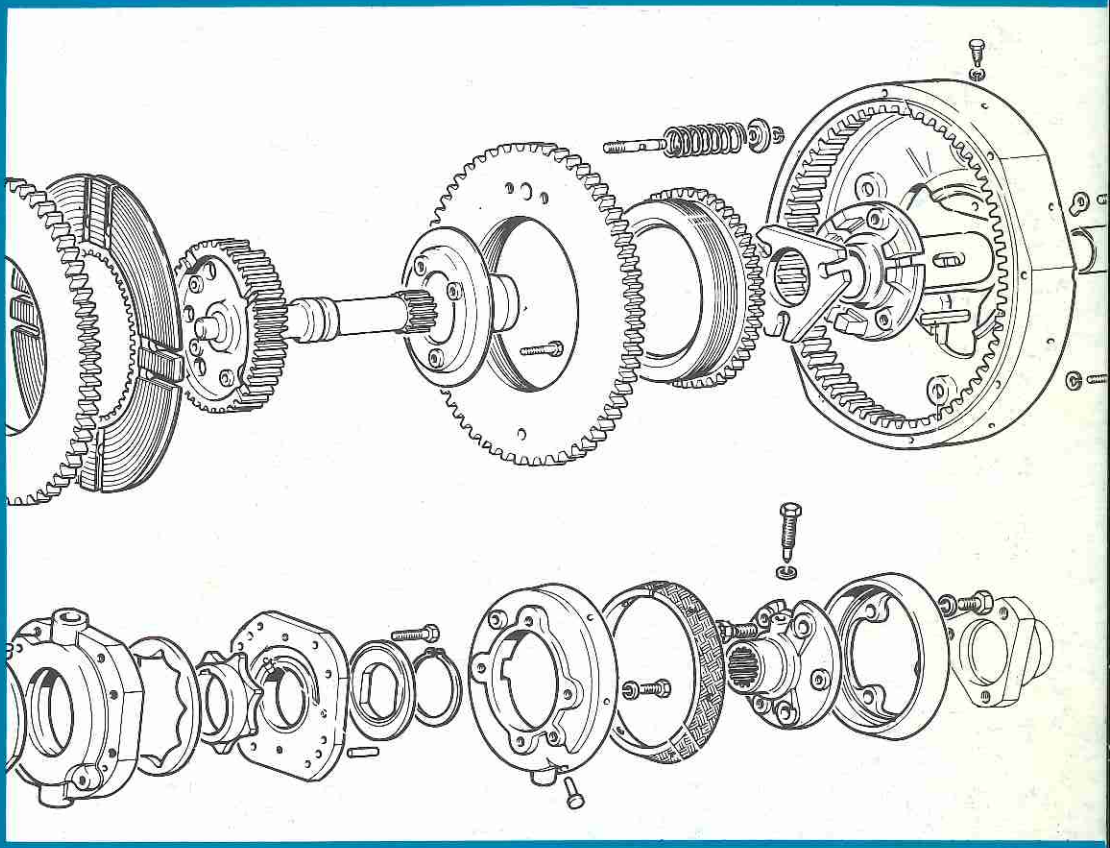
FAO AGRICULTURAL SERVICES BULLETIN 44

replacement parts for agricultural machinery



FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS ROME

FAO AGRICULTURAL SERVICES BULLETIN 44

replacement parts for agricultural machinery

a position paper prepared

by the

fao panel of experts on agricultural mechanization

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome 1981

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I. Introduction

1. The Director-General of FAO established a Panel of Experts on Agricultural Mechanization in 1979. The arrangements concerning its activities, responsibilities and membership were defined as follows:

Purpose

To advise and assist the Director-General on:

(a) Measures to promote collaboration between FAO, national and international institutions, bilateral agencies and industry in the establishment of efficient and appropriate mechanization in the developing countries;

(b) obtaining extra budgetary funds for action programmes in connection with (a).

Membership

Experts qualified to advise on the development of appropriate mechanization and such experts as are specially conversant with agricultural mechanization development on account of their association with contributors to the costs of projects promoted through the Panel. These experts attend sessions at their own expense.

Rules of Procedure General Rules of the Food and Agriculture Organization of the United Nations.

Pattern of Sessions Ad hoc, when convened by the Director-General.

2. The following individuals have been appointed to the Panel by the Director-General of FAO. They all serve in their individual capacity and not as representatives of their governments or their employers.

