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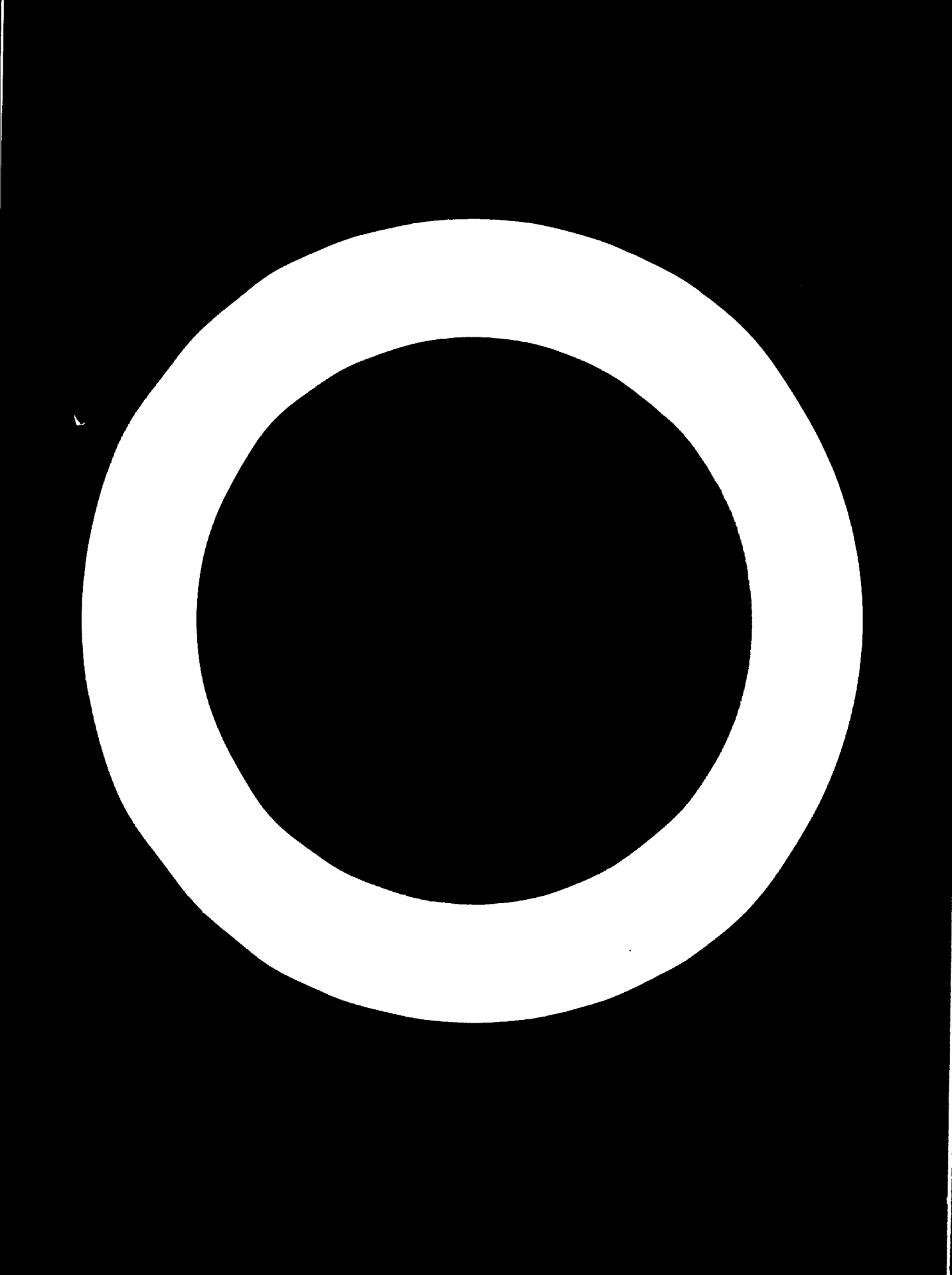
SECOND-HAND MACHINES AND ECONOMIC DEVELOPMENT

by

Netherlands Economic Institute
Division of Balanced International Growth
Rotterdam, May 1958



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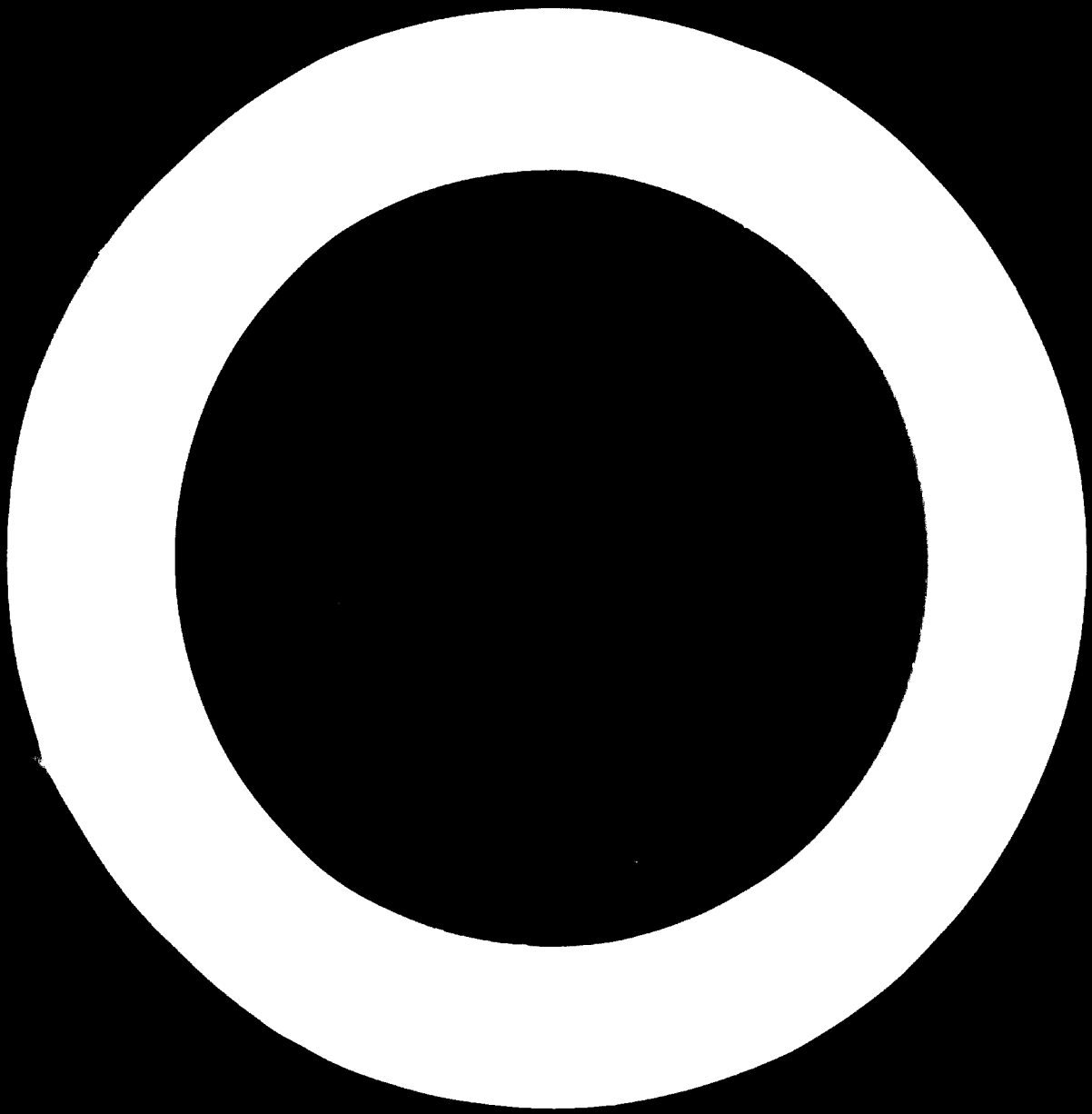
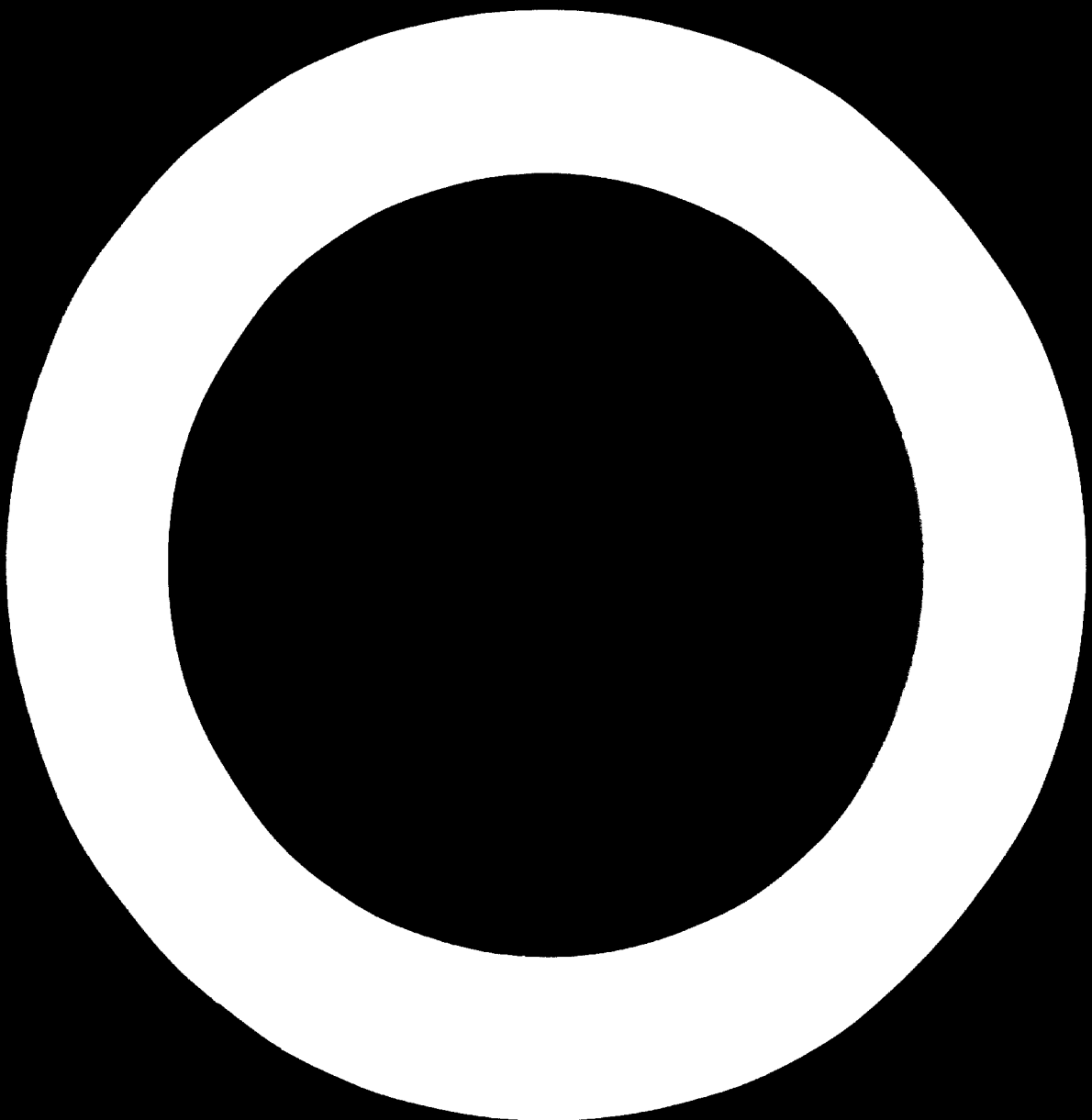


