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THE DEVELOPMENT OF THE ENGINEERING INDUSTRIES IN EAST AFRICA—MECHANICAL ENGINEERING

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THE DEVELOPMENT OF THE ENGINEERING INDUSTRIES IN
EAST AFRICA-MECHANICAL ENGINEERING

I. INTRODUCTION

1. This report deals primarily with the consumption and production of mechanical engineering goods in East Africa and the prospects for the development of the mechanical engineering industries. These industries include three main divisions, first, the production of metal goods such as building components and household equipment, secondly machines and thirdly transport equipment. For further analysis, these divisions are divided into sub-groups according to the Standard International Trade Classification as follows:

69. Manufacture of metal

Finished structural parts and structures n.e.s.
Metal containers for storage and transport
Wire products (excluding electric) and fencing grills
Nails, screws, nuts, bolts, rivets and similar articles
of iron, steel or of copper
Tools for use in the hand or in machines
Cutlery
Household equipment of base metals
Manufactures of metal, n.e.s.

70. Machinery

Power generating machinery, other than electric
Agricultural machinery and implements
Office machines
Metalworking machinery
Textile and leather machinery
Machines for special industries
Machinery and appliances (other than electrical) and
machine parts, n.e.s.

73. Transport equipment

Railway vehicles
Road motor vehicles
Road vehicles other than motor vehicles
Aircraft
Ships and boats

2. Electrical machinery and apparatus (division 72) and iron and steel (division 67) are the subjects of separate reports and are considered here only to the extent that they are necessary in making long-term projections of total demand.

3. No information has been compiled on French Somaliland and Reunion. Mozambique, although not within the sub-region, has been included in the demand forecasts as representing a possible market for the industries of the sub-region.

II. PRESENT CONSUMPTION OF ENGINEERING PRODUCTS

4. The present level of consumption of engineering products in East Africa has been derived from data on production, imports, and exports made available, partly, in response to a questionnaire sent out by ECA and partly from foreign trade statistics. The information obtained related usually to the years 1961/3, and may therefore be considered as giving an average figure of consumption in 1962. In some cases, only value figures were available, in which case they were converted to quantity (tons) on the basis of a detailed product analysis of more complete returns from other countries. No returns were obtained from Rwanda and Malawi - accounting for about 3 per cent of the consumption of the sub-region - and for these countries, estimates were made on the basis of their gross domestic product. The basic information resulting from these enquiries and estimates is presented in Annex I.

5. Total imports of iron and steel and of engineering products, that is, virtually total direct and indirect steel consumption during this period, amounted to 770,000 tons, of which about 430,000 was iron and steel including about 5 per cent non-ferrous metals. The largest consuming country was Rhodesia, and the smallest Somalia.

As shown in the following table, total consumption per head in most countries ranged from 2 1/2 to 10 kilograms, with higher levels of consumption in Kenya (17.5) and in Mauritius, Zambia and Rhodesia (30 to 50). The average for the sub-region was about 10 kilograms.

Consumption per head of all engineering products in 1959/60East African Countries

| Country | kgs. |
|------------|------|
| Ethiopia | 2.43 |
| Somalia | 2.9 |
| Malawi | 2.9 |
| Uganda | 3.4 |
| Burundi | 4.75 |
| Rwanda | 4.9 |
| Tanzania | 5.23 |
| Mozambique | 7.9 |
| Madagascar | 8.5 |
| Kenya | 17.4 |
| Zambia | 30.2 |
| Mauritius | 39.7 |
| Rhodesia | 56.8 |
| Sub-region | 9.9 |

In comparison with these figures, consumption per head in other countries of the world ranges from about 10 kilograms in Pakistan and India to from 400/500 kilograms in USA, Czechoslovakia, Germany, Sweden.

Distribution of consumption per head of Engineering Products1959/60

| | | |
|--------|-------------|--|
| Low | 10-20 kg. | India, Turkey, Pakistan |
| | 20-50 kg. | China, Portugal and Greece |
| Medium | 130-210 kg. | South Africa, Finland, Israel, Poland, Austria, Italy |
| High | 250-500 kg. | Belgium, United Kingdom, Germany, Sweden, Czechoslovakia, United States of America, Canada, Union of Soviet Socialist Republics. |

III. THE PRESENT SITUATION OF THE ENGINEERING INDUSTRIES IN EAST AFRICA

6. Of the total consumption of engineering products (including basic iron and steel) in the sub-region of 770,000 tons in 1962 it is estimated that local production accounted for 190,000 tons or 25 per cent. The highest production was in Rhodesia (70,000-80,000), followed by Zambia (40,000-50,000), Kenya (30,000-40,000), Tanzania (35,000-40,000) and Ethiopia (7,000-10,000). Countries with a production below 1,000 tons per annum included Burundi, Rwanda, Somalia, and Madagascar. It should be noted that the figure for Rhodesia is increased by the output for local consumption of the substantial primary iron and steel industry and for Tanzania by that of the aluminium processing and galvanizing industry.

The engineering industries proper, i.e., excluding the basic metal industries, are relatively well developed in relation to manufacturing industry generally, accounting for 20 per cent of the net output of all manufacturing industry in Kenya and 25 per cent in Rhodesia. Nevertheless, with the development of the economy, the demand for engineering products becomes steadily more important, and engineering goods (excluding iron and steel) account for over one-third of total imports into most countries including Kenya and Rhodesia, which have already a substantial engineering industry.

7. Turning now to mechanical engineering, the most developed sector in all countries is the fabrication of metal products for building and household purposes accounting, e.g., for about one-third of total engineering output in the case of Kenya and one half in the case of Zambia. In the most industrialized countries of the region, two-thirds of this market is supplied by local industry, and in all countries there is at least one factory engaged in these activities.

Light building components are fabricated in structural engineering works in all countries, but because of the handling facilities, sawing, and welding techniques required, the heavier structures are made only

in Rhodesia and Tanzania. In the smaller markets, the structural engineering works include in their activities are manufacture of window and door frames and metal furniture generally, but in the larger markets, e.g., Rhodesia and Kenya, these activities are specialized.

The next most important activity undertaken in most countries, with the exception of Malawi, Somalia and Rwanda, is the manufacture of holloware. Other metal containers for commercial purposes are less generally manufactured, depending in the case of cans, for example, on the availability of exportable agricultural produce.

Wire and wire products are made primarily in Rhodesia, but also in Tanzania and Mauritius. Smaller items include chains, springs, crown corks primarily manufactured in Rhodesia and razor blades manufactured in Tanzania.

8. The next most important activity is the manufacture and especially the repair of transport equipment accounting, e.g., for about one-quarter of total engineering goods products in Rhodesia, Kenya and nearly one-half in Zambia. The repair of road vehicles, railway rolling stock and ships is a most valuable introduction to engineering in under-developed countries since it is easily embarked upon and is free from competition from abroad as repairs are necessarily undertaken in the country where the vehicles are used. An estimate for repairs to road vehicles may be based on the number of vehicles in each country, assuming an average annual value of work done per vehicle (including the value of spare parts) of \$140. In all countries with the exception of Rhodesia the output of this work far and away exceeds that of new equipment.