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3. Shortly after the establishment of the Panel, the Overseas Development Administration of the Foreign and Commonwealth Office of the United Kingdom Government suggested that the Panel should discuss the question of parts for agricultural machinery in developing countries. It offered its sponsorship of a meeting at the National Institute of Agricultural Engineering at Silsoe and this paper is the outcome of discussions by Panel Members at Silsoe in November 1979 and the subsequent work of a sub-group which gave freely of its time to finalize the paper in 1980.

II. Background

4. Modern agricultural mechanization has its origins in the last century with blacksmiths making improved tools and equipment for farmers whose markets were expanding. As agricultural production accelerated and improved manufacturing processes were developed, the blacksmith gave way to industrialists making larger numbers of more sophisticated machines. Direct sales from manufacturer to customer declined and local agents who sold and subsequently serviced these machines took over. Progressively, the links between the manufacturer and the farmer were extended, physically and organizationally, and the farmer's source of supply, of technical advice and of aftersales service, became the local distributor.

5. Since 1945 there has been a rapid increase in agricultural mechanization. In the developed countries the tractor has largely displaced draught animals as a source of power and a steady decline in the number of people working in agriculture has provided a stimulus to increased mechanization and productivity. This has led to a corresponding increase in competition for the farmer's business and to increased emphasis on aftersales service. In the developing countries there have been equally significant developments in agriculture. The need for additional food production to feed rapidly increasing populations has led to greater emphasis on higher productivity through greater use of inputs in general and mechanization in particular. In many instances mechanization has been introduced without the infrastructure necessary to support it. In most developing countries mechanization is dependent on imported items. These and other factors have complicated the establishment of efficient aftersales service.

6. These Guidelines are concerned with one aspect of aftersales service: that of agricultural machinery parts. Some farmers enjoy aftersales service which enables them to maintain and operate their machinery without undue inconvenience throughout its working life. Unfortunately, there are many instances where machines are inoperable, sometimes at critical periods in the production of a crop, because either a replacement part or the skill to fit it is unavailable. There are other instances of less immediate consequence but nonetheless unsatisfactory, where parts are prohibitively expensive, where the level of operator or service/repair skill is too low, where machinery is incorrectly used or mismatched or where soil and climatic conditions cause greater than anticipated replacement and repair problems.

7. Despite general acceptance that all machinery needs regular maintenance and a varying amount of repair during its working life, the full cost of that repair and maintenance is less widely accepted and is sometimes overlooked or ignored. Data collected in Kenya and the Federal Republic of Germany (Table 1), shows that with the exception of machinery with few or no moving parts, the cost of repairs and parts for agricultural machinery in developing countries may range from 130 to 400 percent of the initial cost of the machinery. These figures are substantially higher than those experienced in developed countries and the factors specifically influencing the position in developing countries are set out below.

TABLE 1

Working Life, Repairs and Parts Costs of Farm Machinery

	Working Life in: Years		Working Life in: 000 Acres		Repairs and Parts: % of Purchase Price	
	Kenya	Fed. Rep. Germany	Kenya	Fed. Rep. Germany	Kenya	Fed. Rep. Germany
Wheeled Tractors (30-85 hp)	8	12	10*	12*	130	100
Disc Ploughs - 2 furrow	8	14	4	4	350	150
Mouldboard Ploughs	8	14	5	4	350	300
Disc Harrows (6-1/2'-9')	8	14	10	4.5	400	100
Tooth Harrows	10	14	10	4	50	100
Cultivators - 4 row	8	14	10	4	250	150
Rotary Cultivators	8	8	3	1	400	100
Field Rollers	10	14	10	4.5	50	50
Combine Drills	8	14	8	4	200	100
Fertilizer Spreaders	6	10	9	4	200	100
Crop Sprayers	8	10	10	3	200	50
Combine Harvesters:						
Self-propelled 80 hp	8	10	9	1.5	150	50
Tractor drawn pto	8	10	6	1.3	150	80

Kenya data from "Agricultural Mechanization - Costs and Profitability" by R. Adelhelm and K. Steck, published by GTZ, Stuttgart 1976. Federal Republic of Germany data adopted from KTBL - Taschenbuch fuer Arbeits- und Betriebwirtschaft, 10 Auflage 1980.

* 000 hours

8. Agricultural machinery is frequently used more intensively in developing countries because the machinery population is smaller and more thinly spread, because the climate frequently permits double cropping and, therefore, extends the period of peak working and because the absence of public and private transport facilities leads to considerable non-agricultural use for tractors in particular.