CONTENTS



Preface

This study has been written for the specific purpose of interested persons dealing with development policies in newly developing countries in a method of saving capital by stimulating trade in second-hand capital goods. Therefore, the study has been written in general terms. This subject will require further discussion and research in order to arrive at recommendations on the basis of which trade channels can be properly organised.

A considerable number of the insights upon which this study is based were gained through conversations with persons who themselves are involved in trading of second-hand machines of different qualities. Their co-operation has been indispensable. The Institute very much appreciates their willingness to assist in supplying insights and information.

May 1958

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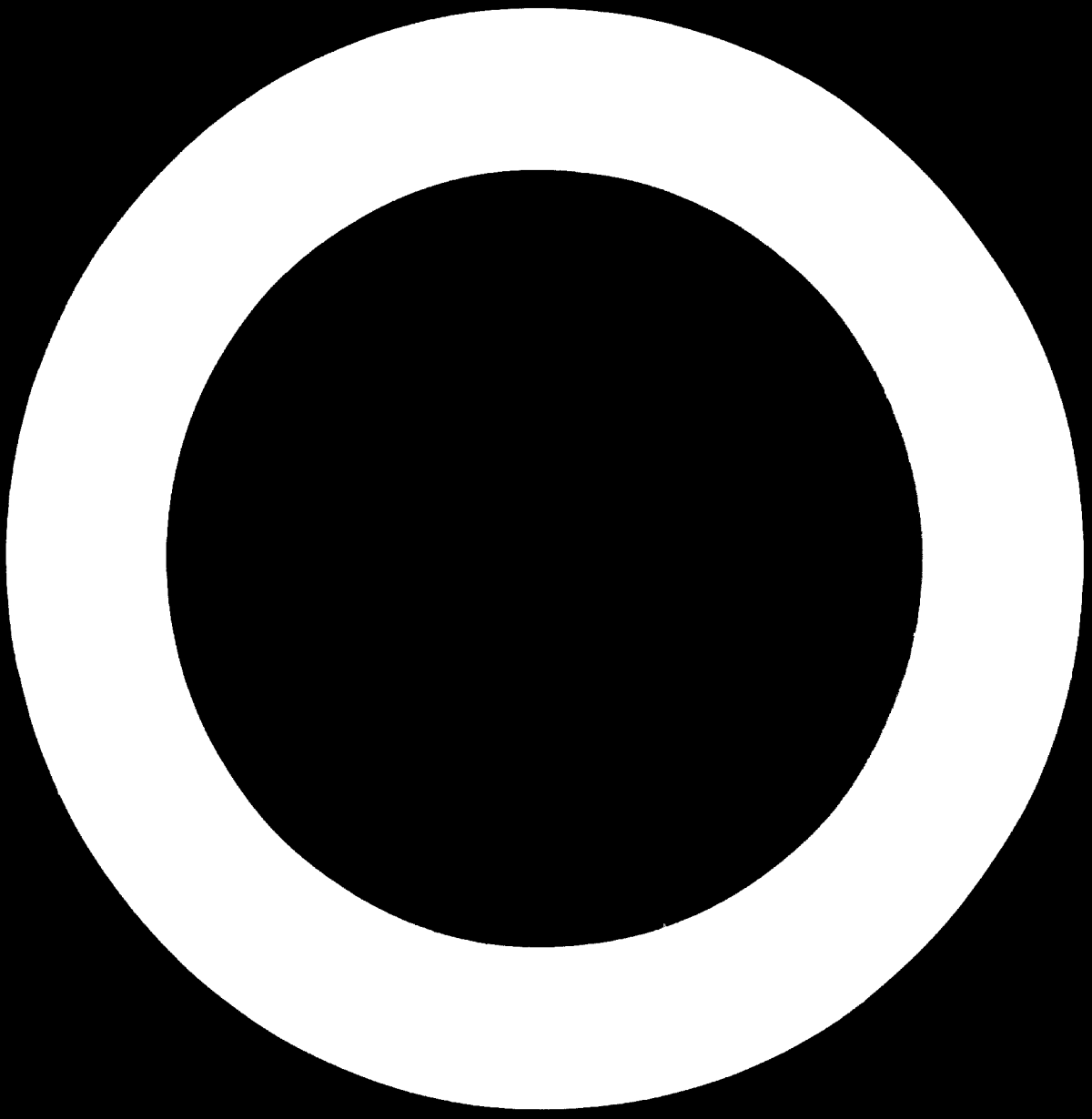

SECOND-HAND MACHINES AND ECONOMIC DEVELOPMENT

CHAPTER I. INTRODUCTION - THREE QUESTIONS

It is generally known that one economic reason for poverty in many parts of the world is a lack of capital equipment. Such areas, even when moved by the drive for economic development, remain poor for a considerable time because a large share of production has to serve direct consumption and, consequently, too little is invested in equipment to increase production.