The proportion of the market for new vehicles held by the domestic industry in the most industrialized countries of East Africa is about one-third. Production falls into the two main categories of complete assembly and partial manufacture. Light commercial vehicles are assembled from imported parts, the method of assembly as carried on, for example, in Salisbury, Nairobi or Tananarive being the same as in

Europe, except that it is less automated, e.g., the work is not carried on a belt and the division of labour is less intensive. Otherwise, the same jigs are used to control welding, bolting and drilling operations as elsewhere. Manufacturing consists of the fabrication of bodies for buses, trucks and heavy commercial vehicles using imported chassis and the construction of trailers using imported wheels and axles. The manufacture of bicycles is being started in Uganda with progressive manufacture of parts to reach 80 per cent in five years.

9. The railway repair shop in any African country is easily the largest and most important engineering establishment. In the main shops, e.g., at Nairobi, Bulawayo, Djibouti, Tananarive, rolling stock including locomotives, wagons and carriages are maintained and repaired according to a regular schedule and the more rapidly wearing parts such as brake blocks, axle boxes, springs and many other components are manufactured in the foundry, forge and machine shop of the works. In some countries, e.g., Rhodesia and Madagascar, the manufacture of wagons and carriages using imported wheels and axles is undertaken and in others, e.g., Kenya, these are assembled.

10. Dry dock and slip way facilities for ship repairing and building exist in Kenya (Mombasa), Madagascar (Diego-Suarez), Mauritius (Port Louis) and ships up to about 3,000 tons can be built in these places. Ships for lake traffic and fishing boats are built up to 1,000 tons at Kisumu on Lake Victoria and up to 100 tons at Burundi on Lake Tanganyika.

11. The production of machinery is the least developed of the metal industries in East Africa (less than 10 per cent of the market in the most industrialized countries) mainly because the national market for the specialized machines used in industry is not large enough. Most of the output consists of repairing imported machines which, in this case, however, is a manufacturing activity since it involves the casting, forging, or machining of replacement parts. The output of new equipment

is in general limited to accessories in general use, such as valves and pumps and equipment for the large basic industries of Africa, i.e., grinding equipment for the mines and milling equipment for the processing of agricultural produce, e.g., cane sugar, oil seeds, sisal, etc. Tractor-drawn agricultural implements (light ploughs and harrows) are manufactured (ex. discs and ball bearings) in Kenya and Rhodesia, assembly and progressive manufacture of diesel engines in Kenya, and it is proposed to manufacture tractors in Uganda. Sewing machines are partly manufactured and assembled in Rhodesia.

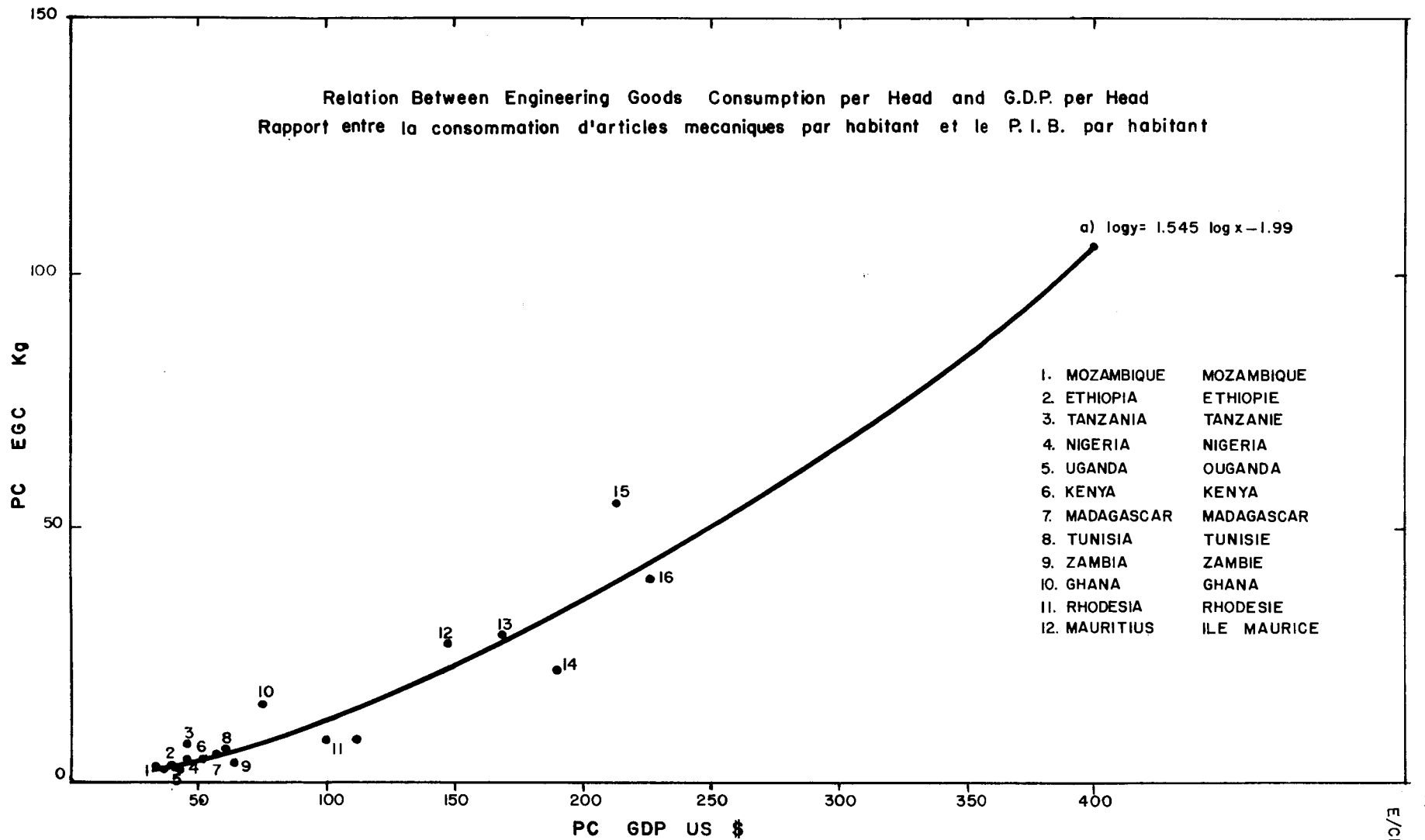
IV DEMAND PROJECTIONS

12. Since engineering goods, either directly in the form of steel for construction, or indirectly in the form of machinery and vehicles, enter into all sectors of the economy, it is reasonable to relate their consumption to the development of the economy as measured by the gross domestic product. The following table shows the level of GDP per head in various African countries in 1962 and the corresponding level of total engineering goods consumption.

