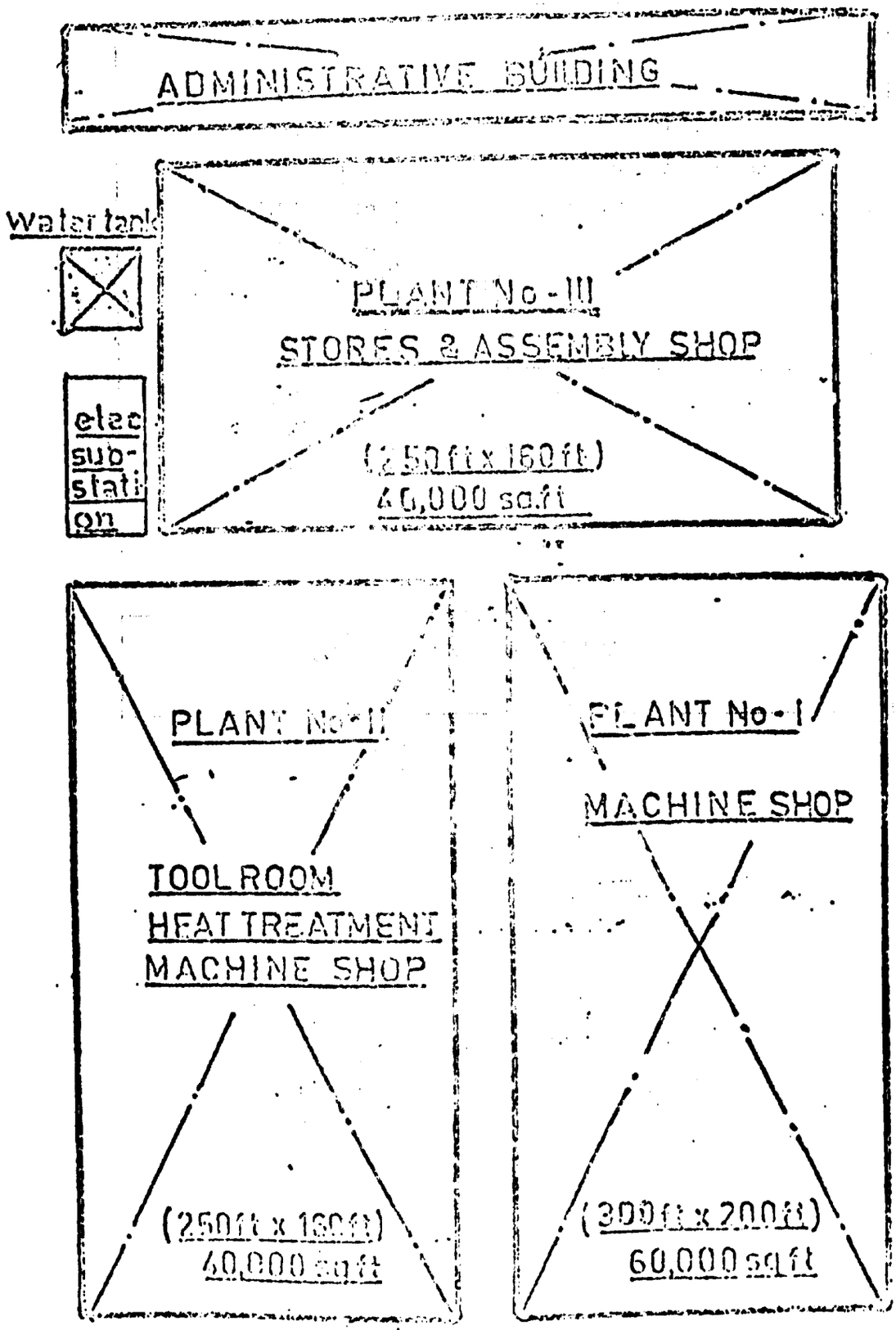
Item	Description of Machine	No.	Estimated Price CIF in US $
93	Brinell hardness testing machine with fine measuring microscope 25x possible load 500 - 750 -3000kg tolerance 1%	1	15,000
94	Vickers hardness tester for loads 0.10 - 10 kg, fine measuring microscope with magnification 200x	1	3,000
95	Various metallurgical equipment	set	4,000
96	Magnetic particle testing apparatus	2	8,000
N	Central Inspection Section		
97	Gear involute + lead testing tooth pitch module 1-17 diameter of base circle 1" to 2.35"	1	15,000
98	Double flank rolling tester dia of gear - 12" distance between axes 2.8" -16" precision 0.0004" enlargement - 200x300x400	1	6,000
99	Dynamic angle flank testing machine - modules 1-6	1	10,800
100	Electical tester for dynamo + starter		5,000
101	Universal measuring machine 16"x4"x6"		
102	Telesurf - (CIA - 0.000004" to 0.002") Horizontal enlargement 100.1 vertical enlargement 1,00,000:1	1	4,000
103	Appartus for sorting and mixed up parts	1	1,000
104	Inspection guages and equipment	set	5,000
105	Inspection tables 24"x24" - 800kg	8	5,000
106	Complete set of dial indicators etc	24 sets	3,000
107	Height guage, vernier caliper, depth gauges etc.	24 sets	3,000
O	Sub Assembly and Assembly fixtures		
108	For all parts where necessary	set	5,000
109	Assembly trolley	8	4,000
P	Paint Booth		
110	Compressory + spray paint equipment	2 sets	10,000
111	Water screen + heating system for drying	1 "	5,000
112	Electrostatic paint equipment	1"	10,000
Q	Compressor Set		
113	Complete air compressor set with water cooli etc. and pipelines, valves etc. line pressure 80psi, delivery 600 cu. Ft/ min.		30,000