One of the ways of breaking this vicious circle in newly developing economies is to lower capital costs per unit of product; another is to increase saving and investment.

This paper deals with one possible method of economizing on capital, namely: the employment of used or second-hand capital equipment. There are, of course, other such methods i.e. more intensive use of capital equipment, proper care of machinery, and choosing labour-intensive techniques (for instance, hand-digging equipment instead of motorized mechanical means of earth-moving).

Can some indication be given of the possible extent to which second-hand capital equipment may be employed in newly developing economies? Unfortunately, the research on which this study is based could find no answer in quantitative terms to this question. This study can only indicate when the use of second-hand equipment is feasible, and how this can be discovered in concrete cases. Also, some suggestions for the improvement of trade channels can be presented. Thus, this study is only a first step in a field that it is certainly worthy of further exploration.

In order to know the conditions under which second-hand equipment can play a role in equipping a country's industry, three questions will have to be discussed:

(a) Under what conditions is it technically possible and economically advantageous to use second-hand instead of new equipment? In all cases where this is possible a potential demand for second-hand equipment exists - i.e. there will be potential buyers. For a market and trade to develop, however, two other sets of conditions will have to be fulfilled:

(b) Under what conditions does a potential supply of second-hand equipment exist? and

(c) What conditions have to be fulfilled to make trade channels function properly - i.e. to make potential supply and potential demand effective?

The first two questions will be discussed in Chapter III. The last question will be discussed on the basis of the functions that have to be performed by trade channels. In this last discussion a number of suggestions will be offered for possible improvement of the market in second-hand capital goods.

Before the three questions are discussed, a short survey will be presented on the advantages and disadvantages of second-hand equipment in general - both from the point of view of the individual manager and the economy as a whole of which he is a part.

It should be remembered that many of the ideas and facts presented in this study were gathered during conversations with persons involved in the trade in second-hand and new machine-tools. Therefore, the study will firstly deal with machine-tools and related machines, although the larger part of the findings may in principle also be applicable to markets where other types of used capital goods are traded.

CHAPTER II. SOME GENERAL OBSERVATIONS ON SECOND-HAND EQUIPMENT

In order to familiarise the reader with the problems involved, the technical and economic advantages and disadvantages of using second-hand equipment will be summarised below.

(a) Advantages vis à vis new equipment

(1) Lower price

The lower price of second-hand equipment is an important advantage especially for newly developing countries, where entrepreneurs are short of funds, and the economy as a whole lacks savings. Managers would only have to raise about 75% of the funds they would need to buy new equipment.

(2) Foreign exchange savings

The purchase of second-hand equipment as compared to the purchase of new equipment then implies a saving in foreign exchange expenditures. This is an advantage for newly developing economies that have to cope with a scarcity of foreign exchange.

(3) Less skill needed

In many cases, the operation of the older second-hand equipment involves less skill. The reason for this is that the older machines are less complicated to operate, and often more robust (i.e. they can "stand more mistakes" made by operators). This is true of many motors, and also true in the field of machine-tools. All this is due to the rapid technical development in the advanced economies that produce the equipment. Together with the development of new techniques,

involving many complicated refinements, skills of operators are increased (in economic terms: considerable investment is made to increase the skill of the labour force). Thus, developed economies adjust themselves to technical development. Newly developing economies, however, often have to start with a very limited skilled labour force. If jobs can then be done without employing labour that has a higher degree of skill, a "skill-saving" advantage is gained.[1])

In cases where the skills to operate modern equipment are absent second-hand equipment may sometimes make possible the execution of certain industrial operations.

(4) Shorter delivery periods

Often, the delivery periods for second-hand pieces of equipment are shorter, because the equipment is immediately available. If the difference between the delivery periods for new and second-hand equipment is considered in terms of product lost, the faster delivery of second-hand capital goods may mean a considerable economic advantage.

(5) A more flexible equipment policy may become possible.

The depreciation period for second-hand equipment is shorter and, thereby, the firm has the possibility of shifting to newer

---

1/It may be remarked that this point cannot be generalised with regard to the operation of all second-hand equipment. Often the skills needed to operate modern machinery are considerably lower than those required for older machinery. In such cases, however, the upkeep and repair of such machines involve considerable skills - not their operation. Such highly specialised skills may not be available. Breakdowns then will result in long waiting periods, lost production, and much higher costs.

or different equipment at an earlier date in the future than would have been the case with new equipment. This may be an advantage especially in cases where markets are growing or quickly changing.

(b) Disadvantages vis à vis new equipment

(1) Shorter economic life

A second-hand machine has already lived part of its lifetime. Therefore, the period during which the machine can serve tends to be shorter than that of a new machine. The shorter period during which the machine can perform its duties tends to increase its yearly costs (i.e. a depreciation allowance represented by an annuity to be calculated on the basis of:

(i) purchase price
(ii) rate of interest
(iii) expected economic lifetime).

As a rule, however, the yearly costs of a second-hand machine are still considerably lower than those of its new alternative because the lower price offsets the disadvantage of the shorter economic life.

(2) Increased risk of break-downs

This is one of the main disadvantages of second-hand equipment - especially of more complicated types of equipment. If the period over which it has been already used is relatively long in comparison to its technical lifetime, the risk becomes considerable. The risk results in unexpected losses due to lower production and added repair costs.

(3) Lower efficiency

The output per unit of time of older machines is often lower than that of their modern alternatives. Thus, older ships are slower, older lathes have a lower speed in turning operations, etc. Since the output per unit of time is lower, the output per operating year will be lower and yearly equipment costs will have to be distributed over a smaller number of products. Consequently, equipment costs per unit of product will tend to be higher. Lower efficiency and higher costs per unit of product also may be due to higher fuel consumption and upkeep expenses. Especially in fields where technical development is fast, second-hand equipment will be relatively inefficient.

(4) Lower quality

A fourth disadvantage of second-hand machinery may be found in the lower quality of its product (although this need not be true in all cases). For example, lathes that have been used for a number of years, will turn products with less accuracy than new ones. The comfort offered by older transportation vehicles may be inferior to that offered by their new counterparts. However, it should be remembered that, as a rule, a rather small percentage of production is of the high-quality and high-accuracy type. For example, apart from luxury transportation, there is the much larger institution of "tourist class" with lower degrees of comfort. Another example is offered by the mechanical industry. The high-accuracy part forms a small part of all production performed by machine tools. Thus, an inquiry into Dutch industries discovered that only 20% of the

machine tool work performed in Dutch factories falls within the high-accuracy category. In other words, some 80% of work done in Dutch factories lies within tolerances that can be attained by fair second-hand machine tools. This is not surprising if one realises that the majority of machine tools in any industry in fact fall within the second-hand category, because they have been in operation for some time.

(5) Lack of spare parts

A fifth disadvantage of second-hand equipment may be a lack of spare parts, or long waits for the delivery of such parts. Particularly, equipment of a specialised nature will often suffer from such a disadvantage.

(6) High overhaul costs

As mentioned under 3 supra, second-hand capital goods may be costly in that they demand high upkeep expenses. This may be also true for overhauls. To put a second-hand automobile in good shape again may involve a thorough overhaul and the renewal of many important parts. Such an overhaul may reduce the advantage of a low initial investment.

(c) Qualities required and limitations

The above survey already indicates some of the requirements second-hand equipment will have to meet in order to be traded fruitfully, and the limitations it has for the buyers.

1. The equipment should not have passed so large a part of its technical lifetime that it becomes unreliable in operation;

2. Considering (1), non-specialised equipment of relatively simple construction will generally be a safer buy, even though it has been used. Also, equipment built by well-known manufacturers in the field offer a guarantee of reliability. The problem of spare parts will also be easier to solve for such equipment. Equipment of simple construction also may be of the "skill-saving" type in comparison to its more modern counterparts;

3. A second-hand machine should result in lower capital costs per unit of product than a new one. If costs per unit of produot were about the same in a given case, another argument in favour of second-hand machines remains it requires less finance. This may be an important argument for many firms.