Engineering goods consumption and GDP

| | GDP/cap US \$ | EGC/cap kg. |
|------------|------------------|----------------|
| Ethiopia | 42.7 | 2.43 |
| Mozambique | 50.0 | 7.9 |
| Tanzania | 55.0 | 5.23 |
| Nigeria | 60.0 | 6.2 |
| Uganda | 63.7 | 3.4 |
| Kenya | 79.2 | 17.4 |
| Madagascar | 112.8 | 8.5 |
| Tunisia | 147.0 | 27.5 |
| Zambia | 185.0 | 30.2 |
| Mauritius | 189.6 | 39.7 |
| Ghana | 190.0 | 27.5 |
| Rhodesia | 210.0 | 56.8 |

Relation Between Engineering Goods Consumption per Head and G.D.P. per Head
 Rapport entre la consommation d'articles mecaniques par habitant et le P.I.B. par habitant



- | | |
|---------------|-------------|
| 1. MOZAMBIQUE | MOZAMBIQUE |
| 2. ETHIOPIA | ETHIOPIE |
| 3. TANZANIA | TANZANIE |
| 4. NIGERIA | NIGERIA |
| 5. UGANDA | OUGANDA |
| 6. KENYA | KENYA |
| 7. MADAGASCAR | MADAGASCAR |
| 8. TUNISIA | TUNISIE |
| 9. ZAMBIA | ZAMBIE |
| 10. GHANA | GHANA |
| 11. RHODESIA | RHODESIE |
| 12. MAURITIUS | ILE MAURICE |

A regression line (see chart) fitted to the above data gives an elasticity of 1.545 for increases of steel consumption in relation to increases in GDP per head, so that for the sub-region as a whole, corresponding to the expected increase in GDP per head of 3 per cent from 1962 to 1970,^{1/} that of engineering goods should increase by 4.6 per cent. After taking account of expected population increases this gives a total increase of 6.7 per cent per annum.

Over a period of twenty years, such a rate of growth would give a total increase in consumption of 440 per cent. Increases of this magnitude have in fact have been obtained during the last twenty years in many countries where consumption, as in Africa, was initially at a low level. The following table shows increases in consumption of engineering goods per head in the twenty years subsequent to 1936/38 in a number of countries with an initial consumption below 50 kilograms per head. The rate of increase of GDP in these countries during the period was between 6 and 10 per cent per annum. Only in the case of Portugal, Turkey, Greece and UAR has the increase in consumption been relatively small, and in the UAR during the last five years of the period an increase in consumption per head of 75 per cent was achieved.

^{1/} The rates of growth for individual countries are given in Annex II. It should, however, be appreciated that isolated economies like Mauritius and Reunion have special problems (such as the low basic land: man ratio) in their economic development, and this study assumes explicitly that the future development in these economies will continue to leave at least as large an industrial component as obtains at present.

Increase in consumption of engineering goods

| | 1936/8 | 1956/8 | |
|------------|-------------------------|-------------------------|----------------------|
| | EGC/cap 1936/8 kg | EGC/cap 1956/8 kg | Per cent increase |
| Brazil | 11 | 37 | 340 |
| Yugoslavia | 17 | 78 | 460 |
| Italy | 52 | 143 | 300 |
| Israel | 42 | 145 | 350 |
| Poland | 30 | 195 | 650 |
| China | 3 | 20 | 670 |
| Venezuela | 37 | 105 | 285 |
| Hungary | 50 | 174 | 350 |
| Rumania | 22 | 124 | 560 |
| Spain | 15 | 70 | 465 |
| Portugal | 23 | 41 | 180 |
| Turkey | 10 | 14 | 140 |
| Greece | 24 | 33 | 140 |
| UAR | 15 | 22 | 150 |

13. The above relation between increases in GDP and increases in total engineering goods consumption has been used to make demand projections for each country in 1970, 1975 and 1980 as shown in Annex II.

Total consumption is expected to increase from the 1962 level of 770,000 tons to 2,740,000 by 1980, i.e., about 3.6 times, and per caput consumption from 10 kilograms to 24 kilograms, i.e., by 2.4 times, which is realistic having regard to the experience of other countries.

Within these increases, changes are expected in the relative importance of the various groups of engineering products and a study has been made of the relation between increases in GDP per head and the percentage which each group forms of total consumption. Groups forming an increasing proportion of total consumption include agricultural

machinery and wire products, and groups forming a decreasing proportion (although increasing absolutely) include hand tools and bicycles. In this way, a table has been derived showing the estimated consumption of the main categories of engineering products for each country^{1/} in 1980 and for the sub-region as a whole in 1970, 1975 and 1980 (Annex III)

^{1/} In the case of the countries belonging to the former Central African Federation the basic figures were increased by 20 per cent to compensate for the low level of consumption in 1961/3 relative to earlier years.

V. THE TYPE, SIZE AND LOCATION OF ENGINEERING WORKS

14. From the purely economic point of view, metal processing works like other factories should be located at the point of lowest cost, including the cost of manufacturing at the site and the cost of assembling raw materials and delivering the finished products to the market. In general, in metal processing, raw material (metal) losses are relatively small and since the cost of transporting finished products per ton mile is from two to six times as high as the cost of transporting raw material (steel sheets or sections) factories are located near the market which also tends to be a local or national market. This tendency is stronger, for example, in the foundry industry where processing losses are high, raw material (scrap) is locally available and where there is also a local market for repair work and construction. Similarly, in the canning industry where the transport cost of tins is about eight times as high as on tin plate, production of cans is located in the agricultural areas which also saves the cost of transporting the produce.

The location and accessibility of the market is determined by the transport system and the distribution of population. The transport system provides good links between Burundi, Uganda, Kenya and Tanzania, but in comparison isolates Ethiopia to the north and, to a lesser extent, Zambia and Rhodesia to the south. This separation is reinforced by the present distribution of population. Tanzania is divided into two market areas, one on the coast centered on Dar-es-Salaam and the other on the southern shore of Lake Victoria. On the other hand the arbitrary choice of limits to the sub-region obscures the fact that Zambia has a substantial market in Katanga and Burundi in particular in the Eastern Congo.

The general market division for the sub-region in 1980 is therefore approximately as follows:

| | |
|----------|-----------------------------------|
| Rhodesia | 720,000 tons plus part Mozambique |
| Zambia | 400,000 tons plus part Katanga |

| | |
|---|--------------------------------------|
| Kenya, Uganda, part Tanzania, Rwanda, Burundi | 880,000 tons plus part Eastern Congo |
| Ethiopia | 160,000 tons |
| Madagascar | 150,000 tons |
| Mauritius | 100,000 tons |
| Malawi | 30,000 tons |
| Somalia | 20,000 tons |

Plants requiring a market larger than that available in the smaller countries are likely to be located in the first three areas and plants requiring a sub-regional market with distribution both by land and sea a coastal location, e.g., Dar-es-Salaam.