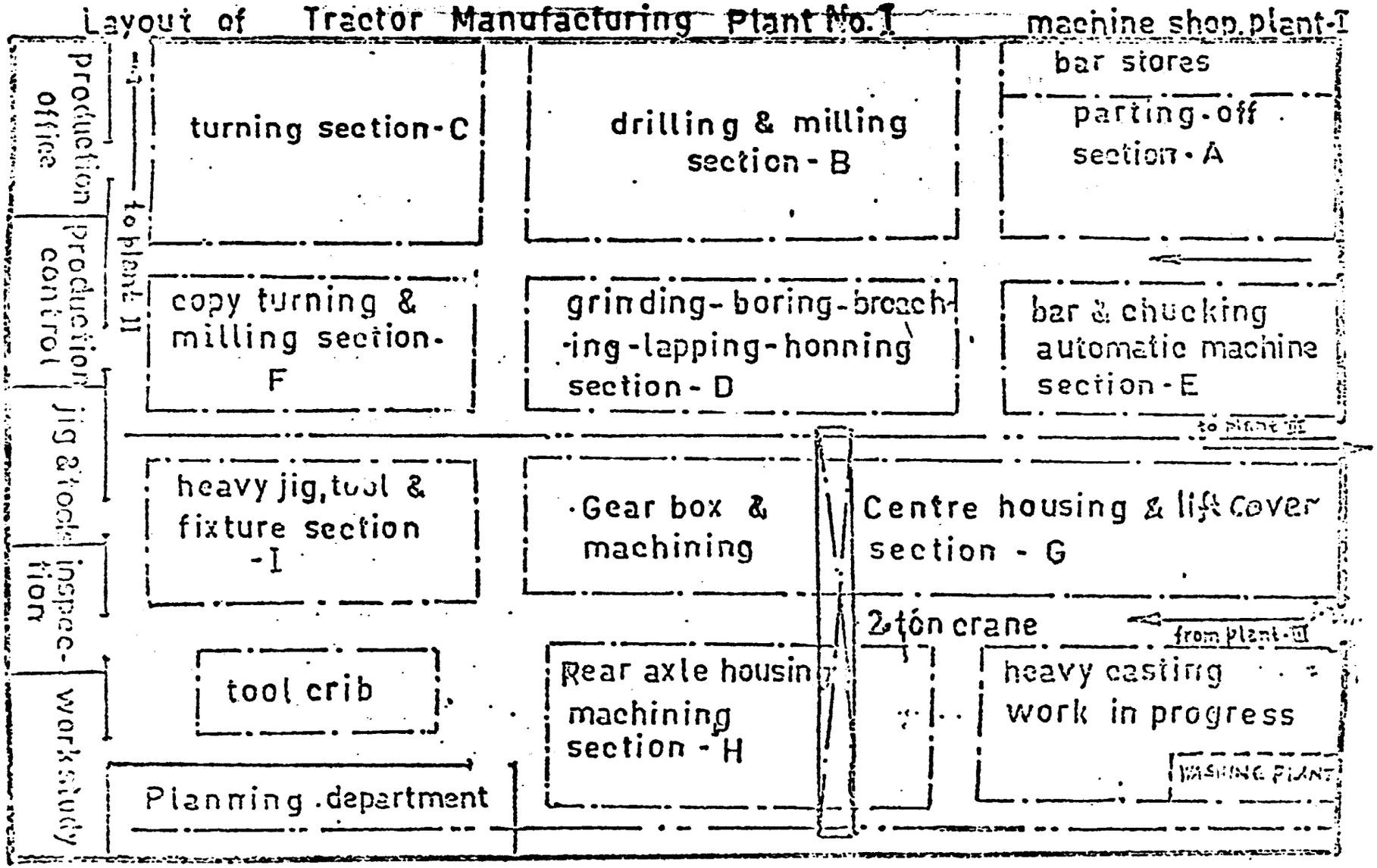
Item	Description of Machine	NO	Estimated Price CIF in US $
H	Mechanical Handling Equipment		
114	2 ton overhead crane for heavy casting area with gantry and installation	1	30,000
115	Fork lift truck - 2 ton	2	45,000
116	Stacker truck - 1ton	2	25,000
117	Pallet trucks - ½ ton	6	10,000
118	Stillage pallets bins, racks	set	10,000
119	Hand pallet trucks	6	20,000
120	Self supporting hoists for machine - ½ ton capacity	30	55,000
S	Stores equipment		
121	Bins, racks, cupboards, etc.	set	40,000
122	Kardex cabinets and system	set	5,000
123	Hydraulic testing equipment	set	5,000
124	Production tools	set	60,000
125	Spare parts (total) based on all machinery	set	250,000
	Total machinery + equipment		3,981.000