4. If a high degree of efficiency in terms of output per minute is a first order technical necessity, new equipment will have to be purchased.

5. A similar point to that under (4) can be made with respect to such requirements as a high degree of precision and reliability.

The above requirements and limitations are not valid for all cases; there are many exceptions.

CHAPTER III. THE CONDITIONS FOR POTENTIAL DEMAND AND SUPPLY

(a) The conditions for potential demand

A manager considering the purchase of equipment will often think in terms of two or more alternative types. One of the alternatives may be second-hand equipment. The manager will consider the physical and technical possibilities of employing each of the alternative types. Once the technical questions are settled, a comparative cost calculation will be made, by means of which the manager will try to find out which of the technically possible alternatives results in the lowest cost per unit of product[1].

In other words, the manager will make an analysis consisting of four steps before he decides what particular piece of equipment to buy.

1. He will set the technical requirements: i.e. he will ask himself what technical specifications will have to be met to produce the particular product envisaged in the volume foreseen.

2. He will seek information on the different alternative machines available for the production job defined by the first stage of his analysis.

1/The analysis made assumes that the manager is rational - i.e. that he is not biased in favour of certain equipment, because it is fashionable to have it in his branch for instance. Moreover, it is assumed that the manager is free to choose between the alternatives. This is not always the case. For instance, he may see himself forced to buy certain equipment, because the institution providing him with a loan does so under the condition that he buys the equipment prescribed by the institution. For instance, a government financing certain industries may force the managers of these industries to buy home products.

3. He will ask himself, whether he can:
   i. install the equipment in his workshop;
   ii. whether his personnel can handle it, or whether he can attract needed personnel;
   iii. whether the purchase of the new equipment can be financed.
4. Finally he will calculate which of the remaining suitable alternatives can perform the prescribed work in the cheapest way, figured per unit of product.

If an entrepreneur making the above analysis comes to the conclusion that he should purchase second-hand equipment, the conditions for potential demand have been fulfilled.

With regard to the technical part of the analysis, the remarks made in the previous section apply. If second-hand machines can meet the requirements of the manager in question, he can consider a used item as one of the possibilities.

Second-hand machines will only be considered for possible purchase during the second stage of the analysis if there are traders that can give information on such equipment. Thus, efficient trade channels will be needed if the managers looking for equipment for replacement or expansion are to consider second-hand equipment at all.

Given the fact that a manager considers a used machine as one of the alternatives, he may find (during the third step of his analysis) such a machine advantageous because of its lower financial requirements, or even because of the lower degree of skill needed for its operation.

The fourth step involves a calculation of costs. If more than one possible machine is considered, that calculation will have a

comparative character. Such a comparative cost calculation will be demonstrated below because it throws some light on the economics involved.

In making the comparative cost calculation, it is supposed that two similar items of equipment (one second-hand and one new) have passed through the previous steps of the analysis.

Suppose the facts about the two alternative machines are as follows:

Table 1

	Second-hand	New
Price (including installation costs, etc.)	40,000.-	100,000.-
Depreciation (i.e. useful) period	10 years	15 years
Rate of interest for loans	10%	10%
Yearly output (maximum)	18,000.-	18,000.-
Normal output level required	16,000.-	16,000.-
Overhaul and repair costs per year	500.-	400.-
Yearly costs of light, floor space, insurance, etc.	1,000.-	800.-
Fuel and raw material costs for output of 16,000 pieces per year	16,000.-	15,000.-
Labour costs for output of 16,000 pieces per year	32,000.-	30,000.-
Raw material costs for output of 16,000 per year	16,000.-	16,000.-

Since the output to be produced per year by the two alternative machines is to be the same, it will suffice to compare the total costs per year of the two machines[1].

The first cost item to be calculated is yearly capital costs, consisting of depreciation + interest charges. For calculating the annuity representing these costs, an approximate formula can be used instead of an annuity table[2]. According to this formula, the annuities are the following:

Second-hand machine:

$$\frac{1}{10} \cdot 40{,}000.- + \frac{1}{2} \times \frac{1}{10} \cdot 40{,}000.- = 6{,}000.-$$

New machine:

$$\frac{1}{15} \cdot 100{,}000.- + \frac{1}{2} \times \frac{1}{10} \cdot 100{,}000.- = 11{,}500.-$$

Other costs of the two machines are already given in the above table; consequently, total costs can be calculated:

1/An excess capacity of 2,000 pieces is rather normal; it may be needed to meet peaks in demand, or to produce an extra batch, because of some lost time (for instance, in the case that the machine needs an extra overhaul or repair).

2/The formula is based on the rather simple idea that the purchase price of the asset is written off in equal yearly amounts - i.e. sums equal to the purchasing price divided by the number of years at which the depreciation period is estimated. The second term of the formula takes account of the interest charge on the sum invested. Constant yearly figures are calculated for the depreciation period. Since on the average half of the sum is invested, the interest charge has to be calculated for half the purchasing price. The only inaccuracy involved in this method is that no account is taken of interest on interest. However, that error is small for practical purposes.

Table 2. Total costs per year for output of 16,000 pieces

	Second-hand	New
Annuity	6,000.-	11,500.-
Overhaul and repair costs	500.-	400.-
Light, floor space etc.	1,000.-	800.-
Fuel and raw materials	16,000.-	15,000.-
Labour costs	32,000.-	30,000.-
Raw materials	16,000.-	16,000.-
Total costs	71,500.-	73,700.-

It is apparent that in this case production with the second-hand machine is more economical. The cost advantage is due to the lower purchasing price of the second-hand machine which results in a lower capital charge per year, notwithstanding the fact that the useful period of the second-hand machine is shorter.

The calculation also shows that the capital cost advantage has to be considerable for the second-hand machine if the balance is to tip in its favour. The reason for this is that the other (i.e. operating-) cost items are often higher for second-hand machines. The example given demonstrates some of these cost disadvantages of second-hand machines. These may counterbalance, or even over-balance, the capital cost advantage. Such disadvantages of higher operating costs will tend to become relatively smaller, as a type of machinery:

- is undergoing less technical development;
- is simpler in construction;
- and as wear and tear have less influence on operating expenses (which will mostly be the case with machines of simple construction).

Here again we meet largely the same technical aspects that were mentioned at the end of the previous section.

Another point that should be remembered is that the disadvantage of higher operating costs tends to be smaller compared to total costs if operating costs are lower, due to:

- lower wages (those will lower overhaul and other labour costs);
- lower costs of light and floor space (for instance due to a more favourable and sunny climate and lower rents);
- lower per unit costs of fuel and raw materials.

The first two points will often hold true in newly developing countries. This is one of the reasons why, in those countries, second-hand machinery will in many cases be economically advantageous. Moreover, higher interest rates will tend to emphasize the lower depreciation allowances for used equipment in comparison to those for new machines, and thereby add to this tendency. In conclusion, we can say that the conditions for potential demand are often favourable in newly developing countries.

There will be cases in which a manager decides for a second-hand machine even though it is expected to produce at higher unit costs. The reason for such a decision against cost considerations will often be a financial one (for instance the availability of foreign exchange).

b. The conditions for potential supply

In the previous section we have seen what considerations and calculations may influence a manager to consider the purchase of second-hand equipment. However, if he is to consider such a purchase there must be a firm offering the machine for sale.

At first sight, it may seem paradoxical that one entrepreneur considers it advantageous to purchase a second-hand machine instead of a new one, while at the same time another comes to the conclusion that he should sell his old machine and buy a modern one instead.

This section will show that this is not necessarily a paradox. From time to time, a manager will consider whether it is advantageous for him to change his machines for new ones. The analysis he makes will show many similarities to the one demonstrated in the previous section. It will run as follows:

i. The manager will ask himself whether the machine in service still meets the technical requirements set, and whether a new machine can be expected to meet them more successfully. The technical requirements may be high and that may force the manager to consider the purchase of new equipment. Here we have the first reason why one entrepreneur chooses new equipment, while another considers second-hand machines advantageous. The technical requirements set for the product of the former may be higher than those set for the products of the latter. A second technical reason may be that a manager plans to increase output to a level that is higher than the one attainable with the used machine.

ii. If the firm is not forced to buy new equipment for technical reasons, the manager may still do well to proceed with the analysis and ask himself whether or not he should change over to new machines for other reasons - namely, economic reasons. The manager will

first of all have to become informed as to the different alternative new machines that can be purchased for the production job.1/

iii. From the alternative machines available, he will select those which he can install, which his personnel can operate, and which he can finance. From these, he will select the one that has the lowest cost per unit of product.

iv. Finally, he will calculate if it is more profitable to:
   1. sell the old machine and start operations with the new one he is considering;
   2. or continue operations with the old machine.