These market divisions are less significant for high valued products, engineering products costing US\$ 1,900 to 2,500 per ton will be more efficiently manufactured and transported on a sub-regional scale than structures or castings costing \$250 to \$500 per ton, for which transport charges over a distance of 500 miles will amount to \$16 to 50 per ton according to loadability.

15. Off-setting the tendency towards a number of local or national factories are the economies of scale and lower manufacturing costs which can be obtained by producing on a large scale for a sub-regional market. These economies consist, first of all, of superior processing methods, e.g., the use of more powerful machines which work faster and shape metal more quickly, the shaping of metal by pressing instead of cutting, the use of special tools in presses, etc. In some cases, e.g., the pressing of car bodies for passenger cars and the manufacture of some components for engines, these economies are decisive. The second economy of scale comes from the possibility of a greater division of labour allowing the operatives to specialize on particular jobs. This is important under African conditions since the efficiency of African labour is much higher on repetitive work. The third economy arises when the scale of operation is sufficient to use to the full the minimum managerial and technical staff necessary for the process in

question and to secure full time operation of plant and machinery by being able to switch production when necessary and so operate on a three shift basis. In the short-term, this is probably the most important economy of scale since technical staff and machines are both very expensive in relation to the level of African wages and to achieve it many establishments make a variety of products and sacrifice the first two economies. The fourth economy derives from the fact that, in general, the capital investment per unit of production is smaller in a large factory than in a small one. This economy must be linked, of course, with the possibility of working as closely as possible to a three shift continuous basis.

16. On the basis of a consideration of manufacturing operations in Europe and the United States, a minimum size has been established for typical plants in each group of engineering activities (Annex IV). Under African conditions it may be assumed that the labour force will be about half as large again as in Europe, i.e., that productivity will be two-thirds of European productivity, and one-third of productivity in United States small plants, and the investment per unit about one-third higher. It will be seen (Annex IV) that these plants usually lie in the range 200 to 500 persons employed under European conditions. Below this figure, and even assuming that the market is available, it is doubtful whether plant and skilled personnel can be fully employed, and above this figure, there may be distribution and managerial difficulties. Such plants are larger than those normally regarded as belonging to small-scale industry. As indicated in another paper, there is considerable scope for small-scale industry but, in general, larger factories with greater capital equipment are necessary to secure long-term increases in productivity.

VI. PROPOSED FACTORIES

17. Since it may be considered that it takes about one year to project a factory, one to two years to construct it, and another year for training and running-in, many of the factories proposed below are not likely to come into production until the 1970's, so that the following proposals relate to the demand projection for 1980. A further reason for choosing this later year is that many of the factories proposed will begin on an assembly basis and will only subsequently undertake substantial manufacturing operations, and the plants proposed below are, in general, manufacturing plants rather than assembly plants.

18. The first group in the metal manufacturing division is 691, i.e., finished structural parts and structures, and consumption in this group is estimated by 1980 to amount to between 65,000 and 70,000 tons per annum. The products of this group are used by the construction engineers who operate in every country, although the extent to which they rely on their own or locally produced materials or imported structures varies from country to country and from product to product. The main items required are:-

| | |
|-------------|---|
| 70 per cent | light steel structures |
| 15 per cent | heavy steel structures, including bridgework |
| 10 per cent | scaffold materials |
| 5 per cent | windows and doors. |

The consumption of heavy structures at about 10,000 tons per annum justifies from a technical point of view one factory and only one for the whole sub-region, and in accordance with the distribution of demand (Annex III) should be located in Zambia. Details of the proposed plant are given in Annex V.

19. The demand for light structures is much greater (45,000 to 50,000 tons per annum) and would be further increased by including metal furniture, e.g., chairs and bedsteads, the consumption of which is comparable to that of windows and doors. As the economic size of the

plant is about the same as for heavy structures, it is possible to consider a factory operating in most countries which in fact is the position at the present time, except that at one end of the scale, modern and specialized factories exist in Rhodesia and Kenya, working at only about half capacity while at the other end, e.g., Malawi, output is only maintained by producing a great variety of products more or less on a jobbing basis rather than on mass production lines. Such a diversification is necessary in the initial stages. A large proportion of metal products such as tanks, window frames, bedsteads, commercial motor bodies, are made by the same processes of cutting, bending, drilling and welding as the construction engineer employs. In Burundi, for example, one engineering firm combines the manufacture of light structures with that of motor bodies, ships and boats, while another combines the manufacture of window and door frames with that of chairs, beds, etc. The more specialized factories, however, have a higher productivity and in due course such items as window and door frames, for the manufacture of which special presses can be used, the manufacture of metal furniture and the manufacture of transport equipment should be specialized activities. A movement in this direction can now only come about as a result of competition and the lowering of tariff barriers. From the table (Annex III), it will be seen that Rhodesian capacity can be increased by one-half while Uganda can produce up to 1,000 tons per annum, Kenya 2,000 tons per annum and Tanzania 3,000 tons per annum. Only highly diversified plants can exist in Ethiopia, Somalia and Malawi.

20. The consumption of metal containers (692) in 1980 at 35,000 tons is estimated to consist of:

| | |
|-------------|--|
| 50 per cent | tanks and vats |
| 15 per cent | gas cylinders |
| 30 per cent | metal boxes and cans and pliable metal tubes |
| 5 per cent | drums for milk, petrol, paint, etc. |

About 70 per cent of total consumption is in Mozambique, Rhodesia and Zambia. Some of the tanks and vats are essentially structural products

falling within the province of the construction engineer and can be made in every country. The products now considered are, however, bent and pressed from flat steel, and include boilers and gas cylinders. Two plants are proposed, one of 16,000 tons per annum capacity including 5,000 tons for gas cylinders, located in either Rhodesia or Zambia and supplying these countries and Mozambique. The other of 7,000 tons per annum capacity, including 2,000 tons for gas cylinders, should be located in Kenya and would supply all other countries.

With regard to cans and metal boxes, there is, as stated above, a strong tendency because of transport costs to manufacture these where they are used for canning operations, e.g., for the export of meat, fish, vegetables and fruit, and such plants are normally established where the export market reaches about \$250,000 per annum. Present capacity will at least double by 1980, location depends on developments in agriculture but present indications are for new factories or extensions in all countries except Somalia and Burundi and in Tanzania where present capacity is probably sufficient.

21. The consumption of wire products (693) at about 80,000 tons per annum in 1980, is one of the largest metal product groups and is estimated to consist of:

- 50 per cent wire rope and cables
- 20 per cent wire gauze and netting
- 10-15 per cent fencing wire.