9. There are other problems which arise from extremes of climate. High temperatures can harm both the engines and the tyres or other rubber parts of machines. High humidity induces corrosion of electrical equipment. Dusty conditions require more frequent filter changes and cause additional engine wear.

10. Soil conditions may also result in additional wear and tear and in most developing countries robust machinery is essential. Newly reclaimed areas are often difficult to cultivate and stones, tree roots and other obstacles in the soil cause implement breakage and damage to the tyres and steering of tractors. Very sandy soils are more abrasive to discs and share plates on ploughs and to the tracks of crawler tractors. The harder soils of dryland farming areas may be too hard for standard imported soil preparation equipment. Underpowered machinery is inefficient and more expensive in terms of parts and repairs. Careful and thorough selection of machinery and equipment is therefore especially important in developing countries and the correct matching of the prime moving equipment and its attached implement is equally important in reducing or avoiding breakage. Implements should be heavy enough to do the required work but not so heavy as to damage the tractor's hydraulics. This is a frequent problem when long distance travel is involved.

11. The need for efficient parts provision within the wider function of aftersales service in the developing countries is therefore clear. No single interest can achieve this:

- governments have an overall responsibility for policy and implementation;
- manufacturers and distributors have technical and commercial responsibilities;
- farmers have operational and maintenance responsibilities;
- multilateral and bilateral aid agencies have roles to play in conjunction with other interests and particular responsibilities on parts and aftersales service requirements in projects they undertake or promote;

- international organizations, including UN agencies, have responsibilities in the provision of realistic and appropriate advice on all aspects of agricultural mechanization.

III. Quantitative Requirements

12. Several variables influence the quantitative requirements of agricultural machinery parts. Some parts need replacement after a specified operational period. The replacement rate of other parts will depend on the conditions under which the machinery is used, its suitability for the work involved, the correctness of its matching with other machinery with which it may be used, and the technical skills and experience of the operator and the service/repair mechanic. Lastly, the incidence of accidental breakdown or failure cannot be predicted.

13. Nevertheless, if machinery is to be kept operable, replacement parts have to be provided and if excessive downtimes are to be avoided they must be provided in the right place in the right quantity at the right time and at an acceptable cost. The first step in the establishment of an efficient parts service must be an estimate of the replacement parts which will be required, classified according to the timing and frequency of their anticipated replacement.

14. Classification of parts is frequently done on the basis of fast and slow moving parts and standard components. A number of fast-moving parts could be classified as consumables, including items replaced at fixed (i.e. service) intervals, as well as normal wearing parts. Other items could be classified as predictables such as those which are replaced at major overhauls or during the working life of the machinery. Standard components are items which are standard to a range of machineryincluding nuts, bolts, washers, split pins, etc. (see Annex I).

15. There are other items which are less easy to predict as they are neither consumables nor subject to wear and their replacement, if necessary at all, is difficult to predict. Such items would normally only be ordered on demand.

16. An international manufacturer has reported that out of a central stock of 15,000 parts items, 50 items accounted for 90 percent of sales in 1979 and 4,000 items were not sold at all. Another manufacturer, in a different area of agricultural mechanization, has supplied a breakdown of parts movement which is summarized in Table 2. The same wide variation in parts movements is apparent. In both cases there is a commitment to retain stocks of all parts of all machines for an appropriate period of years after manufacture of the machine/model has ceased.

Table 2

Annual Parts Movements
From a Major Manufacturer's Central Store

14%	-	nil movement
30%	-	1 - 3
22%	-	4 - 12
8%	-	13 - 24
6%	-	25 - 36
3%	-	37 - 48
1%	-	49 - 60
16%	-	61 or more

17. Estimating the timing and frequency of replacement parts is only the first step in establishing an efficient parts service. Subsequent steps are just as complex and more significant in financial terms.

IV. Organization and Management Requirements

18. The overall responsibility of an efficient parts service is to strike a balance between 100 percent availability, which is uneconomic, and customer satisfaction. Because of the fluctuating demand of customers it is impossible to match manufacture precisely to their needs and effective liaison 'upstream and downstream' is a prime necessity.

19. Depending on their source, different parts have differing lead times or delivery schedules. For locally manufactured items these may be very short but for imported items the lead times will not only be longer because of the number of links in the delivery chain but may also be subject to foreign exchange restrictions.