Clearly, it will be profitable to sell the used machine when its value to the firm in continued use is lower than its sales value.

Of course, the sales value can be determined rather easily in most cases. It may be considerably higher than the scrap value for a used machine that is not worn out. For certain types of machines, the second-hand value can often be determined according to an existing standard formula, depending upon the number of years it has been in use.

1/Here again the manager is assumed to behave rationally. In many cases, unfortunately, this is not the case. Consequently, machinery is kept in the plant until it is worn out, technically, while no periodic calculations are made to see whether costs could not be reduced by selling a machine and replacing it with new equipment. It is for this reason that one of the suggestions for stimulating trade indicated in the part dealing with trade channels, is to let salesmen of new machinery offer "calculation services".

The determination of the value the machine has for the firm is often done incorrectly. The fact that no generally adopted and simple calculation exists in this field often forms an impediment to the supply of second-hand machines, because it leads many entrepreneurs to follow the uneconomical practice of keeping their machines in operation for too many years. Such practice are detrimental to all concerned.

In calculating the value of the used machine for the firm, a manager has to ask the question: what is it worth to keep the used machine, instead of operating a new one - i.e. does it still have value for the firm in comparison to new equipment? That value can be found by calculating the difference between the direct operating costs of the used machine (i.e. wages, power, raw materials and upkeep) and the full costs of the new machine (i.e. its direct operating costs + the annuity representing depreciation and interest charges). This difference taken over the years during which the used machine can still be expected to remain in operation should, of course, be expressed in present "discounted" values. The calculation will have to be made on the basis of a certain yearly output. Thus, the discounted difference between the direct operating costs of the used machine and the full costs of its new alternative is, in fact, what it is worth now for the firm to have the used machine instead of a new one (i.e. it is the discounted "value added" by the old machine during the rest of its operational life).

If the value of the used machine calculated in the above-mentioned way is lower than its sales value, the firm will gain by selling it.

The following calculation is presented to show the practical application of the principle just described.

Table 3

Information on the two machines (figures based on output of 6,000 pieces per year).

	Used	New
Sales value or price	4,000.-	15,000.-
Useful period	5 years	15 years
Rate of interest	10%	10%
Yearly overhaul and repair costs	600.-	400.-
Yearly costs of light and space	1,100.-	800.-
Fuel and raw materials' cost per year	5,000.-	4,500.-
Labour costs per year	2,000.-	1,500.-

Calculation of costs	Direct operating costs, used machine	Full costs, new machine
Annuity, based on purchasing costs of new machine of 15,000, depreciation period of 15 years and rate of interest of 10%: $\frac{1}{15} \cdot 15{,}000.- + \frac{1}{2} \times 0.10 \cdot 15{,}000 =$		2,250.-
Overhaul and repair costs	600.-	400.-
Light and space	1,100.-	800.-
Fuel and raw materials	5,000.-	4,500.-
Labour costs	2,000.-	1,500.-
Totals	8,700.-	9,450.-

The calculation shows that the cost difference amounts to 750.- per year in favour of the used machine. This yearly difference (for the 5-year period over which the used machine can still remain in operation) has to be expressed in present values in order to find the total present value of the used machine.

The total present value has to be obtained by computing the present value of the 750.- cost difference for each of the 5 coming years. This can be done with the aid of the interest (or discount) rate of 10% and the formula for discounting[1].

The computation yields the following (rounded) figures:

present value of cost difference for first year	680.-
" " " " " " second "	625.-
" " " " " " third "	560.-
" " " " " " fourth "	510.-
" " " " " " fifth "	470.-
scrap value of machine (figured at 500.-)	310.-
Total present value of machine if continued in operation	3,155.-

---

1/ The general formula for the present or discounted value of a certain sum a, which is due over x years, is that sum which we would have to invest now, so as to produce the given sum at the end of the x-year period. So if:

a = sum due over:
x years,
r = discount rate
y = the present or discounted value

$$y = \frac{a}{(1 + r)^x}$$

This computation demonstrates that, in this case, selling the machine now is more profitable for the business since it can obtain a price of 4,000.-, while the present value of the machine in continued operation is only 3,155.-.

The computation also teaches us that different wage levels may influence the outcome of our calculations. Thus, a manager figuring on the basis of a lower wage level may come to the conclusion that he should keep the used machine. This indicates that, in newly developing countries with low wages, the managers will tend to keep their equipment longer and consequently save capital. The higher interest rates in those countries will reinforce this tendency.

c. Demand and supply conditions in general terms

The findings of the calculations in the preceding two sections may be put in general terms with the aid of symbols:

U_a = Used machine's depreciation allowance, as calculated by the buyer (i.e. on the basis of the price he pays for it, which is always higher than that made by the seller because trading, transportation and installation costs have been incurred;

U_{dir} = Used machine's direct operating costs;

U_s = Used machine's sales price;

N_f = New machine's full costs;

T = Number of years during which old machine remains operational.

To simplify the procedure, it will be assumed that discounting the figures for future years is not necessary. Thus, for instance, the cost differences between used and new machines as described above need not be expressed in present values, but can be multiplied by T to find the value the used machine has for the firm. This simplification will not significantly alter the conclusions.

Conditions for potential demand are fulfilled, if:

$$U_a + U_{dir} < N_f \qquad (1)$$

Conditions for potential supply are fulfilled, if:

$$T \cdot (N_f - U_{dir}) < U_s \qquad (2)$$

It can be demonstrated that, for entrepreneurs having the same levels of factor costs (interest, wages, etc.) and making the same product, these demand and supply conditions are never fulfilled at the same time. In order to prove this, formula (1) can be written as follows:

$$U_a < N_f - U_{dir} \;;$$

$$T \cdot U_a < T\,(N_f - U_{dir}) \quad \text{(both sides multiplied by T)}$$

If both conditions for demand and supply are to be met at the same time, the following should be true:

$$T \cdot U_a < T \cdot (N_f - U_{dir}) < U_s$$

This can never be fulfilled for the simple reason that $T \cdot U_a$ can never become smaller than U_s, because $T \cdot U_a$ is the sum of depreciation allowances that has to cover the purchasing price of the used machine for the buyer. As explained before, the purchasing price for the buyer is always higher than the selling price of the seller because trade, transport and installation expenses have to be covered.

All this leads to the common-sense conclusion that the conditions for both the supply and the demand for used machinery can never be met for a group of entrepreneurs that work under the same technical and cost conditions.

d. Summary of findings.

The conclusions of the previous sections can now be summarised. The conditions for both demand and supply of second-hand machines can only exist if:

Technically different products are made, or processes are technically different.

1. The seller has higher precision requirements than the buyer.
2. The seller has higher speed requirements to fulfill than the buyer.
3. The seller wants to shift to a higher output level than the one his used machine can achieve, while the buyer's level of output still falls within the limits set by the machine.

Economic conditions are different for buyer and seller

1. The seller can afford to sell the used machine and finance the purchase of a new one, while the financial resources of the buyer are too limited to purchase new equipment;
2. The rate of interest relevant for the buyer is considerably higher than the one the seller has to employ in his calculations;
3. Direct operating costs are lower for the buyer than for the seller, i.e. if:
   i. his wages are lower;
   ii. his repair and upkeep expenses are lower (largely determined by wages also);

iii. his per unit raw material and fuel costs are lower (in cases where the old machine uses more raw materials than the new alternative).

The above summary makes clear why trade in second-hand equipment is feasible both between rich and poor countries and within rich countries. Thus for example, trade in second-hand capital goods not only exists between the United States and South America, but also within the United States.