Two wire drawing works should be established; one drawing fine and high tensile wire for cables and rope with a capacity of from 40,000 to 50,000 tons per annum; and another drawing mild steel wire for fencing, etc., with a capacity of 30,000 tons per annum. Economies would be derived by locating these plants alongside the steel works manufacturing wire rod e.g., as at present in Rhodesia.

Three factories each with annual capacity of about 15,000 tons are proposed for the manufacture of wire rope and cables: one in Rhodesia, one Zambia and one in Kenya.

Two factories are proposed for the manufacture of wire gauze and netting; one in Zambia and one in Kenya, each with a capacity of 7 to 8,000 tons per annum, together with an extension of capacity in Rhodesia.

The manufacture of wire fencing for general purposes including building should be undertaken in one factory with a capacity of 8 to 10,000 tons per annum located in either Kenya, Rhodesia or Zambia in order and serving the whole sub-region.

22. The total consumption of nails, screws, bolts, etc., in 1980 will be between 55,000 and 60,000 tons per annum. The minimum scale of output is low and each country could produce these articles, but it would be desirable for the various countries to agree to specialize on different size ranges. The principal consumers are Zambia, Rhodesia, Kenya, Tanzania and Ethiopia but a more detailed study is required before recommendations can be made on location, capacity and types.

23. The estimated consumption of group 695 (tools for use in the hand or machines), in 1980 is about 40,000 tons, of which between 80 and 85 per cent will consist of hand tools used in agriculture and forestry, i.e., spades, forks, hoes, etc. It will be assumed that about half these requirements are imported. Consumption would allow of factories with the following capacity: Kenya, 5,000 tons per annum capacity for own use; Tanzania, 5,000 tons per annum capacity for own use and export; Zambia 5,000 tons per annum Rhodesia, 2,000 to 3,000 tons for own use; Ethiopia and Zambia, 2,000 tons per annum; Madagascar, 1,000 tons per annum. Such plants exist in Kenya, Uganda, Rhodesia and Burundi, and present capacity in these countries is probably adequate.

24. The demand for cutlery in 1980 is estimated at about 5,000 tons per annum, and the local industry should be able to cover between 40 to 50 per cent of consumption. Imports of stainless steel will be required and factories with annual capacity ranging from 20 to 400 tons (see Annex V) can be established in the various countries to meet domestic requirements. The manufacture of razor blades is already

established in Tanzania and the factory should supply the whole of the sub-region.

25. The demand for household equipment in 1980 will amount to about 30,000 tons per annum, of which about 60 per cent will consist of holloware and enamelware, and 20 to 25 per cent of domestic stoves, cookers, etc. (non-electric).

Holloware factories with a capacity of between 2,000 and 3,000 tons per annum are of an economic size, and new factories can be located or existing capacity expanded in Kenya, Rhodesia, Zambia, Madagascar, Tanzania.

For the manufacture of domestic stoves two factories each of 1 to 1 1/2 thousand tons per annum should be constructed in Kenya and Tanzania.

26. Group 698, consisting of miscellaneous manufactures of metal, is a large one with an estimated consumption of about 70,000 tons in 1980. It includes such items as springs, chains, crown corks and a great variety of fittings for building and domestic use e.g. door hinges, locks etc., which can be stamped out on small presses located in every country.

27. The next two divisions concern the manufacture of machinery and transport equipment and give rise to factories in which a variety of components are manufactured and then assembled into complete machines or vehicles. At present, most of this work in African countries is assembly work based on imported components. For the 1980 projections given below it is assumed, however, that the factories envisaged will be manufacturing most of their requirements, although they may begin with substantial imports of components. In many cases, the size of the market is sufficient for only one factory, but as the market increases there will be a possibility of either two factories or of manufacturing components in specialized factories at a number of places in the sub-region. In any event, some more general components or accessories, e.g., starters for internal combustion engines, reflectors and

accumulators for motor cars, can be specialized in this way from the beginning. As many of these plants produce high value products, they can be located virtually anywhere.

A further point in connexion with the manufacture of machinery and transport equipment is the desirability of accepting some limitation on variety at an early stage so that the market for new equipment can be reduced to a manageable number of types and the production of replacement parts facilitated.

28. The first group in the machinery division is the manufacture of power generating machinery (711) for which the demand in 1980 will amount to 35,000 to 40,000 tons. Of this, 60 per cent will consist of internal combustion engines and 20 to 25 per cent of steam generating boilers.

If it is assumed that about half the requirements for internal combustion engines can be met by local production, say up to units of 50 H.P., then there is room for one large factory with an output of 10,000 tons per annum or 15,000 to 20,000 engines. The main markets for these engines will be Rhodesia/Zambia and Kenya, in order of importance, and the factory might be located in Rhodesia/Zambia or, alternatively, two smaller factories producing from 8,000 to 10,000 units per annum could be located in Kenya and Rhodesia/Zambia.

Steam generating boilers should be produced in a sub-regional plant of 6,000 to 8,000 tons annual capacity, located in Rhodesia, Zambia or Uganda. Such a plant would require about half its material in the form of pipes, and half in the form of plates.

29. The consumption of the next group, agricultural machinery, etc., (712), is estimated at about 54,000 tons in 1980. Important categories are tractors and accessories accounting for between 50 and 60 per cent of consumption, i.e., 28,000 tons per annum, and agricultural machinery, i.e., cultivating and harvesting machines accounting for 20 per cent, or about 10,000 tons per annum.

The total consumption of tractors is estimated at between 18,000 and 20,000 units, and between 14,000 and 16,000 up to about 25 H.P. should be produced and the others imported. In this case, a sub-regional market is necessary and Tanzania (Dar-es-Salaam) probably offers the cheapest location.

Of the market for agricultural machinery, about 3,000 to 4,000 tons per annum will consist of ploughs, and six plants each with a capacity of 6 to 700 tons per annum are proposed. Important markets are Rhodesia, Zambia, Kenya, Tanzania, Ethiopia and Madagascar.

The remaining agricultural machinery, i.e., harvesting, sowing, threshing etc. equipment, should be manufactured in a sub-regional plant with a capacity of from 7 to 8,000 tons, located in Kenya.

30. In the office machinery category (714), a sub-regional factory should be constructed for the manufacture of typewriters and simple calculating machines with an annual output of some 200,000 to 250,000 units. These are high value products and although a central location (Kenya) is proposed their manufacture can be located anywhere.

31. In the metal working machinery group (750), demand by 1980 should reach between 11,000 and 12,000 tons and about half, say 5,000 to 6,000 tons, will consist of a number of relatively simple machines which should be produced in specialized factories each catering for the whole sub-region. These factories would employ from 15 to 300 people (see Annex V) according to product and should be located as follows:-

1. Vertical bench and hand drilling machines with an annual capacity of 2,000 tons in Zambia.
2. Shears and metal cutting saws with an annual capacity of 1,000 tons in Tanzania.
3. For the manufacture of tool grinding machines five factories each of capacity 200 tons per annum may be constructed in Tanzania, Uganda, Kenya, Rhodesia and Zambia.