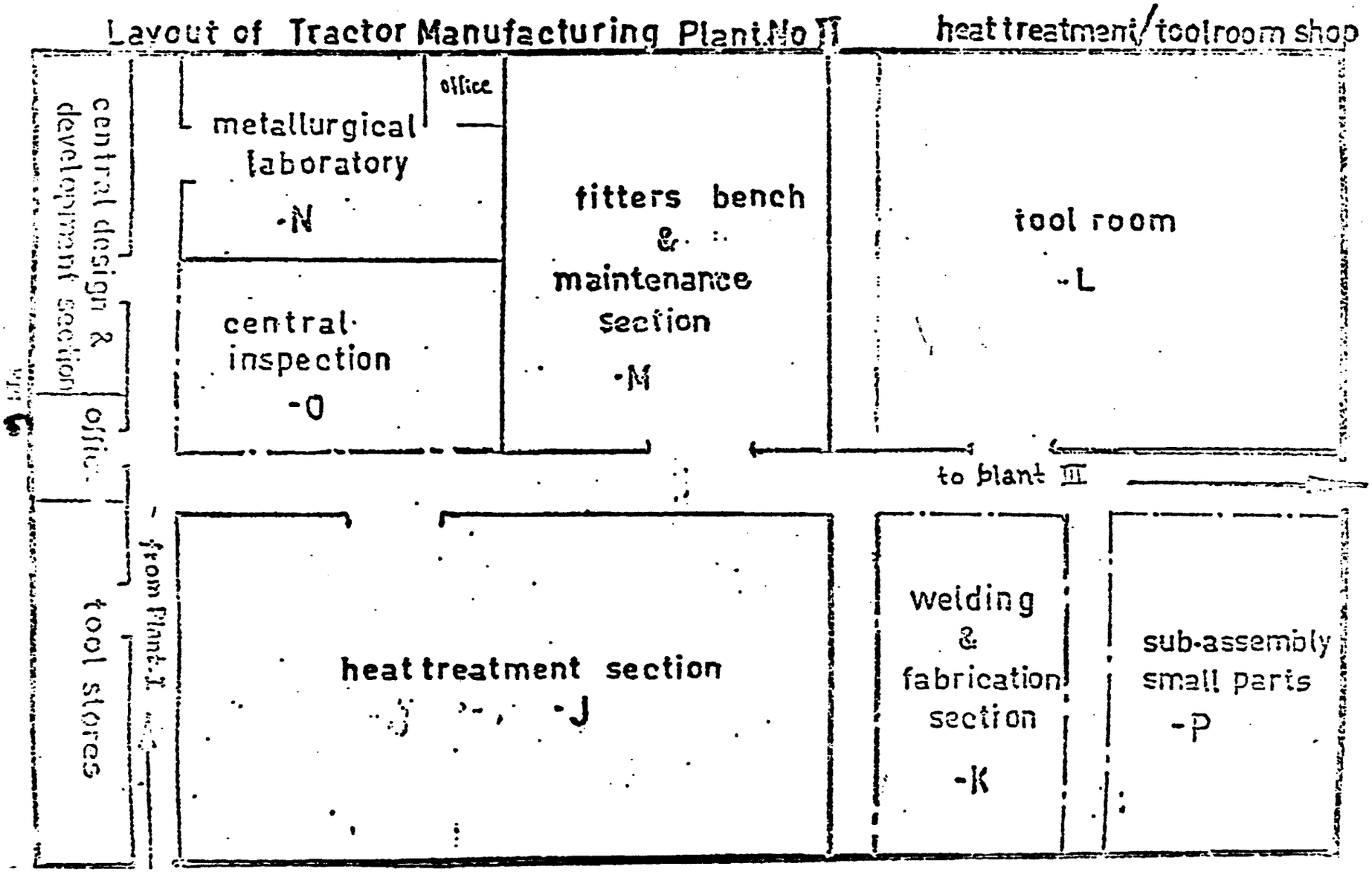
CIF Landed

FACTORY LAYOUT FOR MEDIUM SIZE TRACTOR

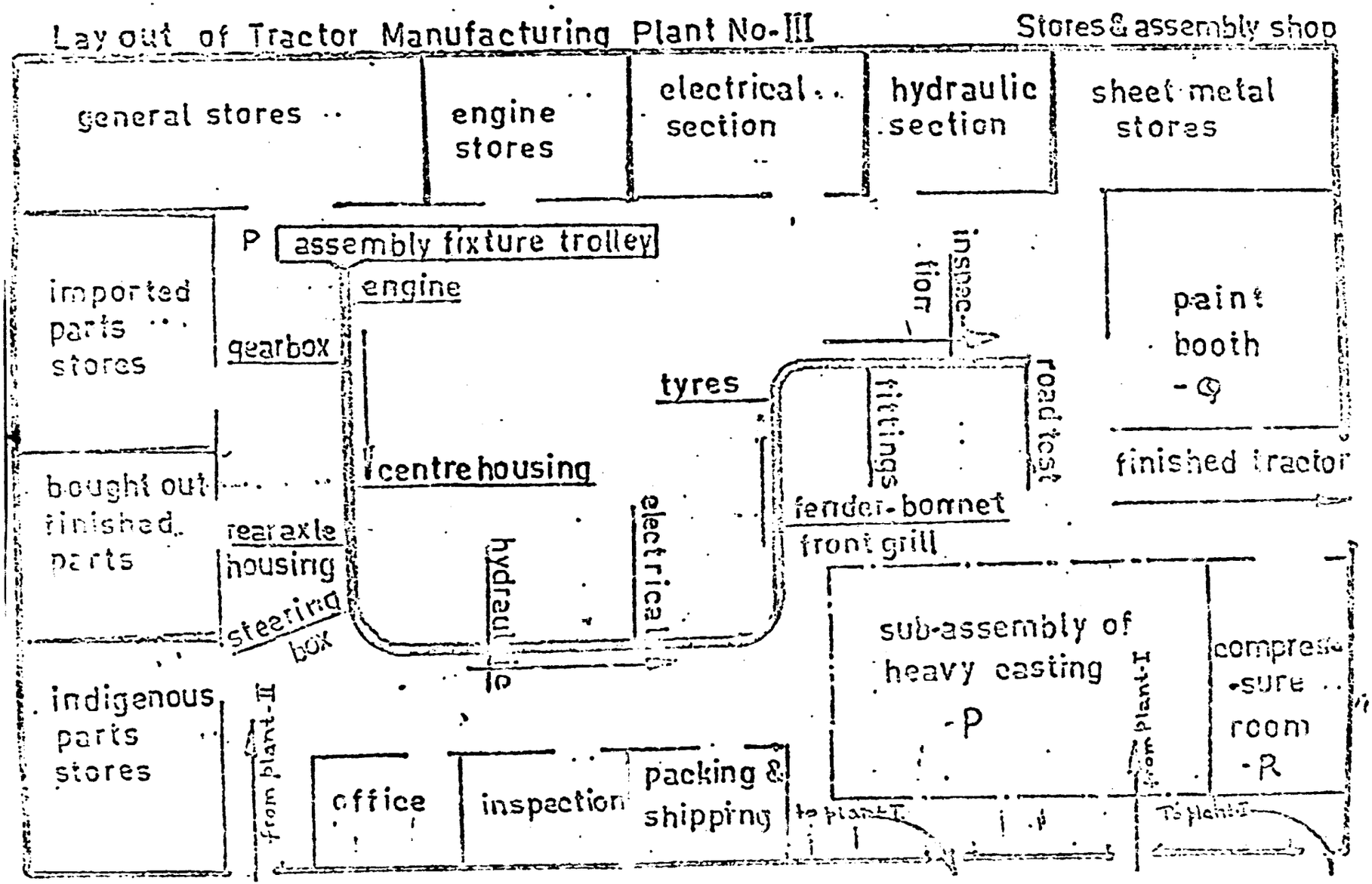
PRODUCTION - 3500 tractors/year/1-shift 8hours




Layout of Tractor Manufacturing Plant No. I
machine shop plant-I
production office
production control
jig & tools
inspection
work study
to plant II
turning section-C
drilling & milling section-B
bar stores
parting-off section-A
copy turning & milling section-F
grinding-boring-broaching-lapping-honning section-D
bar & chucking automatic machine section-E
to plant III
heavy jig, tool & fixture section -I
Gear box & machining
Centre housing & lift cover section - G
2-ton crane
from plant-III
tool crib
Rear axle housing machining section - H
heavy casting work in progress
WASHING PLANT
Planning department


Layout of Tractor Manufacturing Plant No II
heat treatment/toolroom shop
central design & development section
office
metallurgical laboratory
-N
office
central inspection
-O
fitters bench & maintenance section
-M
tool room
-L
to plant III
from Plant I
tool stores
heat treatment section
-J
welding & fabrication section
-K
sub-assembly small parts
-P

Lay out of Tractor Manufacturing Plant No-III



Annex-3
page 17

8. Investment Required

Basic investment

A	Fixed Capital	Cost US $
a	Land	-
b	Building cost i Administrative+ elect. sub-station + road	80,000
	ii Factory building 140,000 sqft. at US$ 6.00 Per sqft.	840,000
c	Furniture + fittings + Office equipment	60,000
d	Machinery and equipment	3,981.100
e	Electrical installation 3000 kva	60,000
f	Erection	50,000
g	Transport (2trucks, 12cars, 2vans + 1 crane)	170.000
h	Contingencies 10%	558,900
A total fixed capital US $		5,800,000
B	Working Capital	
a	Direct material (3 months)	2,100,000
b	Direct + indirect labour (3 months)	525,000
c	Training cost	25,000
d	contingencies	100,000
B	Total working capital	2,750,000
C	Total Investment Required excluding land (C=A+B)	8,550,000

9. Composition of Tractor based on major part grouping

MOM - Factory Manufactured Parts

BOF - Bought Out Finished

BOSF Bought Out Semi-Finished

IMP - Import

Indigenous manufacture of tractors needs the following supporting industries in the metal sector:

1. Foundry 2. Forging + die casting sheetmetal 3. Steel mills for sheet metal and sections

Item	Main Parts Group	Description	MOW	BOSF	BOP	IMP
010	Engine	Main engine, radiator fuel, lub oil, air intake, system, starter, dynamo/alternator incl. electricals			X	X
020	Lift cover + controls	Hydraulic lift cover housing, control shafts pins etc.	lift cover castings, control shaft pins	lift cover castings		
030	Gearbox housing	Housing, gears, splined shafts bearings, seals rings, yokes, clutch + clutch control, gear change lever + mechanism	Gear box housing shafts, yokes control levers, gear change lever	gear box casting forged shafts	X	X
040	Centre housing	Housing, differential, crown wheel and penion, bearing, splined shafts, PTO gears, seals etc.	centre housing and shafts	centre housing castings + forged shafts	X	X
050	Rear axel housing (LH+RH)	Housing, axels, shafts, rear brake drums brakes, brake controls. Bearings, seals dead weights.	rear axel housing (LH+RH) brake drums, axel shafts (LH+RH	rear axel housing castings, forged axel shafts, break drums castings	X	X
060	Front suspension + front support	Front axels, stub shafts, front hubs, bearings, seals, dead weights.	Front axels, stub shafts, hubs, dead weights	Forged axels, die cast hubs	X	X

Item	Main Parts	Description	MOW	MOSF	BOP	IMP
070	Hydraulic pump + three point linkage	Hydraulic pump hydraulic cylinder and piston, draft and position control equip., shafts, pins etc. linkage, bars, pins chain.	Hydraulic cylinder, piston, draft + position control equipment.	Forged body of cylinder		X
080	Steering box and linkages	Steering box steering wheel and linkages	linkages	forged linkages	X	X
090	Hand brake linkage + attachments	Hand brake, linkage etc.	Handbrake linkage		X	X
010	Pedals and Footsteps	Brake, throttle and clutch pedal controls + footsteps	brake, throttle, clutch pedal + foot step			
011	Sheetmetal and press work	Fuel tank, front bonnet, front grill, fenders, instrument panel exhaust pipe, tool box with lid			X	
012	Wheel + tyres	Front + rear wheel rims, tyres			X	X
013	Electrical Equipment	Front lights, rear lights, instruments, fuel, water, hydraulic wiring cutouts, battery, fuses etc.			X	X
014	Hardware	Bolts, Nuts, Studs washers, circlips, screws, sockets chains, etc.	Special bolts, nuts and studs		X	X
015	Toolkit	Spanners etc.			X	X

Summary of the parts to be manufactured indigenously

Item	Parts or group description	Type of Operation
1	Lift cover housing	Casting + machining
2	Gearbox housing	" "
3	Centre housing	" "
4	Rear axel housing (LH+RH)	" "
5	All trans mission shafts (simple or splinned)	Machinery + heat-treatment (heat treatment where recommended)
6.	Yokes, shift lever, gear change lever and mechanism	Die casting + machining
7	Rear Axel shafts (LH+RH)	Forging + machining + heat treatment
8	Brake drums	Casting + machining
9	Front stub axels (LH+RH)	Forging, machining + heat treatment
10	Front hubs	Casting + machining
11	Axel beams (front suspension)	Forging + machining
12	Link rods	" "
13	Linkbars	" "
14	Hydraulic cylinder	" "
15	Hydraulic cylinder piston	" "
16	Draft and position control equip.	Pressing, metal forming machining
17	Steering connection rods + links	Forging + machining
18	Clutch padel, brake pedal and accelarator pedal, footstep	" "
19	Hand brake system	Machining
20	Special bolts, nuts, studs, pins and levers	Machining electorplating or galvanising

Summary of parts to be manufactured indigenously - in various phases of production.