The above summary also shows why trade in second-hand equipment is highly developed in the United States. The reasons are that:

A. There is considerable supply originating both from firms that have to keep abreast of fast technical development requiring continuous modifications of products and also often a high quality level, and also from firms that have to adjust themselves to continual changes in market conditions requiring changes in the products designed[1]. All this makes for the existence of a supply of perfectly useful second-hand machines that have often been employed for a small number of years and, therefore, are a safe buy.

B. There is a considerable demand because there are a large number of industrial firms that need machines for jobs where the requirements of changing markets or fast technical

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1/The application of the latest findings in the technical field on a large scale, and markets demanding products of modified design are two typical features of an economy with a high per capita income. The US automobile industry offers an example.

development are not so critical. Such firms can very well employ the machines offered, for instance, for a process that is slightly different, or the same process that does not require as high a level of technical efficiency or a first class level of precision.

These points show why it is not necessarily a paradox if second-hand machine trade is highly developed in an advanced economy. Remarkably enough, the newly developing countries often look down upon used capital goods. In some of the latter countries laws exist that even prohibit imports of second-hand machines, thereby robbing the economy of the advantages of second-hand equipment. Thus, a paradoxical situation exists. Economies that can use second-hand machines best deny themselves the economic opportunities involved, while advanced economies make the fullest possible use of the advantages of second-hand capital goods.

Of course, the paradoxical situation is understandable. The fact that both governments and buyers in newly developing countries have purchased second-hand equipment - without taking into proper consideration the conditions under which such equipment has advantages - has lead to many disillusionments. Apart from that, factors at work in the trade sector have left existing opportunities unused or have lead to abuse. Clearly, if trade channels are not well-developed, the advantages of second-hand machinery will remain only potential.

CHAPTER IV. THE TRADE CHANNELS

a. Introduction

As long as trade channels in second-hand equipment remain insufficiently developed, its selling costs are high in comparison to the selling costs of new machinery. The higher selling costs will swell the purchasing price that the final buyer has to pay for second-hand equipment and, consequently, reduce or even eliminate one of the most important advantages of second-hand equipment: its low price.

All this makes it understandable why international trade in second-hand capital goods often only deals with large individual objects, such as aeroplanes, ships or very large and costly machines. In these cases the capital costs saved are so large that trading expenses of each transaction can be covered relatively easily. Even a thorough quality-check becomes financially possible. Such a check moreover is often easier if the item is a costly one because its individual "history" is generally well-known, and that in itself already offers a good indication of the quality, i.e. the safety of the buy.

Other objects often traded internationally are machines that are practically worn-out. Such items are sold at prices approaching those that would be quoted for the machine's weight in scrap iron. The machines are shipped "as they are", i.e. without overhaul or repair. Traders in low-wage countries buy them and overhaul those that need little repair to become useful again for low-accuracy work. They sell the items thus overhauled to repair shops and other small businesses (who often lack the funds for purchasing

new equipment). Often, the overhaul is of the "paint brush type", and the prices quoted are too high for what the machines are worth. The result is that the buyers feel disillusioned and acquire a general distrust of used machines. Such feelings are irrational because they don't take into account the conditions under which the purchase of second-hand equipment is technically warranted and economically advantageous.

The above example shows what an important role mutual trust plays in the trade of second-hand machines; mutual trust between the men in the various stages of the trading channels and between the trader and the final buyer. In long distance trade the lack of contact - because face to face meetings are expensive - is one of the chief reasons why very little mutual trust has developed. Apart from all that, the development of mutual trust has too often been frustrated because the tradesmen themselves have insufficient knowledge in the field, and are of the "quick-profit" type that do not plan a business with an eye to the long run - i.e. on establishing continuing relations.

These introductory remarks may suffice to show some of the main problems of the trade channels. Now a more systematical analysis may be made. First, the functions of the trade channels will be summarized. Second, problems of the scale of trade, specialisation, and integration shall be touched upon. At the same time, some suggestions for improvement will be discussed.

b. Functions of the trade sector

These functions may be summarised as follows:

1. Finding the prospective suppliers

2. Collection of goods from suppliers. Generally, the suppliers

are dispersed geographically. Therefore, traders have to collect their products before they can pass them on to the next firm in the chain or the final buyer.

3. Selection, gradation and pricing. These functions are so closely related that they cannot be considered separately from each other. Once supplies on hand have been put into different quality classes by the trader, the most important price-determining decision has already been taken. One of the functions that is part and parcel of this complex is that of keeping a proper assortment in order to meet the demand for the different types of goods in each class.

4. Distribution of products to the final buyers. This implies finding the buyers, meeting their needs and selling the goods to them. In the field discussed in this report, this function also involves offering information and service to the buyers. This is especially important in the field of trade in machinery, where handling has to be a matter of skill and care.

5. Provision of finance

6. Risks have to be borne

   i. the supplies kept in storage or on the move are subject to the risks of fire damage, quality defects, price changes, etc.; and

   ii. there are risks involving bad debtors.

7. Transportation of the goods

8. Storage of goods during their successive stages of moving from supplier to final buyer.

If trade channels are to exist at all, the above functions must be performed. Under some conditions it may be impossible to perform certain trade functions; for instance, because the density of suppliers or buyers in a certain area is too small relatively to the costs that have to be incurred to reach them. We may assume, however, that there are still possibilities for the further development of trade in second-hand machinery - i.e. it is not the physical and other impediments beyond the control of the trade sector that are hampering its further development. Consequently, it can be assumed that an improvement in the economics of operation will also increase the volume traded - although nothing can be predicted about the extent of this increase.

The following basic problems appear to be involved in achieving an economical performance of the trading functions:

Firstly, there is the problem of the scale of operations. A certain minimum scale is required to make operations on an economic basis possible, since many functions can be performed more cheaply as the scale of operations increases. Any plans about the setting up of certain trade channels should, therefore, be preceded by an analysis as to whether a certain minimum scale of operations can be reached.

Secondly, intimately connected with the problem of the scale of operations is that of specialisation according to products or groups of products; For example, should the second-hand machinery trade be carried on by firms specialising in such trading. Or, could firms trading new machinery also trade second-hand machinery? Another type of specialisation is the one where traders deal in a certain category of items (e.g. machine tools), both used and new.

Thirdly, there is the question of specialised versus integrated firms, from the point of view of functions performed. In other words, should subsequent trade functions be performed by a number of different firms specialised in each of these functions, or should a number of functions be performed by one firm? In reality, we find most firms operate somewhere between full integration and complete specialisation.

With these basic points in mind, a number of suggestions will be drawn up with regard to the improvement of the trade channels for second-hand goods.

c. Some suggestions for the improvement of trade channels

This section will be set up according to the trade functions indicated above.

1. Finding the prospective suppliers of second-hand machinery involves three questions:

i. What second-hand machines are most fit for trade?

ii. Who are the possible suppliers?

iii. What types of firms are most fit to find the suppliers and their products?

The first question has, in fact, already been answered. The suitable items are either very valuable single pieces that can be traded, or smaller items that can be traded "en masse". We shall especially deal with the smaller items because the impression has been gained, from the inquiries made, that trade in the medium and smaller machines seems most difficult to stimulate. Smaller items should have the following characteristics in order to be most suited for second-hand trade:

- simple construction;
- non-specialised (e.g. lathes, drills, etc.);
- built by well-known firms in the field (i.e. with a view to spare parts and repair);
- not older than a certain number of years, below which the large majority of such items can still be expected to be in good running order for non-precision work. This maximum age limit will make for more security with regard to quality (see also under "selection and gradation"). The maximum age could be determined on the basis of experience already gained (e.g. in the United States market), and by consulting manufacturers.

What firms are liable to be the suppliers? Clearly, those firms that decide to purchase new equipment. It is for this reason that finding the prospective suppliers may in many cases be performed best by the firms that sell the new machinery. Thus, trade in second-hand machinery will in many cases begin with firms that primarily sell new machines.

Here the interests of trade in new and used machines run parallel: the more used machines are collected, the more new ones are sold. This process may be stimulated in two ways:

i. by providing financial facilities to firms that would like to purchase new machinery;

ii. by providing what could be called a "calculation service".