4. A special factory for the manufacture of simple lathes for repair shops with a capacity of about 3,000 tons per annum may be located in Kenya.

32. Total consumption of the textile and leather machinery group (717) will amount to between 15,000 and 16,000 tons by 1980, of which from 10,000 to 12,000 tons will be textile machinery. This estimate is in conformity with the requirement for textile machinery given in the paper on textiles (E/CN.14/INR/86). This demand will include some 3,000 to 4,000 looms per annum and 100,000 spindles, and should be met by a sub-regional plant located in Kenya.

The demand for sewing machines will amount to about 100,000 units per annum, and should be manufactured in two factories employing about 500 people, one in Kenya and the other an expansion of the existing plant in Rhodesia.

33. The group, machinery for special industries, (718) is the largest machinery group with a demand expected to exceed 100,000 tons per annum in 1980. It includes more specialized items such as paper making machinery and glass working machinery, but it also includes machinery generally required in the sub-region for milling and food processing, mineral crushing, road making, etc. The distribution of machines required is estimated at

| | |
|------------------|---------------------------------------|
| 20 per cent | food processing |
| 60 per cent | excavators for mining and road making |
| 5 to 10 per cent | mineral crushing |

It is suggested that present capacity in milling and food processing in Kenya, Rhodesia and Tanzania could be expanded and two new factories of 4,000 to 5,000 tons per annum capacity erected in Kenya and Rhodesia. For excavators, four new factories are proposed, each with an annual capacity of 5,000 to 6,000 tons and located in Tanzania, Zambia, Rhodesia and Kenya. A sub-regional plant for the manufacture of stone and mineral crushing equipment with a capacity of 6-10,000 tons should be located in Uganda.

34. The market for machinery and appliances (719) will also exceed 100,000 tons per annum, and will include the following main types of machines:

| | |
|-------------|-------------------------------|
| 10 per cent | Air conditioning machinery |
| 35 per cent | Pumps and centrifuges |
| 5 per cent | Valves and similar appliances |
| 20 per cent | Lifting and loading machinery |
| 10 per cent | Weighing machines |

It will be possible to construct plants for each of these types. For the manufacture of valves, etc. (from bronze and other copper alloys), a sub-regional plant is proposed with a capacity of 3,000 to 5,000 tons per annum, and located in Zambia. For light pumps, four or five plants with 2,000 to 3,000 tons capacity and for medium pumps four or five of 3-4,000 tons. Two or three plants of 3,000 to 4,000 tons annual capacity would meet requirements for weighing machines, and three or four of 4,000 to 5,000 tons could provide winches and hoisting equipment. These plants would be located in the principal consuming countries, i.e., Kenya, Rhodesia, Zambia. Air conditioning machinery could be installed by constructional engineers in most countries.

35. The third division of engineering goods consumption consists of transport equipment. The demand for railway rolling stock (721) will amount to between 55,000 and 60,000 tons by 1980, and about half of this will consist of freight cars. It would be economic to meet this demand by constructing two factories, each with a capacity of 1,000 cars per annum of 15 tons average weight. These factories should be located in Rhodesia and Kenya. They could be supplied with plate, either imported or from the proposed steel works and with wheels and axles from a factory of 8-10,000 tons annual capacity which would also supply replacements. The factory would be attached to the steel works, probably in Rhodesia.

36. Road vehicles form the largest single item in engineering demand and by 1980 will amount to about 320,000 tons. The distribution according to types is estimated to be as follows:

| | |
|-------------------|---------------------------------------|
| 40 to 50 per cent | passenger cars |
| 10 to 15 per cent | buses |
| 10 to 15 per cent | replacement parts |
| 20 to 40 per cent | light commercial vehicles and lorries |

The demand for passenger cars will amount to between 120,000 and 150,000 units annually, of which it would be reasonable to manufacture half locally. This demand is sufficient to sustain one sub-regional factory which would assemble the cars - including light commercial vehicles - and manufacture the main components i.e. engines (cast from aluminium alloys) and bodies (pressed from sheet steel). Since aluminium is already being cast in Tanzania and a sheet steel mill is proposed this would appear to be a suitable location. Some of the components e.g. wheels, springs, starters, reflectors, should be produced in specialized plants, and other specialized plants with an annual capacity of between 2-3,000 tons should manufacture accessories such as valves, pivots, axles, etc., and replacement parts for all models including imported cars. Such plants would be located in the main centres of consumption i.e. Rhodesia, Kenya, Uganda, Ethiopia, Madagascar, Zambia.

37. Group 733 with an annual consumption by 1980 of 25,000 tons consists mainly of bicycles - about 60 per cent, and trailers - about 10-15 per cent.

The tonnage for bicycles is equivalent to an annual demand of from 1 to 1 1/2 million units and since it is economic to produce on a scale of from 15 to 20,000 units per annum, a number of factories can be established and in fact one could be established if necessary in each country.

With regard to trailers only one factory catering for the whole sub-region and producing some 15-20,000 units per annum is justified and should be located in Tanzania.

38. The total production of the mechanical engineering factories proposed above would amount to 800,000 to 900,000 tons per annum, or about 60 per cent of the total consumption of mechanical engineering goods. Consumption of iron castings for this production would be about 140,000 tons per annum, of steel castings about 40,000 tons and of forgings and pressings (other than motor car bodies) 80,000 to 100,000 tons. About 80 per cent of these castings and forgings will be produced in the engineering factories themselves, and some 20 per cent will come from specialized foundries. In addition, foundries will be required for the electrical machinery industry and for certain building components and household equipment, e.g., manhole covers, siphons, cisterns, baths, pots, stoves and laundry irons, and for general repair work.

There are a number of foundries in Rhodesia where the market is also sufficiently large to give rise to some degree of specialization. In Zambia a large iron and steel foundry makes grinding materials and equipment for the copper mines and obtains scrap from the same source. At the other extreme a small foundry employing about a dozen persons and covering a wide range of ferrous and non-ferrous castings operates in Somalia (Mogadiscio). Every country should have at least one foundry, using local scrap and operating initially as part of the general engineering shop engaged primarily on repair work. A general foundry of this kind is required in Malawi and existing facilities in Kenya, Tanzania and Madagascar could be improved.

39. No recommendations have been made in regard to ship construction, failing a study of sea transport prospects, but ship building is a major outlet for steel plate and sections, and in conjunction with the local steel industry would make a big contribution to the economy. Apart from repair work, the various yards are at present engaged in the construction of ships for coastal trading and it is probable that this trade will increase rapidly as the integration of Africa proceeds.

VII. CONCLUSIONS AND SUMMARY

40. The market for engineering products in the sub-region is expected to increase at a rate of between 6 1/2 and 7 1/2 per cent per annum during the next fifteen years. It is the largest single group of goods imported into African countries, accounting for about one-third of total imports and this proportion is likely to increase still further with the growth of industrialization unless active steps are taken to develop local production on a large scale.