20. Accurate stock records are at the heart of an efficient parts service. The system may be simple or sophisticated, depending on the type and numbers of machinery (Annex 2). The critical requirement is that the system of inventory control provides accurate and understandable data on which to base forward ordering. Over time, regular analysis of stock movements will assist the parts service to balance availability against offtake at an acceptable cost. Lack of parts is an immediate inconvenience to farmers and a potential loss of business; surplus or unrequired parts are uneconomic and a potential loss of profit.

21. An efficient parts service must, over time, be self-financing but in the early stages of mechanization development this may be difficult to achieve. Adequate funds must be available at the outset to ensure adequate stock, suitable facilities and competent, well-trained staff. Table 3 illustrates the possible increases from ex works cost in the exporting country to ex-depot in the importing country.

Table 3 Typical Cost Escalation on Imported Parts

	Ex works	$ 10.00
+ c.i.f.	10%	$ 11.00
+ finance	15%	$ 12.68
+ handling	3%	$ 13.03
+ warehousing	7%	$ 13.94
+ depreciation	40%	$ 19.52

22. Parts facilities are linked with service and repair facilities and, together with sales, form an integrated operation. Machinery populations and density will determine the size and location of service/repair facilities and therefore those for parts. For smaller machinery populations the costs will almost invariably be higher than for a large, dense population. According to the estimates of an international manufacturer, a central repair workshop for a fleet of 100 medium size (60 hp) tractors needs to carry a parts

list of 2,700 items. The total investment in parts, equipment and tools (but excluding buildings) for a repair workshop of this capacity exceeds $ 150,000 at 1980 prices.

V. The Role of Government

23. A reliable and cost-effective machinery parts service is only possible within a soundly implemented mechanization policy which must, in turn, be harmonized with government policy and objectives on economic and social development.

24. Government policy influences the economic environment and largely determines the general business climate. It therefore exerts critical influence on the agricultural mechanization sector, either specifically or as a general background influence. The areas of policy which directly or indirectly impinge on machinery parts availability and cost are:

1. Incomes and prices in the agricultural sector
2. Subsidies, grants and credit policies
3. Foreign exchange and fiscal policies and regulations
4. Local manufacturing objectives
5. Structural policies on public and private participation in distribution, ownership and use of machinery and equipment
6. Institutional provisions on quality control, standardization, testing and evaluation, training and extension.

25. In countries where agricultural mechanization is fully developed, it is normally associated with a prosperous but relatively small agricultural population and a strong industrial base which is usually the source of most of the machinery used in agriculture. In these circumstances the impact of government policy on all aspects of agricultural mechanization is likely to be indirect rather than direct.

26. In countries where agricultural mechanization is only partly developed, and imports provide the major source of agricultural machinery, government policy has a direct and specific impact on mechanization and on parts availability and costs in particular.

Well considered and consistent policies can achieve the double objectives of appropriate mechanization development and of conservation of foreign exchange.

27. Government policy on imports of parts should enable farmers to maintain their machinery in optimum condition. The original importation may have involved a priority choice between various foreign exchange options or it may have been provided from bilateral or multilateral aid. In any event, it represents an addition to the country's capital stock and therefore requires appropriate conservation. If replacement parts are expensive, farmers will be discouraged from prompt repair and maintenance. Governments can positively lower costs by allowing the importation of parts free of duty, but if this is not practicable imported parts should be dutiable at a lower rate than that applying to the original machinery.

28. Government policy should recognize the need for continuity of supply of both parts and original machinery. Governments must ensure that the importer and the supplier are able to meet their commitments in the short and long-term and should also ensure that its policy and its implementation permit this. In some instances government may be justified in firstly, restricting the availability of makes or models of machines in order to ensure an acceptable population in terms of aftersales service requirements, and secondly, specifying a minimum level of parts to be held by distributors for all machinery in use in the country.

29. Where import licenses are required, foreign exchange is allocated, deposits have to be made in advance, margins are subject to control, etc., the interaction of different policies may create unforeseen difficulties in the aftersales sector. It is the responsibility of governments toensure that administrative arrangements are not counterproductive, and do not discourage the farmer from seeking, and the distributor from providing, efficient aftersales service.

30. Government fiscal policy should recognize the importance of the distributor in the supply and servicing of machinery and encourage the creation of a favourable long-term business climate in which reasonable prices may be charged for prompt and efficient service and reasonable profits earned.