Financial facilities are often offered to buyers of new machines. Therefore, this is probably not a field where much improvement would be possible.

Providing a "calculation service" may be a method of suggesting to the users of machines that it pays to sell certain

machines and to replace them with new ones. As mentioned before, the management often modernises too late from an economic point of view, i.e. machines are only sold when they are worn out technically, and not when they have become less economical than new ones. A calculation service could show managements that they should sell certain used machines and replace them by new ones. If the calculation method presented before were developed into a routine procedure, applicable by salesmen of the companies trading in new machines, the salesmen would have a powerful argument with which to convince certain firms to modernise.

2. The collection of the second-hand items from suppliers could, of course, also be organised most economically by the firms selling the new machines if the situation described above prevails.

3. The problem of selection, gradation and pricing is one of the biggest problems in this field. How can a seller of second-hand machinery determine the quality of the items he is going to sell? Completely reliable testing methods are very expensive in most cases, and their application would often nullify the price advantage of the used machines. Therefore, such testing methods are usually not applied - except to very large and valuable items. Consequently, the requirements mentioned under Point 1 seem to offer the only practical possibility of creating a maximum degree of certainty from the point of view of quality. Trade in second-hand machines has often acquired a bad name because the machines traded were too old. In addition, the buyers often acquired too high an impression of the quality from the salesmen of used machines. In the United States the chances for such

mistakes are considerably reduced because the makers of machines have taken care that every machine has a plate that clearly shows the year in which it has been built (that year has often been stamped into the machine to prevent falsifications). Further, catalogues are published that show the value of certain machines after normal use for certain periods. It will be clear that, with such measures, trade in second-hand machines can become an organised affair in which the problems of selection and gradation - so vital to this sector of trade - can be solved with reasonable degree of certainty. Trading firms could increase certainty by adding the "personal histories" of machines, where that is not too difficult to obtain. In many cases, indicating the name of the last user will offer an increased guarantee as to reasonable quality, if the last user is an industrial enterprise with a good name. It will be clear that the above-mentioned measures will be of the greatest importance if international trade in second-hand machines is to be organised on a wider scale especially because personal contacts between persons of international trading firms are mostly more expensive and therefore less frequent than those between domestic businessmen. Since the procedures just indicated offer a reasonable degree of certainty for the large majority of cases, while they consume relatively little time and money per transaction, they are well-suited for trade "en masse".

The question arises whether the potential supply in certain areas is sufficient to attain an economical volume of trade in machines meeting the requirements mentioned under Point 1.

There is no doubt that the supply in the United States is ample. The area that comes next to the USA in importance appears to be Western Europe. One of the difficulties met in Western Europe is the relatively large number of makes in comparison to the USA. Whereas the majority of machine tools is produced by some eight manufacturers in the USA, there are at least 15 to 20 producers of importance in the European market. This complicates the problems connected with selection and gradation, the supply of spare parts, etc. However, taking into account such development such as the European Common Market and the proposed Free Trade Area, the chances are that the future will see combinations of European machine-tool manufacturers that will reduce their number. Apart from that, traders in second-hand machines could specialise in a few of the 20 makes. A sufficient volume of such trade with newly developing countries would, most probably, only be possible for well-known larger dealers (firms moreover that can buy the makes in which they specialise in sufficient volume). This will probably only be possible for firms that operate in the large industrial areas of Europe. Considering previous remarks, the set-up could be the following: firms selling new machines for a few makers could negotiate with those makers to obtain a clear identification plate for each machine (if that is needed) and the catalogue mentioned above. While selling new machines with the help of the calculation service previously mentioned, they could at the same time tap the source of supply of used machines (that will in many cases be of the same makes as the new ones they sell). Consequently, the firms could specialise in trading these

second-hand machines along with their sales activities on behalf of the new machines of the same make. The experience of their technical and sales staffs together with their contacts with the producers would make such firms especially fit to trade in the second-hand "by-product" of their sales of new machines.

In this context an important question arises: will producers be ready to co-operate with such schemes? Clearly, some of them will reason that the sales of second-hand machines will spoil potential markets for new machines. In response to this it can be pointed out that American producers already have taken measures that in fact encourage second-hand trade. Moreover, there is a strong argument for producers to encourage second-hand trade in their make in newly developing countries. Such countries are new and often expanding markets. If the make is introduced there via second-hand trade, there will be more buyers of the equipment because of its lower price. This is true since the majority of firms in such countries suffer from financing difficulties. If second-hand machines are traded in a proper way, these firms will in many cases no doubt decide in favour of a purchase of a used machine. Thereby, that particular make of machine is introduced and, by the time that the machine has to be replaced, the chance may be good that a new one of the same make will be ordered.

4. <u>The distribution of products to buyers and offering them information and service</u>. One may question whether international trade in second-hand machines would have to be integrated (i.e. should the firms collecting the machines also sell them in newly developing countries?). The reason is that the

collecting firms will often have no branch offices in the newly developing countries, and they will not take the trouble of setting them up for the sake of trade in second-hand machinee. However, even if they do have branch offices they may not want to trade the used items because that may spoil their reputations and conseequently do harm to their sales of new machinery. Therefore, branch offices and subsidiaries of the collecting US and European firms will often want to remain specialised in the sale of new machines. Consequently, a separate set-up will have to be employed. Here we run into another difficulty that prevents the used machine trade from growing. The trade sector of newly developing economies is often insufficiently developed to handle trade in machines - let alone second-hand machines, which is a branch that demands a combination of technical and commercial skills. Here one may ask whether it would not be possible for governments to play a stimulating role. Governments may establish contacts with machine traders in Europe and the USA in order to stimulate the organisation of sales of second-hand machines in their country.

For an initial period, co-operation could be established between governments and machine traders on the basis of contracts stipulating the purchase of certain amounts of machines, while the company would on its part provide technical assistance to organise sales and servicing activities and train the necessary personnel in the newly developing country. The contract could be of a mixed character if necessary, i.e. providing for the purchase of both new and second-hand machines. Using such contracts, existing branch offices of the trading firm dealing

solely in new machines could most probably offer their services without risk to their name and goodwill. It will be clear that such contracts will only make sense if the scale of trade is sufficient to cover the expenses of the technical assistance involved. The required minimum scale of trade may, in the beginning, only be attainable in the larger newly developing countries.

5. The provision of finance for used machines could be more difficult than it is for trade in new machines. The reasons are that the quality of the goods traded is not as secure as it is in the case of new machinery and the financial position of the debtors is weaker on the average (many of them buy second-hand equipment because of a weak financial position). Consequently, the credit required to finance this type of trade suffers a greater risk than that needed for trade in new machines. As risk bearing and providing finance can in practice seldom be divorced from each other, the firms providing the credits will have to take a part or all of the risks. Even then, credit may be difficult to obtain, in many cases, and it will also be more expensive. Therefore, financial arrangements may have to be part of the contracts mentioned above. For instance, the government of a newly developing country could offer certain guarantees against bad debts, just as the trading company on its part would offer certain guarantees with regard to the quality of the machine.

6. Risk bearing, insofar as it is connected with the provision of finance, has already partially been treated in the previous paragraph. However, there are more risks. A buyer of used

machines may pretend that the quality is poorer than can reasonably be expected, e.g. that a machine purchased broke down after a few weeks. How can the supplier know that the complaints made are reasonable if the buyer lives far away, and travelling expenses for a technician to check on the spot are prohibitive in comparison to the sale made? He will often send the parts demanded without taking the trouble of sending one of his men. Buyers, knowing this, may abuse this situation by pretending breakdowns that have not occurred. The best guarantee against this type of abuse is a sales organisation in the newly developing country itself. Clearly, the expenses of making checks on the spot will, in most cases, not be prohibitive for such an organisation. Here we find another argument for the form of co-operation suggested above.

Furthermore, contracts made could contain a clause that provides for a penalty in cases where claims by the buyers prove to be unjustified (a penalty sufficient to cover the expenses involved in making the check on the spot). In general, contracts should be written with great care to provide guarantees against misunderstandings and abuse. It should be clearly stipulated what does and does not fall under guarantees and for what period. Standard contracts could prevent extra costs and trouble.