41. Present capacity is estimated to be capable of supplying about one half of the present demand for metal fabrications and about one-third outside Rhodesia; about one-third of transport equipment, mainly on an assembly basis, and one-tenth outside Rhodesia; about 5 per cent of machinery requirements.

42. New capacity is proposed to supply about two-thirds of the demand for metal fabrications and about half the demand for machinery and transport equipment on a manufacturing basis. The total investment required will amount to \$130 million and the total employment created to 36 thousand under European conditions and would be increased by one-third and one-half respectively under African conditions. The total consumption of electrical energy for the factories would amount to 175 million kwh per annum requiring between 120/150 kw capacity.

43. The following plants are proposed:

| | | |
|----------|--|----------------|
| National | light structures and metal furniture | each country |
| | foundry and general engineering | " |
| | cutlery | " |
| at each | nails, screws, bolts | " |
| | buses and lorries assembly and body building | " |
| | bicycles | most countries |
| | agricultural implements | " |
| | hollowware | " |
| | hardware | " |

| | | |
|--|-----|-----------------------------------|
| pumps | | most countries |
| grinding machines | | " |
| agricultural machinery | | " |
| car accessories | | " |
| cans | | " |
| Area (serving two or three adjacent countries) | | |
| tanks, boilers, gas cylinders | (2) | Rhodesia, or Zambia, Kenya |
| wire rope and cables | (3) | Rhodesia, Zambia, Kenya |
| wire gauze and netting | (2) | Zambia, Kenya |
| internal combustion engines | (2) | Kenya, Zambia |
| sewing machines | (2) | Rhodesia, Kenya |
| food processing machines | (3) | Kenya, Rhodesia, Tanzania |
| excavators | (4) | Kenya, Rhodesia, Zambia, Tanzania |
| freight cars | (2) | Rhodesia, Kenya |
| domestic stoves | (2) | Kenya, Tanzania |
| hoisting machinery | (3) | Kenya, Rhodesia, Zambia |
| weighing machinery | (3) | Kenya, Rhodesia, Zambia |
| wire drawing | (2) | near steelworks |
| Sub-regional heavy structures and bridgework | | Zambia |
| wire fencing | | Kenya, Rhodesia, Zambia |
| Razor blades | | Tanzania |
| Steam generators | | Rhodesia, Zambia, Kenya |
| Tractors | | Tanzania |
| Typewriters & calculating machines | | anywhere (Kenya) |
| Valves | | Zambia |
| Trailers | | Tanzania |
| Passenger cars | | Tanzania |
| Wheels & axles (railway) | | near steelworks |
| Lathes, drilling machines, screws and shears | | Kenya, Tanzania, Zambia |
| Textile machinery | | Kenya |

44. Details of all proposed plants are given in Annex V.

ANNEX I

Average Annual 1961/3 Consumption of Engineering Products in East Africa

| Group | Description | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia | Sub-Region |
|---------|--------------------------------------|----------|---------|--------|---------|--------|------------|----------|------------|--------|---------|-----------|----------|---------|------------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 671 | Pig a. sponge iron a ferro-alloys | 20 | - | - | - | - | 1,700 | 968 | 30 | 253 | 501 | 10 | 1,953 | 362 | 5,797 |
| 672 | Ingots a. other prim. f. of J or S. | 45 | - | - | - | - | 5,250 | 266 | 16 | 103 | 2,725 | 53 | 24 | 40 | 8,522 |
| 673 | Bars, rods, angles, shapes | 17,600 | 1,170 | 2,650 | 2,430 | 2,055 | 2,850 | 7,342 | 10,200 | 2,254 | 31,694 | 6,610 | 14,948 | 17,000 | 118,803 |
| 674 | Universals, plates a. sheets | 9,800 | 1,560 | 3,520 | 3,240 | 2,740 | 6,200 | 8,897 | 12,800 | 4,039 | 44,937 | 5,904 | 49,730 | 15,600 | 168,967 |
| 675 | Hoop a. strip | 102 | - | - | - | - | - | 2,686 | 306 | 743 | 1,918 | 3 | 1,212 | 188 | 7,158 |
| 676 | Rails a. railway track constr. mat. | 15 | - | - | - | - | - | 2,587 | 180 | 402 | 1,732 | 137 | 40,288 | 2,350 | 47,691 |
| 677 | Iron and steel wire | 225 | - | - | - | - | 220 | - | 240 | - | - | - | 1,995 | 633 | 3,313 |
| 678 | Tubes, pipes and fittings | 1,460 | 234 | 530 | 486 | 411 | 2,100 | 1,950 | 5,080 | 1,381 | 7,847 | 1,486 | 14,464 | 10,500 | 47,929 |
| 679 | J. a. st. castings a. forgings | 34 | - | - | - | - | - | 226 | 29 | 236 | 604 | 20 | 1 | 196 | 1,346 |
| Div. 68 | Non-ferrous metals | 580 | 117 | 265 | 243 | 205 | 1,675 | 1,790 | 669 | 169 | 5,275 | 377 | 6,018 | 1,000 | 18,383 |
| 691 | Finished struct. parts a. structures | 160 | - | - | - | - | 47 | 822 | 320 | 137 | 754 | 5,486 | 4,000 | 6,340 | 15,054 |
| 692 | Met. containers for stor. a. transp. | 390 | 156 | 352 | 324 | 274 | 3,000 | 185 | 353 | 27 | 1,130 | 75 | 2,300 | 890 | 9,456 |
| 693 | Wire products (excl. electric) | 920 | 156 | 352 | 324 | 274 | 440 | 909 | 630 | 1,205 | 2,960 | 233 | 3,985 | 3,960 | 16,348 |
| 694 | Nails, screws, nuts, bolts, rivets | 710 | 117 | 265 | 243 | 205 | 170 | 612 | 1,330 | 270 | 1,251 | 895 | 3,317 | 2,100 | 11,485 |
| 695 | Tools for use in the hand or mach. | 870 | 156 | 352 | 324 | 274 | 1,840 | 2,514 | 770 | 883 | 3,333 | 106 | 3,600 | 985 | 16,007 |
| 696 | Cutlery | 88 | - | - | - | - | 96 | 57 | 155 | 50 | 270 | 26 | 300 | 124 | 1,166 |
| 697 | Household equipment | 290 | 78 | 162 | 162 | 138 | - | 745 | 1,070 | 409 | 1,750 | 295 | 1,420 | 965 | 7,484 |
| 698 | Other manuf. of metal, n.o.s. | 1,040 | 156 | 352 | 324 | 274 | 3,950 | 938 | 1,520 | 492 | 1,994 | 800 | 3,000 | 2,735 | 17,575 |
| | Total 671-698 | 34,349 | 3,900 | 8,800 | 8,100 | 6,850 | 29,538 | 33,494 | 35,698 | 13,053 | 110,675 | 22,516 | 152,555 | 65,968 | 525,496 |
| 711 | Power gener. mach. other than el. | 115 | 84 | 188 | 176 | 146 | 135 | 143 | 350 | 107 | 1,400 | 738 | 2,900 | 773 | 7,255 |
| 712 | Agricultural mach. a. implem. | 670 | 168 | 375 | 352 | 292 | 1,900 | 1,180 | 820 | 330 | 1,900 | 520 | 3,600 | 1,270 | 13,377 |
| 714 | Office machines | 29 | - | - | - | - | 38 | 15 | 46 | 6 | 117 | 9 | 290 | 67 | 617 |
| 715 | Metalworking machinery | 95 | 42 | 94 | 88 | 73 | - | 751 | 54 | 385 | 413 | 9 | 527 | 285 | 2,816 |
| 717 | Textile a. leather machinery | 250 | 31 | 75 | 66 | 55 | 130 | 360 | 678 | 230 | 1,120 | 127 | 800 | 187 | 4,109 |
| 718 | Mach. for special industries | 1,300 | 274 | 610 | 572 | 365 | 1,060 | 1,934 | 790 | 2,471 | 2,286 | 23 | 9,000 | 8,650 | 29,335 |
| 719 | Mach. a. appliances (other than el.) | 1,300 | 336 | 750 | 704 | 473 | 4,500 | 950 | 1,270 | 460 | 3,300 | 760 | 9,500 | 5,320 | 29,623 |
| 722 | El. power mach. a. switch gear | 420 | 84 | 188 | 176 | 109 | 430 | 725 | 270 | 412 | 471 | 103 | 3,000 | 2,050 | 8,438 |
| 723 | Equip. for distributing electricity | 540 | 84 | 188 | 176 | 109 | 1,630 | 518 | 510 | 235 | 993 | 321 | 3,294 | 2,400 | 10,998 |
| 725 | Domestic electr. equipment | 250 | 31 | 75 | 66 | 55 | 41 | 215 | 345 | 140 | 545 | 95 | 1,380 | 425 | 3,663 |
| 726 | El. appar. for medical purposes | 7 | - | - | - | - | 47 | 31 | 3 | 27 | 24 | 1 | - | 200 | 340 |
| 729 | Other el. mach. a. apparatus | 480 | 63 | 142 | 132 | 73 | 580 | 650 | 860 | 460 | 1,420 | 880 | 2,200 | 1,470 | 9,410 |
| 731 | Railway vehicles | 1,050 | - | - | - | 365 | 3,320 | 1,800 | 290 | 300 | 3,180 | 28 | 4,203 | 1,090 | 15,626 |
| 732 | Road motor vehicles | 6,300 | 735 | 1,640 | 1,540 | 1,280 | 6,800 | 6,500 | 4,800 | 4,300 | 19,100 | 1,500 | 24,000 | 10,700 | 89,195 |
| 733 | Road veh. other than motor veh. | 124 | 168 | 375 | 352 | 255 | 1,550 | 980 | 360 | 750 | 1,530 | 154 | 2,600 | 1,200 | 10,398 |
| 734 | Aircraft | 3,250 | - | - | - | - | 240 | 3 | 34 | 20 | 1,000 | 4 | 1,400 | 40 | 5,991 |
| 735 | Ships a. boats | 21 | - | - | - | - | 140 | 20 | 79 | 16 | 80 | 20 | 102 | 90 | 568 |
| | Total 711-735 | 16,201 | 2,100 | 4,700 | 4,400 | 3,650 | 22,541 | 16,775 | 11,559 | 10,649 | 38,879 | 5,292 | 68,796 | 36,217 | 241,759 |
| | Total 671-735 | 50,550 | 6,000 | 13,500 | 12,500 | 10,500 | 52,079 | 50,269 | 47,257 | 23,702 | 149,554 | 27,808 | 221,351 | 102,185 | 767,255 |