The manufacturing programme and planning should be based on a phase out ...

Phase I 1. Lift cover housing

2. Gearbox housing, centre housing, rear axel housing.

3. Brake drums, special bolts, nuts, studs, pins, levers and rods

4. All other parts to be procured either by boughtout finished locally or by import.

Phase II 5. All transmission shafts (simple + splined)

6. Yokes, shift lever, gear change levers and mechanisms

7. Rear axel shafts

8. Front axel stub, fronthub, link rods all other parts to be procured either by bought out finished or by import.

Phase III 9. Axel (front) beam, linkage bar

10. Hydraulic cylinder, hydraulic cylinder piston

11. Draft and position control equipment

12. Steering connection rods

13. Clutch padel, brake pedal, accelerator pedal

14. Hand brake system

all other parts to be procured either by bought out finished or by import

11. Estimated Manufacturing Cost

Based on 3500 tractors/year/1 shift - 8 hours basis

		Cost US$
a	Imported cost of parts (CIF to factory door)	5,600,000
b	Indigeneous parts with local or imported raw mat	2,800,000
c	Total raw material cost	8,400,000
d	Labour costs	2,100,000
e	Overhead costs (incl. indirect material, power, fuel, water, lubricants, spare parts all others)	2,100,000
	Total annual manufacturing costs	12,600,000

12. Annual Sales Turnover (estimated)

Type	Unit selling Price Ex Factory US $	Production/Year	Total Annual Sales US $
40HP Tractor	4,000	3,500 units	14,000,000

13. Total Annual Cost (excluding profit) based on 3,500 tractors/year/1 shift.

a	Estimated Manufacturing cost	12,600,000
b	Total sales cost	200,000
c.	Depreciation of fixed capital at 10% per annum	580,000
	Total annual costs	US $13,380,000

14. Profit (before tax)

Annual sales turnover	US$	14,000,000
Total annual costs	US$	13,380,000
Profit before tax	US$	620,000

ANNEX 3 (e)

COMMON BASIC FACILITIES AND SERVICES

The common basic facilities and services for the manufacture of agricultural machinery and equipment will be the real backbone of the rural industrial development. It will be the launching pad for all basic requirements for the manufacture of idigenous parts for the industries in rural, small and medium sectors. These units of engineering basic facilities and services are extremely capital intensive and manufacturing activities require high sophistication skill and from machine and manpower and therefore need special attention and consideration.

The small, medium and even the large factories cannot normally afford to install all the machinery and equipment required for the manufacturing activities. It is often economical to procure certain parts either in finished or in semifinished condition from the outside industries through subcontracting or direct purchase. In order to promote the industrial activities by attracting a greater number of manufacturing units from the urban areas and simultaneous assistance to the local engineering industries it is desirable to establish the following common basic engineering and metallurgical facilities and services with special reference to rural and non-urban areas. Such services should not only meet the requirement of agricultural machinery manufacturing sectors, but also manufacture components and provide services to other engineering and metallurgical industries.

The following Annexes outline the general requirements for various basic facilities and services:

3 e (i) Central Foundry (Ferrous and Non-ferrous) and Forging Shop

3 e (ii) Central Tool Room for Tools, Jigs and Fixtures

3 e (iii) Central Repair, Maintenance, Prototype Manufacture and Training Shop

3 e (iv) Central Galvanising, Electroplating and Phosphating Plant

3 e (v) Central Heat Treatment Shop

3 e (v) Quality Control and Inspection

ANNEX 3 e (i)

ESTABLISHMENT OF CENTRAL FOUNDRY AND FORGING SHOP

The establishment of a Central Foundry and Forging Shop is a basic requirement for all manufacturing units in the metal sector of the rural industries and particularly for the manufacture of agricultural machinery and equipment and will form a Common Engineering Services facilities within the development centre.

- Ferrous Foundry (Cast Iron, Steel, etc.)
- Non-ferrous Foundry (Brass, Aluminium, etc.)

Therefore, the central foundry will produce Cast Iron, S.G. Iron, Malleable Iron, Forging Steel, Brass, Aluminium. These materials are essentially needed for any metalworking industry development and particularly for the manufacture of agricultural machinery and equipment in the rural areas.

Criteria for Minimum Factory Production of Ferrous Foundry

The minimum factory production of Grey Cast Iron and Steel ingot production will be:

- 20,000 tons of liquid metal per annum, i.e. 60 tons of liquid metal per day, considering 250 working days per year.

Raw materials for the foundry will be:

- Scrap Steel, Pig Iron.

The production of various grey cast iron and steel requirement will be as follows:

1. High duty Grey Iron for casting - 5,000 tons/year (Grade 17 or Meehanite specification)
2. S.G. Iron and Malleable Iron - 9,000 tons/year
3. Steel Castings - 1,000 tons/year
4. Special Steel ingots for forging - 5,000 tons/year.

Equipment for the Ferrous and Ferro-alloy Foundry

(a) Ferrous Melting Shop

(i) Direct Arc Melting Furnace 6 tons/batch capacity complete with electrical transformer 3000/4000 KVA capacity with 11 KV, 3 [illegible] suitable for operation with basic and acid linings.

(ii) Mains Frequency Induction Melting Furnace 4-5 tons/batch capacity with power input 1000/2000 KW for melting of iron and steel. H.T. Power required - 11 KW, 3 Phase, 50 c/s.L.T. Power required - 415 V, 3 Phase, 50 c/s

(iii) E.O.T. Crane - 20 meter span, 10 ton capacity

(iv) Electromagnetic Discs - 1.25 meter (4 ft.) diameter for lifting the iron for charging

(v) Platform and Weighing bridge - 10 ton

(vi) Immersion Type Pyrometer for measuring liquid metal up to 2000° C

(vii) Optical Pyrometer - 1200° C to 2000° C

(viii) Combined bottom and tip pouring ladles 10 ton, 5, 3 and 1 ton capacity. Hand shanks sizes 50 kg., 100 kg., 250 kg.

(ix) Muffled Furnace for preheating of Ferro-alloys, oil fired or electrically heated temperature rise up to 800 C to 1000° C

(x) 10 ton capacity of Induction Metal holding furnace about 500 KW Power input for super heating the metal.

(xi) Continuous heat treatment furnace for heat treating the Malleable Cast Iron range up to 1000° C.

(b) Moulding Shop

(i) Continuous Mixer - 10 tons/hour

(ii) Vibratory Shake, Precrusher, Vibratory Conveyor, Overband Magnetic Separator, Surge Hopper

(iii) Complete set of core makers and moulders tools, cope boxes, etc.

(iv) Pneumatic Moulding Machines

(v) Stationary Sand Slinger with Ramming Cup

(vi) Roller Conveyors, Jib Cranes, standard Steel Pins, Moulders hand tools, etc. Rolled steel fabricated mould boxes.

(c) Fettling Shop

Fettling machines and equipment

(d) Pattern Shop

Band saw machine, planning machine, crosscut circular saw, combined Disc Bobbin sander, wood turning lathes, Pillar Drilling Machines Hand Tools.

(e) Maintenance Shop

Turning and screw cutting lathe, chucking lathe, radial arm drilling machine, shaping machine, planning machine, boring machine and tools.

(f) Common Service for Foundry

(i) Electric Substation
(ii) Air Compressor Set
(iii) Oil Tanks, Water Reservoir, Pipelines
(iv) Dust and Fume Disposal System
(v) Forklift Truck, etc.

(g) Testing Laboratory

Chemical Section, Sand Testing Section, Mechanical Testing Section, Metallography Section, Heat Treatment Section, Non-destructive Section to be equipped with all machinery and equipment.

Criteria for Minimum Factory Production of Non-ferrous Foundry

The minimum facotry production of non-ferrous castings will be for various parts of pumps, crop protection equipment and tractors.