Apart from the above risk which is peculiar to used-machine trade, there are a number of normal risks such as fire damage and other similar risks due to mishaps. These are not higher due to the fact that used goods are traded. Therefore, normal insurance coverage should be possible.

The risk of price changes will have to be borne by the trading firms themselves, and there seem to be no reasons to assume that such risks are excessive and that insurmountable problems exist here to impede trade.

7 and 8. Transportation and storage are functions that can also be performed in the normal way, without any special provisions that have to be made because the machines are used. Therefore, these functions create no special problems.

d. Summary of the main suggestions for improvement of trade channels.

1. Finding prospective suppliers and collection could in many cases be organised by firms selling new machines. In doing so, such firms could offer "calculation services".

2. Equipment most fit for second-hand machine trade of smaller items on a large scale is non-specialised equipment of simple construction, built by well-known firms, and not older than a certain age (to be determined on the basis of experience for each type of equipment). If the trade sector sticks to equipment complying with the above characteristics, the problems of gradation and pricing will be considerably simplified because the risks of poor quality would be kept within reasonable limits.

3. In newly developing countries where proper trade channels for used machinery are still in their infancy, governments may stimulate their development in the beginning. For an initial period the government could make a contract with a

well-known trading firm, stipulating the purchase of certain amounts of machines and the provision of technical assistance on the part of the firm. Such a form of co-operation would offer possibilities of coping with problems like sales, information to buyers, servicing, and the risks involved in financing (bad debtors), abuse and quality defects.

CHAPTER V. OVERHAULING AND REBUILDING - SOME REMARKS

The previous pages have dealt with the functions to be performed by the trade sector. One may ask whether it would pay for second-hand machines to be overhauled and rebuilt before they are sold to the users.

Overhauling and rebuilding has the following advantages and disadvantages.

a. Advantages

Technical aspects: Improved performance in terms of speed, accuracy and reliability.

Economic aspects: more value produced due to more efficient operations (speedier and less risks of breakdown), and in many cases the possibility of performing more jobs than would have been possible without rebuilding (e.g. a rebuilt lathe can cover a wider range of tolerances because it can do higher precision work after rebuilding). Breakdown claims will be reduced and it will be possible to offer a guarantee.

b. Disadvantages

Technical aspects: since rebuilding machines requires highly skilled mechanics and bench-workers, it may be questionable whether all machines that are called "rebuilt" have really gained in technical performance. The term "overhaul of the paint-brush type" has already been mentioned. In other words, overhauling may only be pretended on the parts of some dealers since they lack proper skill and experience.

Economic aspects: a good rebuilding job requires first class skills and considerable experience; it is costly.

It becomes relatively costlier as the value of the machine to be rebuilt is lower, since there are always a number of more or less fixed costs involved. Some of those costs are the following: transportation and insurance to the rebuilding plant, the costs of taking the machine apart and finding out what parts need a thorough overhaul and even replacement. All these costs tend to decline less than the value of the machine - i.e. such costs will probably prove to be a smaller percentage of the value of a large machine worth $500,000, - than of the value of a machine worth $5,000. It is basically for this reason that the rebuilding of large machines is more common than the rebuilding of smaller units.

All this may explain that overhauling and rebuilding is expensive and risky, and generally only pays if it is done by highly experienced firms in the field and for large units. Therefore, newly developing countries that still have to build up trade channels would probably be wiser to abstain from setting up overhauling and rebuilding establishments. To prevent failures first things have to come first.

CHAPTER VI. NATIONAL PRIDE - AT WHAT PRICE?

This report would not be complete if it did not mention an impediment to the second-hand machine trade that is of a psychological nature. It sometimes happens that newly developing countries forbid the trade in second-hand capital goods not only because of disappointments, but also because it is supposed to be unacceptable from the point of view of "national pride".

Here we enter a field of value judgments about which no scientific discussion is possible. The only remark that can be made in this study is that decisions to prevent second-hand machine trade are often made without regard to the potential advantages to be gained. In other words, the officials taking such measures do not ask themselves what price they make their countrymen pay for "national pride".

If they consider the problem more fully, such officials may come to the conclusion that it is worthwhile to devise regulations that can prevent disappointments and abuse in the future, rather than to forbid the import of all used machines. Such laws do not exist in most developed countries; apparently officials in those countries do not consider the importation of second-hand equipment unacceptable for their nations' pride.

It may be hoped that this psychological obstacle to the development of trade relations will play a smaller role in the future.

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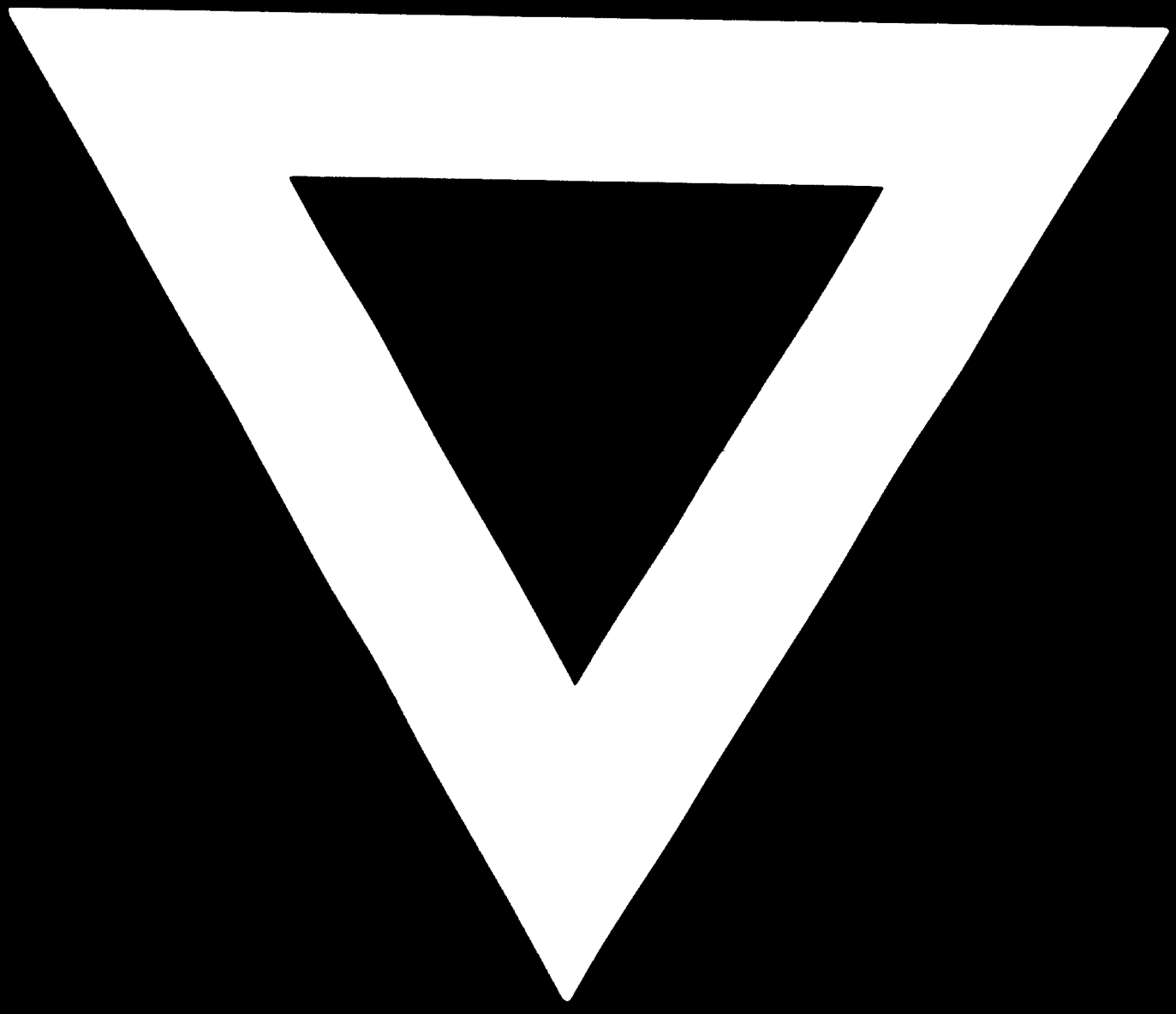

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