31. Government should ensure that parts are supplied to a clearly defined specification on materials and performance and should enforce these through authoritative bodies responsible for standards, testing and evaluation. Governments should also insist that parts and instruction books are provided in adequate numbers with all machinery.

32. Governments may wish to encourage national manufacture of parts as a step in the progressive industrialization of the economy, and to that end discourage imports. National manufacture should reduce foreign exchange outflows and should also contribute to the accumulation of skill and experience in engineering but neither should be achieved at the expense of operational efficiency in the agricultural machinery sector. Any policy of encouraging national manufacture should therefore be based on strictly imposed and enforced standards of operational performance. Given these requirements the limitation of imports is put in perspective, and appropriate financial or quantitative limitations may be imposed.

33. In encouraging national manufacture, governments should recognize the financial and managerial requirements of new businesses and where practicable assist the development of the necessary services to meet this need.

34. Government should accept overall responsibility for ensuring that the general level of technical skill is appropriate to the engineering requirements of its agricultural machinery sector and in particular that satisfactory training facilities are available for operators, service mechanics and parts staff.

35. Governments should ensure that their extension services are competent to advise farmers on the correct operational use of agricultural machinery. Preventive maintenance procedures exert a positive effect on the costs of maintenance and repair, and it is therefore incumbent on governments, and all other interests, to help keep maintenance and repair costs to a minimum.

36. In their overall approach to agricultural mechanization, and in particular to the problems of satisfactory aftersales service, governments should recognize the complex and interrelated factors involved. The most satisfactory answer lies in a mechanism which will fulfil the dual purposes of advising the decision-making function in government on the one hand and on the other providing national institutions and teaching establishments, distributors, extension services,and farmers with both general guidelines and specific advice on agricultural mechanization. Such a consultative committee on agricultural mechanization should include representatives from the following:

- Ministries of Agriculture (and Credit), Finance, Planning and Industry
- Importers and Distributors of agricultural machinery
- National Institute of Agricultural Engineering
- National Association of Agricultural Engineering
- Agricultural universities, colleges and institutes
- Farmers and Farmers organizations.

Its responsibilities would include:

- Evaluation of existing and proposed mechanization policy
- Recommendations on testing and evaluation of machinery, teaching, training and extension at all levels
- Monitoring of standards and performance in the provision and aftersales service of machinery and parts

VI. The Role of National Associations, Institutes and Teaching Establishments

37. Colleges, universities, national associations and institutes may have little direct involvement in the day-to-day provision and management of parts but in the broader context

of developing effective and appropriate mechanization in any country they have a role to play. In particular, colleges and universities should pay adequate attention to parts in their curricula and include specific teaching on parts management. National Associations of Agricultural Engineers and National Institutes of Agricultural Engineering have a role to play in promoting and developing systems to deal with parts supply and service.

VII. The Role of the Manufacturer

38. The manufacturer of agricultural machinery has an overall long-term responsibility to anticipate the requirements of his customers and to modify his existing products or develop new ones to meet these needs. Awareness of trends in technology as well as in agricultural research and practice, knowledge of population changes and economic and social developments are all necessary to both the large international and the normally smaller national manufacturer.

39. In order to fulfil his role the international manufacturer should:

(a) undertake a long-term commitment to supplying the market and not to treat it as marginal business;

(b) provide or make available machinery for testing and evaluation in conjunction with appropriate local organizations;

(c) evaluate the operational conditions, soil and climatic conditions, infrastructure levels, etc., in all areas where machinery will be used and where necessary make appropriate adaptation to his machinery;

(d) recognize the probability of higher marketing and management costs, longer lead times and possibly slower growth and lower profits;

(e) Establish, monitor, and appropriately support, distribution, sales and aftersales service;

(f) provide clear and preferably illustrated instruction books and parts lists with all machinery in the main language(s) of the users;

(g) provide appropriate warranties on machinery and parts;

(h) provide training facilities for distributors staff.

40. The national manufacturer should:

(a) secure adequate financial resources to support development, sales and aftersales service costs;

(b) secure adequate technical know-how;

(c) accept high design and performance standards, especially in a protected market;

(d) Undertake testing and evaluation in conjunction with appropriate local organizations;

(e) establish, monitor and support distribution, sales and aftersales service;

(f) Provide clear and preferably illustrated instruction books and parts lists with all machinery in the main language(s) of the users;

(g) provide appropriate warranties on machinery and parts;

(h) provide training facilities for distributors staff;

(i) collaborate with suppliers of main items of machinery and with other parts manufacturers.