- Installed capacity - 1000 tons per year for Brass
  - 300 tons per year for Aluminium.

The production of various Brass and Aluminium will be:

- 60% Cu + 40% Zn (Brass) - 750 tons/year
- 80% Cu + 20% Zn (Bell Metal) - 250 tons/year
- Aluminium Alloy - 300 tons/year

Equipment for Non-ferrous Foundry

(a) Non-ferrous Melting Shop

(i) Oil fired crucible furnaces (for gravity casting) - 3 - off fitted with air control atuomatic burner, etc., including chimney

(ii) Hot Chamber Die Casting Machine with high pressure plunger goose neck attachment
Locking capacity - 130 tons
Plunger diameter $1\frac{1}{2}$", Area 1.76 sq.in.
Pressure on metal - $7\frac{1}{2}$ tons
Volume per shot - 13 cu.in.
Weight per shot - Aluminium - 1.25 lbs.
Weight per shot - Brass - 3.9 lbs.

(iii) Automatic sand core making machine (Duplex type) for gravity casting

(iv) Automatic shell moulding machine (Duplex type) for gravity casting

(v) Beryllium-Copper Steel Dies

(vi) Hand Shanks - 1 kg., 2 kg., 5 kg., capacities. Core keeping trolleys.

(b) Fettling Shop
Fettling Machines (Pneumatic Type)

(c) Trimming Section
Trimming Machines, Belt and Sanders, etc.

(d) Other facilities will be from the main ferrous foundry shop.

Forging Shop

Criteria for Minimum Factory Production in Forging Shop

Minimum factory production of forging shop will be 5000 tons of finished forged/year, i.e. 20 tons of forged parts/day, 250 working days/year.

Equipment for Forging Shop

(a) Forge Plant
(i) Hammer Forging Machine - 80 ton capacity for hot forge up to 20 kg. forge part
(ii) Upset Forging Machine - 40 ton capacity (for hot forge)
(iii) Drop Forging Machine - 40 ton capacity (for hot forge)

(b) Heat Treatment Shop
(i) Preheating Furnace up to 1600° C oil fired or electrical heating with thermostat control
(ii) Annealing Furnace

(c) Billet Cutting Shop

Gas cutting machine, part of machine, shearing machine, abrasive cutter and pedestal grinder

(d) Inspection and Metallurgical Laboratory

This will be part of Central Foundry.

(e) Mechanical Handling

Forklift Truck, EOT Crane, Bins, Weighing Scale up to 5 tons.

Material Specification for Forging Tools and Dies

During forging operation there are three main causes for tool deterioration:

- pressure
- abrasion
- heat.

The problem is more serious for the dies, since these are in more intimate contact with the hot material and far greater period of contact. Ferro-alloy e.g. Tungsten and Chromium are the two alloying elements found to be the most effective for the selection of die material.

Composition of Die Steel for Forging

Carbon - 0.4 to 0.5%
Tungsten - 18%
Chromium - 3 - 4%
Rest Iron.

Alternatively

Carbon - 0.8 to 0.9%
Chromium - 3 to 4%
Manganese - 0.5 to 0.6%
Rest Iron

Heat treatment of the tools according to the manufacturers recommendation.

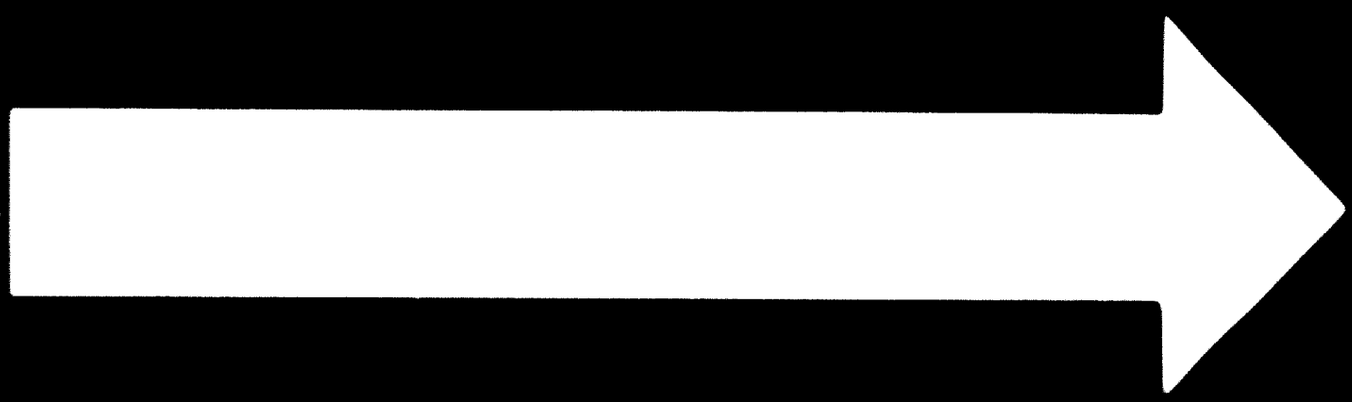
see Annex 3.8 (ii)

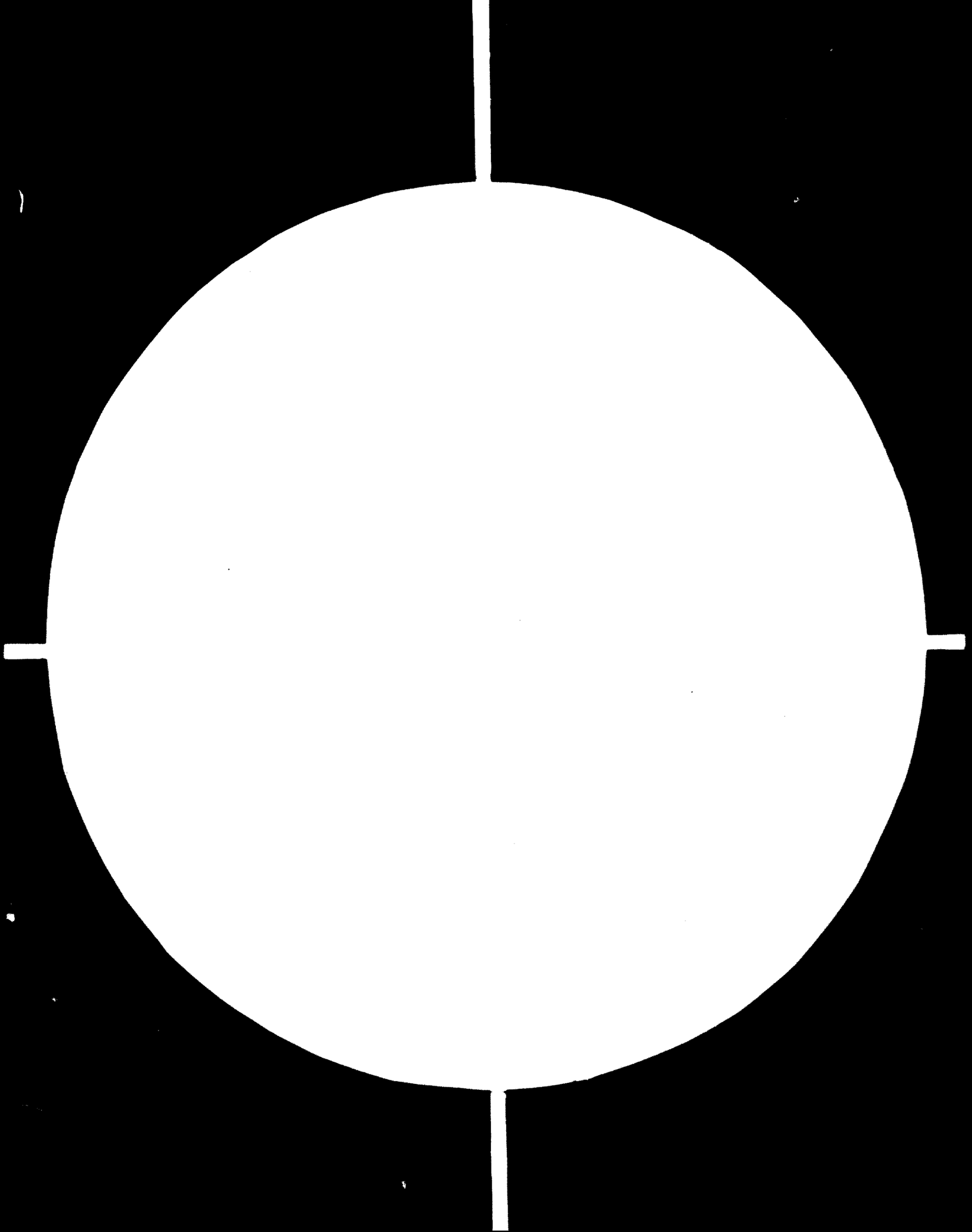
ESTABLISHMENT OF CENTRAL TOOL ROOM FOR MANUFACTURE OF JIGS, TOOLS, FIXTURES AND PRECISION SPARE PARTS