VIII. The Role of the Distributor*

41. The distributor is the focal point for all aspects of aftersales service in agricultural machinery. While the first responsibility is for sales, the second responsibility is for aftersales service and is no less important than the first. This is widely accepted by most distributors and by most of the manufacturers they represent. Subjectively, distributors recognize that poor aftersales service on expensive machinery (the largest single item of expenditure for most farmers) is bound to prejudice future sales.

42. A brief explanation of the status of distributors may be useful. In the case of imported agricultural machinery, the distributor is normally a separate corporate entity from the manufacturer and may be a cooperative or a parastatal agency and may be either a national or expatriate company. In some countries the distributor is a department of a company with wider agricultural and industrial trading interests.

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* In most instances the terms 'dealer' and 'distributor' are used interchangeably. The term 'agent' is sometimes used but an agent acts on behalf of a principal for a fee or commission.

43. The relationship between manufacturer and distributor is normally formal and contractual. The manufacturer sells to the distributor and the distributor resells at his own risk and with varying degrees of discretion on margin or mark-up on machinery and parts. The relationship is to some extent at 'arms length' but the distributor is expected to conform to the overall strategy of the manufacturer and to achieve an acceptable volume of business in the manufacturers' products.

44. In return, the manufacturer hands over the day-to-day business in the country or region to an organization with strong local links, which invests its own capital in the distributorship and deals with the administration of the business up to and including the extension of credit to the farmer customer. The manufacturer's fixed and working capital commitments are correspondingly reduced and personnel commitments are normally confined to temporary technical assistance and guidance (permanent if the business requires or justifies it) and to sales policy liaison.

45. The justification of the system is that the distributor, for the reasons already mentioned, can or should handle the manufacturer's products more effectively and at lower cost.

46. In his relationship with the manufacturer the distributor has an obvious responsibility to advise him of current and anticipated developmentsin prices, on the general business climate and of trends in customers' requirements.

47. The national manufacturer may or may not have the same relationship with his distributor as the international manufacturer. In some cases the national manufacturer may sell through agents or even sell direct and may assume responsibility for service and repair. This may be completely satisfactory for low volumes of business in comparatively small areas, but as the volume and area of sales expand and the capital and managerial requirements increase, there is increasing justification for a division of financial and functional responsibilities.

48. The relationship described above may vary from time to time and from place to place. The distributor may request, or the manufacturer may offer, additional inputs or assistance to meet a special need. The most obvious examples are extended credit to deal with delayed payments or slow moving stock, the return of dead stock, loans for additional facilities or technical assistance in training.

49. Irrespective of detailed variations in the relationship it is the distributor who is directly responsible for aftersales service, including the provision of adequate parts at reasonable prices.

50. The distributor's relationship with his farmer customers is more complex. He must obviously give priority to prompt service at reasonable cost. So far as parts prices are concerned, the distributor is clearly entitled to a reasonable return on his invested capital and a reasonable profit. It is less than reasonable to take excessive margins on parts to compensate for deliberately low margins on machinery. Taken to excess, such a policy is unscrupulous. Just as governments should be consistent in their attitude to imports of machinery and replacement parts for it, the distributor should be consistent in his pricing policy on machinery he sells and the subsequent aftersales service he provides.

51. At some point the farmer may wish to have a machine repaired whereas the distributor may wish to sell him a new one. This is fairly common business situation and may not necessarily reflect adversely on the distributor unless his pricing policies are inconsistent and unfair to the customer.

52. While factors outside the distributor's control may partly determine his pricing policy, the distributor has an obligation to provide aftersales service at reasonable cost to the farmer. Equally, the distributor should not be forced to provide parts or service at uneconomic rates. Where the distributor is a cooperative or parastatal organization, member pressure or government pressure may be exerted to force margins and prices to a level that does not allow the business to operate efficiently.

53. The distributor has a clear responsibility to advise and assist his farmer customers on the correct use and maintenance of his machinery. (In the broader context the distributor should advise his customer on the suitability of the machine for the work it is intended to do.) Instruction books and parts manuals in the main language(s) of the country should be provided with every machine and replaced if necessary. Demonstration and training are also essential aspects of aftersales service.

54. Lastly, the distributor should maintain regular contact with his customers and should encourage them to observe the manufacturer's instructions on service and overhaul intervals. A service agreement which specifies the period which the agreement will cover and the charges which will apply is one way in which satisfactory distributor/customer relationship can be established. The distributor is normally responsible for settling warranty claims on machinery and parts and should adopt an evenhanded approach to his customers and his suppliers.