The role of central tool room in the rural areas will be to provide the rural industries with:

(i) Manufacture of jigs, tools, fixtures for production facilities

C-627





(ii) To train highly skilled tool makers;

(iii) Maintenance of all special purpose tools;

(iv) Manufacture of precision spare parts for the industry.

The tool room will be geared for precision work up to 0.00001" and surface finish up to 0.2 of 1 micro inch.

Criteria for Minimum Factory Production

The tool room will be capable to handle yearly:

- 10,000 units of small and simple tool grinding
- 1,000 milling cutters grinding and lapping including H.S.S. and Carbide Tipped Tools;
- 500 Jigs and Fixtures weighing 100 tons;
- 1000 Simple Jigs and Fixtures - 100 tons;
- 200 Sharpening of Broaches;
- 500 Special Gear Cutters Grinding

Essential Machinery and Equipment for Tool Room (Detailed specifications are reflected only for special machines in tool room work)

Tool Room High Precision Machines

(i) Jig Boring Machine with all accessories

Boring and Facing Head, Boring Bars, Collect Chucks, Internal Micrometer, Depth Measuring attachment, Auto positioning Jig Boring Machine capable of sensing position to an accuracy of 0.00002". In order to give extensive scope of precision machining, the machine should be equipped with:

- two dimensional tracer controlled copy milling
- automatic profile generation
- auxiliary horizontal boring spindle
- automatic selection of co-ordinate
- automatic quill retraction system

Specification - work table - 60" x 30"

work table longitudinal traverse - 45"

work table cross traverse - 26"

Spindle speeds (stepless) - 40 - 2000 r.p.m.

Spindle feeds (8 up and down) - 0.0005" to 0.012"/per spindle revolution

(ii) Precision Universal Grinding Machine with Accessories

Height of Centres - 6", Distance between Centres - 24" to 60"

Wheel speeds (2) - 1561 - 1910 r.p.m.

Work speeds (4) 40-200 r.p.m.

Table Speeds -3" to 192"/min.

Wheel head infeed - 0.003" to 0.0002"

Work head swivel - 90° right - 45° left

Wheel head swivel - 90° right - 90° left

Underslide swivel - 90° right - 90° left

(iii) Tool Room Die Sinking Machine (Duplex Head Type) with electro-hydraulic tracer control

Table Size - 48" x 24"

Maximum Depth of Die - 10"

Maximum length of Die - 20"

Maximum width of Die - 20"

Spindle speeds - 30 to 1800 r.p.m.

Horizontal, Vertical - 0.25" to 20"/minute and transverse travel

Automatic Horizontal and vertical step feed - 0.010" to 3" in inch/stroke

(iv) Precision Cylindrical Grinding Machine with internal grinding attachment

Max. wheel diameter - 20"

Max. wheel width - 4"

Height of Centres - 6½"

Capacity between centres - 24" - 72"

Wheel speeds(2) 955 - 1205 r.p.m.

Work speed (6) 16 to 235 r.p.m.

Table speed - 3" to 240"/min.

(v) Optical Dividing Head

Calibration can be up to 2 seconds. Maximum distance between centres - 18"

(vi) High Precision Gauge Grinding Machine

(specification items will be as above)

(vii) Precision Internal Grinding Machine

(specification items will be as above)

(viii) Precision Surface Grinding Machine

Longitudinal traverse - 22"

Cross Traverse - 8"

Maximum height from table to Centre Spindle - 16½"

Working table - 20" x 8"

(ix) Universal Milling Machine with Accessories (standard machine)

(x) Universal Horizontal Boring Machine (standard machine)

(xi) Precision Lathe with all Accessories (standard Machine)

(xii) Precision Universal Broach Sharpening Machine
Suitable for both internal and surface broaches. Maximum length 80", micro-feed attachment and built in frequency changer.

(xiii) Precision Twist Drill Grinder with Attachment
For grinding twist drills both LS and RH, high speed steel and carbide tipped dia. 1/32" to 3".

(xiv) Precision Automatic Face Mill Grinder
For grinding a lapping face mill cutters (LH and RH) tips for HSS and tungsten carbide. Milling cutter diameter - 6" to 12", Maximum grinding wheel size - 10" x ½" x 1½" Bore.

(xv) Double Ended Grinding and Lapping Machine with Angle Plate and Table (Parallel Face)
Maximum wheel size 8" x 3"
Wheel size for lapping 6" x ½"

(xvi) Precision Turning Lathe with Cross Slide Swivel for Turret
(xvii) Standard Upright Drilling Machine
(xviii) Standard Radial Arm Drilling Machine
(xix) Standard Knee Type Milling Machine
(xx) Standard Shaping Machine
(xxi) Double Ended Grinding Machine
(xxii) Double Ended Polishing Machine
(xxiii) Band Saw with Endless Saw Blade
(xxiv) Electric Arc Welding Machine up to 800 Amps

} Standard Medium Size Machine

(xxv) Electric Spot Welding Machine up to 3/8" Thickness to be welded

(xxvi) Precision Surface Table - 36" x 36" - 1/2 ton weight

(xxvii) Working Surface Table - 24" x 24" - 200 kilo weight

(xxviii) Heat Treatment Furnace
36" x 20" x 20" - Temperature up to 1600° C. Electrically heated.

(xxix) Quenching Tank - 36" x 36" x 36"

Fitters bench, vices, universal vices, hand tools, drill sets,

(xxx) Measuring Instruments

(a) Horizontal High Precision Optical Comparator

Total range of scale - ± 0.005"

Graduation of scale - 0.00005"

Vertical movement of workpiece - 3 3/8"

External maximum diameter 4"

maximum distance 6"

Minimum pitch diameter gauged 25/32"

Facilities for rapidly and accurately checking external and internal plain cylindrical gauges, screwing gauges.

(b) Tool Makers Microscope

With compound table, field of view, work centre cradel, vee-support, protractor ocular.

(c) Precision Slip Gauges (3 sets required)

1 set of 81 pieces comprising (BS888)

Range	Steps	Pieces	Grade
0.1001 in. - 0.1009 in.	0.0001 in.	9	For Workshop
0.101 in. - 0.149 in.	0.001 in.	49	For Inspection
0.05 in. - 0.95 in.	0.05	19	For Calibration
1 in, 2 in, 3 in, 4 in.	-	4	

(d) Universal Test Indicator Set

Dial Indicator, Back Plunger with 1.5 mm. (1/16") and radius anvil

Graduation - 0.001 in.

Reading - 0-100 or 0-50-0

Range - 0 to 0.2 inches

(e) Lever Type Dial Indicator

(f) Standard Reference Vernier

(g) Vernier Depth Gauge

Open vernier reading direct to 0.001 in.

(h) Vernier Height Gauges

Capacity from 0 to 36 inches

Capacity from 0 to 18 inches

(i) Base Tangent Caliper

Capacity up to 4 inches

Reading to 0.001 inches

(j) Vernier Calipers, Squares, Engineers Squares, Bevel Protractor, Combination Set, Small Hole Gauge, Telescopic Gauge, End Measuring Micrometer Set, Depth Gauge Micrometer, Internal Micrometer, Hand Grip Deep Frame Micrometer, Thread Measuring Tools and Micrometer

ANNEX 3 e (iii)

*** CENTRAL REPAIR, MAINTENANCE, PROTOTYPE MANUFACTURE AND TRAINING SHOP

This common engineering service facilities will provide allround maintenance facilities to the small and medium size firms in the rural areas. With the available machinery and equipment it will be possible for the development centre to manufacture prototype agricultural products designed by the product development and design services section. More over an extended training facilities can be provided in this section so that the workers in the rural areas will receive all round practical training on manufacture, repair, maintenance of the plant. In this way a linkage can be established amongst the design and engineering sections of the development centre and the linkage between the industries and the development centre as a whole.

Central Repair, Maintenance, Prototype Manufacture and Training Shop

Minimum Machinery and Equipment Required

(i) Lathe for turning and screw cutting-
Maximum swing over bed- 36"
Capacity between centres - 72"
Maximum length of threads - 6"
Maximum diameter of thread - 6"
Maximum pitch - 5 threads/inch

(ii) Capstan Lathe with Hex-Turret and All Accessories
Diameter of hole through spindle - $2\frac{1}{2}$"
Maximum swing under overhead support - $13\frac{1}{2}$"
Maximum distance of spindle flange to turret - $33\frac{1}{2}$"
Maximum length of bar stock-8"

(iii) Universal Milling Machine with Compound Dividing Head and Vertical Milling Attachment

Capacity - 30" x 8" x 20"

Speeds - 18 ranging 26 to 1250 r.p.m.

Feeds - 18 from $\frac{1}{2}$ to 30 i.p.m., $9\frac{1}{2}$" diameter Universal Dividing Head

(iv) Knee Type Milling Machine with Dividing Head

Capacity - 30" x 8" x 20"

Speeds - 18 ranging from 26 to 1250 r.p.m.

Feeds - 18 from $\frac{1}{2}$ to 30 i.p.m.

(v) Horizontal Boring Machine with Sliding Head and Swiveling Work Table

Maximum diameter face and bore - 60"

Spindle traverse vertical - $7\frac{1}{2}$" to $65\frac{1}{2}$"

Revolving table - 48" x 48", maximum distance facing slide to boring stay - 140"

(vi) Cylindrical Grinding Machine with Internal Grinding Attachment

Grinding wheel size - 20" x 2" dia. x 8"

Maximum diameter ground - 10"

Maximum length between centres - 72"

Roll face length - 48" wt. of Roll - 350 lbs. (maximum)

(vii) Surface Grinding Machine with Magnetic Table

Size of table - 20" x 8"

Lognitudinal Travel - 22"

Transverse Travel - 8"

Grinding Wheel - 8" diameter

(viii) Radial Arm Drilling Machine with Universal Table

6 ft. spindle radius, capacity - 3" diameter in M.S.

Speeds - 15 to 1500 r.p.m. - 17 steps

Feeds - 0.004 to 0.030 i.p.r. 6 steps

(ix) Upright Drilling Machine

Capacity - 3" diameter in M.S.

Speeds - 15 to 1500 r.p.m. - 17 steps

Feeds - 0.004 to 0.030 i.p.r. - 6 steps

(x) Gear Hobbing Machine with Accessories

Maximum distance - centre of work spindle to centre of Hob Arbour $5\frac{1}{2}$"

Hob Arbour diameter $1\frac{1}{4}$"

Maximum hob outside diameter 4"

Maximum DP module Cast Iron or Steel 4 to 16

(xi) Gear Shaving Machine with Accessories

Capacity - 18" diameter

Pitch Diameter - 1 to 18 inches

Outside Diameter maximum - 18.875

DP or Module - 4 to 16, Cutter diameter - 9", Maximum face width straight 10", Maximum crown width - 6"

(xii) Vertical Lathe with Turret Slide Arrangement and Side Tool Attachment

Table diameter - 36"

Maximum diameter of work - 44"

Down feed of turret tool head - 24"

Vertical traverse of side tool - 30"

(xiii) Heat Treatment Furnace

Oil fired or electrically heated heat treatment furnace maximum temperature up to 1200° C with thermostat control.

(xiv) Quenching Tank

Steel Fabricated Tank - 36" x 36" x 36"

(xv) Press Brake

Maximum bending pressure - 50 tons

Effective work length - 100"

Width of table - 8"

Stoke - 0 to 4", Number of stoke/min. 9

(xvi) Eccentric Press

Capacity - 50 tons

Blank thickness up to - 1/8" in MS

(xvii) Tube Bending Machine

Maximum of tube diameter - 2" in M.S.

(xviii) Nibbling Machine

Maximum tensile strenght of plate - 50 tons/sq. in

Edge cutting - up to 1/8"

No. of stroke per minute - 2800 to 1400

Maximum circular cutting - 28" diameter

(xx) Shearing Machine

Shear in mild steel plate - up to 15/32"

Shearing length - 100"

Stroken per minute - 15

(xxi) Hydraulic Press

(xxii) Electric Arc Welding Set

Maximum current - 500 amps.

(xxiii) Electric Spot Welding Set

Maximum thickness of material M.S. - ¼"

(xxiv) Oxyacytilene Welding Set

(standard)

(xxv) Profile Gas Cutting Machine

Maximum size to be cut - 48" diameter.....

(xxvi) Crankshaft Turning Machine

Crankshaft size - length - 30", Pin. diameter - 3"

(xxvii) Crankshaft Grinding Machine

Crankshaft size - length 30", Pin. Diameter - 3"

(xxviii) Portable Tools and Equipment

Drilling, grinding, trimming, etc.

(xxix) Electrical Measuring Equipment and Maintenance Equipment

Common Services for Maintenance Section

(i) Electrically driven compressor set
(ii) Water tank, oil tank and pipeline
(iii) Electric substation
(iv) Forklift trucks, cranes, etc.
(v) Fitters Bench, cupboards, etc.

Machinery for Training

Medium and Small size:

Lathes, milling machines, drilling machines, welding machines, boring machines and also to use all the machinery in the maintenance shop for practical training.

ANNEX 3 e (iv)

*** ESTABLISHMENT OF CENTRAL GALVANISING, ELECTROPLATING AND PHOSPHATING PLANT

The above processes are used to protect the surface of the components associated with the agricultural machinery and equipment. It is difficult for the small firms in rural areas to install in their own plant the metal surface treatment machinery which are generally capital intensive

and beyond the means of small establishments. In order to facilitate this service amongst the industries in rural areas, the development centre can install such a plant for common engineering use.

Electroplating Process

The process of metal surface treatment will be as follows:

(a) Bright Zinc Plate, Passivate and Bleach

Any conventional Bright Zinc Plating Process to give a minimum thickness of 0.0003" and passivated with a conventional chrom type passivating solution and bleached to give a zinc coating of good appearance which will withstand 48 hour Acetic Acid Salt Spray ASTM B. 287.

(b) Copper and Nickel Plate

Any conventional Copper Plating Process followed by a conventional nickel plating process to give a minimum thickness of 0.0006" of good appearance.

(c) Copper , Nickel and Chrom Plate

Any conventional Copper Plating Process followed by a conventional chrom plating process to give a resultant thickness of 0.0006" to conform with BS. 1224 of good appearance.

(d) Phosphate, Stain and Oil Process

Any conventional phosphating process, providing it conforms with a particular weight, dyed by any approved water stain and sealed by any approved oil to give corrosion protection specified by manufacturer.

(e) Parcolubrize Process

Phosphate with parcolubrize and seal with an approved lubricating oil to give a good corrosion protection surface.