IX. The Role of Aid Agencies

55. Aid agencies play a significant role in assisting developing countries in the mechanization of their agriculture. This takes various forms - loans, grants, bilateral trade agreements and technical assistance. So far as the supply of machinery and parts under aid is concerned, there are certain guidelines which should contribute to optimum effectiveness.

(a) Donor and recipient should jointly evaluate the suitability of the machinery under offer from the following standpoints:

  (i) the operations to be performed;
  (ii) the probable parts requirements over its working life;
  (iii) the service and repair facilities required.

(b) In some instances the machinery under offer may be new to the recipient country. In these circumstances it is essential that the donor ensures that satisfactory long-term arrangements are made for aftersales service and parts in particular;

(c) Where the machinery under offer is already available in the recipient country the most satisfactory method of supplying parts is through the existing distributor system;

(d) The least satisfactory arrangement is to provide parts up to a certain proportion of the machinery's cost without reference to the distributor and with insufficient or no regard for the pattern and timing of parts requirements. Flexibility in such arrangements is essential to avoid both waste and shortage;

(e) Where donors provide parts on the basis of a certain number of years' requirements the recipient must budget for likely parts requirements in subsequent years, and must, as in the case of the donor, avoid an inflexible approach to the timing and type of parts purchases;

(f) Most problems arise when machinery is provided on a 'one-off' basis. Even though the make and model(s) may already be in use in the recipient country, the aid may be devalued unless manufacturers and distributors are consulted and satisfactory arrangements are made to meet the additional service and repair requirements;

(g) Unless donor and recipient are fully satisfied that the necessary operational and mechanical skills are available to keep the machinery in good working order for the optimum number of years, provision must be made for technical assistance in training;

(h) All aid programmes/projects involving capital goods such as agricultural machinery should be monitored throughout the working life of the machinery rather than the period of the programme/project.

X. The Role of the Farmer

56. The role of the farmer can be simply expressed - to select the most suitable machinery for the work to be done and thereafter to use and maintain it so as to optimize its operational efficiency and working life. In practice the considerations involved are more complex.

57. The farmer's initial decision to mechanize, or to intensify his mechanization, will normally be based on considerations of higher productivity or decreased drudgery or both. He may or may not have the option to buy or to hire the machinery or the service. Depending on the scale of his operations, hiring expensive machinery for specific work such as primary tillage may be the more advantageous decision. There is little doubt that to purchase machinery which can do some but not all the work for which it was intended is an error, and probably an expensive one.

58. Most farmers would benefit from impartial advice on the considerations involved in the purchase of machinery. In many instances it repesents one of the largest items of capital expenditure which a farmer makes and he should seek the best advice he can get from the extension service, from neighbouring farmers and from distributors.

59. If his decision is to buy rather than to hire or rent machinery which will do the required work, the farmer's second responsibility is to satisfy himself that the machinery can be serviced and repaired promptly and at reasonable cost. In his selection of machinery the farmer should recognize the axiom that any machinery is as good as the backup service that goes with it. He should therefore establish whether the distributor offers a service contract on the machinery and furthermore whether any appropriate operator training facilities are available.

60. The farmer should ensure that instruction books and parts manuals in his national language are provided with the machinery of his choice and in his own interest should familiarize himself with and follow the operating and maintenance instructions. If the farmer ignores the specified maintenance procedures or over extends the service interval in the belief that he is saving money the final expense will be much greater and will properly be for his account rather than the distributor.

61. Either on his own or in conjunction with other farmers, he should actively cooperate with the distributor trade, the extension service, national institutions and government, in efforts to maintain the national stock of agricultural machinery in optimum condition.

ANNEX I

- 1) fast moving (i.e. consumables):

filter cartridges
V-belts
gaskets
plugs
pistons
piston rings
roller bearings

- 2) slow moving (i.e. predictables):

V-belt pulley
cable strap
battery
set of wiring
hood fasteners
silencer
injection pump
nozzles
steering arm
steering knuckle
voltage regulator
generator
starter motor
oil filter
oil cooler
control pipe
clutch lining
thrust bearing
brake lining
brake disc
shift pin

- 3) standard components:

spring lockwashers
screws
pins
washers
wing nuts
nuts
bolts
studs
duplex rings
pipe clips
filter cartridges
O-seals
snap rings
rubber seals
rivets
clamps
battery
tires