Plating Shop

1. Parkolubrize Bonderize and Copper Plating

(i)	Bonderising Vat 4' x 3' x 3' Deep	- 1 off.
(ii)	Hot Swill Vats	- 3 off.
(iii)	Trichlorethylene degreasers	- 1 off.
(iv)	Copper plate vats 6' x 3' x 3' deep	- 1 off.
(v)	Hoists and runways	- 2 off.
(vi)	Parkolubrizing vats - 3' x 3' x 3'	- 1 off.
	6' x 3' x 3'	- 1 off.

Power Requirement

The vat loads depend on the number of components per jig and the number of jigs loaded to the vats.

Total capacity - 500 amps

For Copper Plating - 25 to 30 amps per sq. ft. for the calculation of vat loading

Estimated Process time -

Parkolubrize - 15 to 25 minutes/vat.

Copper Plating for carburising - 30 minutes/vat.

2. Bright Zinc, Copper, Nickel and Chrome Plating

(i) Trichlorethylene degreaser - 1 off.
(ii) Zinc Plating Vats 6' x 3' x 3' - 1 off.
(iii) Galvanised hot swill vat 3'x3'x3' - 1 off.
(iv) Galvanised hot swill vat 6'x3'x3' - 1 off.
(v) Galvanised cold swill vat. 3' x 3' x 3' - 1 off.
(vi) Stainless Steel Nitric Acid vat. 3' x 2' x 3' - 1 off.
(vii) Stainless Steel Nitric Acid vat. 4' x 3' x 3'' - 1 off.
(viii) Stainless Steel Proscal vat. 3' x 3' x 3' - 1 off.
(ix) Copper Plating vat. 6' x 3' x 3' - 1 off.
(x) Zinc Plating Barrel - 1 off.
(xi) Nickel Plating vats. - 6' x 3' x 3' - 1 off.
(xii) Chrom Plating vats 6' x 3' x 3' - 1 off.
(xiii) Rinsing vats 3' x 3' x 3' - 6 off.
(xiv) Various air taps, benches, vices, jigs, hoists, etc.

Estimated Process Time

Bright Zinc Plating - 15 minutes

Barrel Zinc Plating - 60 minutes

Copper Plating, Ni and Cr. - 60 minutes to give a thickness 0.0006

The electroplating shops need a suitable chemical laboratory with equipment for the analysis of chemical and treated surface properties of parts.

The section will be able to cater for processing the following parts: Chisel, tines, discs, gears, pinion, etc. for phosphating and gear lever, bolts, nuts, rods, caps and many other parts for bright zinc plating or Ni. Cr. plating of tractors and implements and for other industries in the rural area.

ANNEX 3 a (v)

*** ESTABLISHMENT OF CENTRAL HEAT TREATMENT PLANT

Heat treatment is the essential requirement to condition the steel parts in order to sustain greater load bearing characteristics and to increase the surface hardness for greater resistance to abrasion and wear. Substantial parts of agricultural machinery and equipment needs heat treatment e.g. chisels, tines, discs, transmission shafts, gears, cams, spri· , connecting rods, etc. Heat treatment equipment are also capital intensive and require high degree of chemical and metallurgical attention and consideration. In agricultural machinery and equipment, the certain parts require three types of heat treatment.

(1) Surface hardening and tempering to give a required surface hardness
(2) Through hardening and tempering to give a specific hardness within the material of the parts.
(3) Anneling - to reduce the hardness in order to continue further machining operations.

Considering the magnitude of engineering and technical skill involved during the heat treatment process, it is desirable if a central heat treatment shop can be installed within the framework of the development centre as a part of Common Engineering Service Facilities for rural industries. Small and medium size industries will be able to heat treat their parts and components without having individual investment. The centre will also provide the technological know-how through the technological advisory services and will thus create a linkage between advisory services and engineering common services and the local industries require the heat treated parts.

Essential Machinery and Equipment Required for Central Heat Treatment Shop

1. Normalising and Anneling Shop
   (i) Continuous Normalising Furnace
   (ii) Trolleys (overhand rails)
   (iii) Hand Trays and Stillages for storing.

   Process time 15 minutes.

2. Carburising by Pack Hardening Process

This is the usual method of case-hardening and is the most economical for "deep" cases or for parts which require grinding after hardening. This is most suitable for artisan and small scale level.

The process require:

(i) Charcoal grains of $\frac{1}{4}$" size to $\frac{1}{2}$" size
(ii) Pack hardening boxes - 12" x 18" x 12"
(iii) Oil fired furnace up to 900°C size - 36" x 36" x 36"
(iv) Water or Oil Quenching Tank - 48" x 48" x 48"
(v) $\frac{1}{4}$ Ton Hoist

Case Depth
- up to - 0.040" at 900°C for four hours
  for small pieces up to 1" x 1" x 1"
- up to - 0.040" at 900°C for 8 to 12 hours
  for relatively large pieces to be carburised

Case-Hardening Steels and Heat Treatment

The following are the general case hardening steel used in Agricultural Machinery Industries.

Specification	Refine	Quench	Harden	Quench
EN 32A	870/900°C	Water or Oil	760/780°C	Water
EN 32C	870/900°C	Water or Oil	760/780°C	Water
EN 32M	870/900°C	Water or Oil	760/780°C	Water
EN 361	850/880°C	Water or Oil	780/820°C	Oil
EN 362	850/880°C	Water or Oil	780/820°C	Oil

3. Carburising, Hardening and Tempering Shop

(i) Carburising furnace with endothermic generator using propane and town gas (if available)
(ii) Hardening furnace oil fired or electrically heated
(iii) Oil Quenching vats
(iv) Water Quenching vats
(v) Trychlorethylene Degreasers vat
(vi) Mobile crane
(vii) Hoists for degreasers
(viii) Cooling conveyer

Case Depth Achieved

0.010 inch - 1 hour

0.025 inch - 2 hours

0.035 inch - 3 hours

0.035 to 0.070 inch - 6 hours

0.070 to 0.085 inch - 10 hours

0.085 to 0.100 inch - 14 to 24 hours

Salt Tempering

(ix) Salt type tempering furnace

(x) Trychlorethylene Degreasers Vat.

Tempering time - 60 minutes

4. Induction Hardening Shop

(i) 145-KW Hardening Furnace

(ii) 75-KW Tempering Furnace

(iii) 60-KW Tempering Furnace

(iv) Oil Quenching Tank

(v) Water Quenching Tank

(vi) Washing Plant

(vii) Electric Grab Crane

Alternatively

(i) Open Hearth Hand Controlled Hardening Furnace

(ii) Oil Quenching Vats

(iii) Water Quenching Vats

5. Cyanide and Nutral Salt Hardening and Tempering Shop

This is for very small parts to be heat treated by batch size.

(i) Twin 24" cyanide pots

(ii) Trichlorethylene degreaser vat.

(iii) Pre-heating pots

(iv) Oil Quenching vats

(v) Water Quenching vats

(vi) Benches for wiring and jigging for degreasing

Case depth	-	Minutes
0.005 inch	-	30
0.010 inch	-	60
0.015 inch	-	90
0.020 inch	-	120
0.025 inch	-	150
0.030 inch	-	180
0.035 inch	-	210

Tempering After Cyanide Treatment

(vii) 55 KW Tempering Furnace or

(viii) Continuous Salt Type Tempering Furnace

(ix) Loading trolleys

[redacted] 3 a (vi)

Quality Control and Inspection

Quality of a product cannot be created at the final stage of manufacturing process. Quality is within the product. Therefore, quality control is an important and most vulnerable operation in the production process. A quality control centre will be able to assist small firms for the introduction of a good quality control system. This requires:

- provision of caliper, micrometer, depth gauge, height gauge, etc.;
- design of special production inspection gauges e.g. gap gauge, plug gauge, thread gauge, etc.;
- quality control charts with upper and lower limit for quality control;
- statistical quality control for bar or chuck atuomatic machines;
- inspection and control of tool geometry and technology involved in it;
- improvisation of special inspection tools;
- training of inspectors and quality control engineer.

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche

C-627

81.10.23