ORDER | Immediate | Routine | Indent Placed

Part No

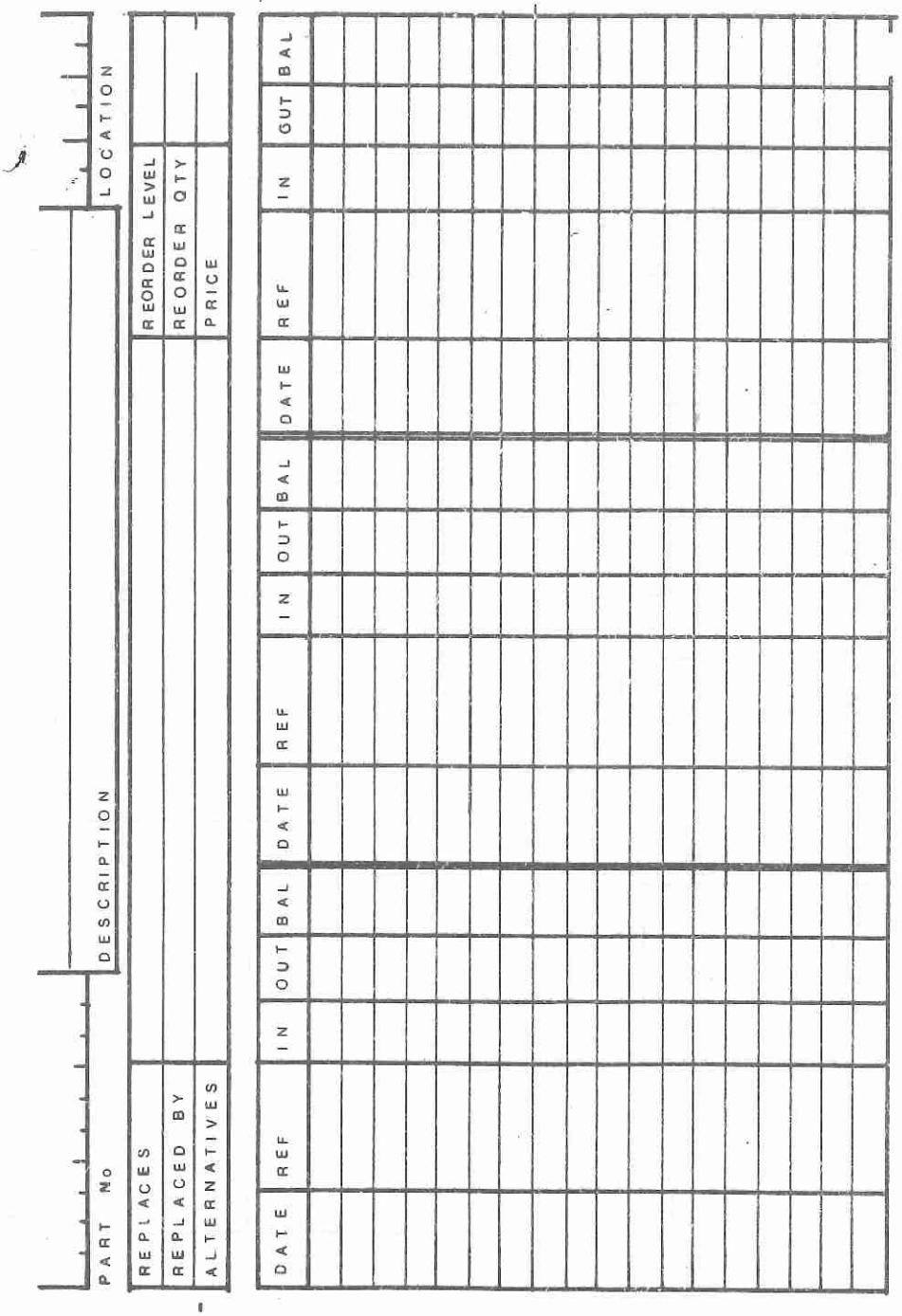
Supplier _____

	Flag month delivery expected												IMM
USAGE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
19													
19													
19													
19													
19													
19													

ORDERS			RECEIPTS		RESERVATIONS				
DATE	ORDER No	QTY	DATE	QTY	DATE	RESERVED FOR	QTY	DATE	ISSD

O.D., N.I.A.E. Stock & Purchase Control Card (SIDE 1)

ANNEX II (cont.d)



(SIDE 2)

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