ANNEX II
Forecasts of total engineering goods consumption

| | Growth rates 1962-1970 | | | | 1962 | | | 1970 | | | Growth rates 1970-1980 | | | | 1975 | | | 1980 | | | | | | |
|------------|--------------------------|-----|-----------|-----------|--------|-----------|-----------|--------------|--------|-----------|------------------------|--------------|--------|-----|-----------|-----------|--------|-----------|-----------|--------------|--------|-----------|-----------|--------------|
| | Popul. | GDP | PC GDP | PC EGC | Popul. | PC GDP | PC EGC | Total EGC | Popul. | PC GDP | PC EGC | Total EGC | Popul. | GDP | PC GDP | PC EGC | Popul. | PC GDP | PC EGC | Total EGC | Popul. | PC GDP | PC EGC | Total EGC |
| | % | % | % | % | | | | | | | | | % | % | % | % | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Ethiopia | 1.7 | 3.9 | 2.2 | 3.4 | 20.75 | 42.7 | 2.43 | 50.5 | 23.75 | 50.2 | 3.18 | 75.8 | 2.0 | 5.5 | 3.5 | 5.4 | 26.25 | 59.4 | 4.1 | 107.6 | 29.00 | 70.4 | 5.33 | 155 |
| Somalia | 1.8 | 4.3 | 2.5 | 3.9 | 2.07 | 54.7 | 2.9 | 6.0 | 2.40 | 66.0 | 3.94 | 9.5 | 2.0 | 5.0 | 3.0 | 4.6 | 2.65 | 74.9 | 4.9 | 8.1 | 2.93 | 89.0 | 6.14 | 18 |
| Rwanda | 1.2 | 3.9 | 2.7 | 4.2 | 2.76 | 49.1 | 4.9 | 13.5 | 3.03 | 60.8 | 6.81 | 20.6 | 1.5 | 5.0 | 3.5 | 5.4 | 3.25 | 70.5 | 8.9 | 28.9 | 3.50 | 84.9 | 11.58 | 41 |
| Burundi | 2.6 | 4.4 | 1.8 | 2.8 | 2.63 | 50.7 | 4.75 | 12.5 | 3.25 | 58.5 | 5.92 | 19.2 | 2.6 | 5.0 | 2.4 | 3.7 | 3.70 | 66.6 | 7.1 | 26.3 | 4.20 | 75.0 | 8.52 | 36 |
| Malawi | +20% ^x 2.8 | 4.5 | 1.7 | 2.6 | 3.70 | 34.1 | 2.85 | 10.5 | 4.60 | 38.9 | 3.50 | 16.0 | 2.9 | 5.5 | 2.6 | 4.0 | 5.30 | 44.1 | 4.3 | 22.8 | 6.10 | 50.1 | 5.23 | 32 |
| Mozambique | 1.8 | 6.1 | 4.3 | 6.6 | 6.58 | 50.0 | 7.9 | 52.0 | 7.58 | 70.0 | 13.17 | 99.8 | 1.8 | 5.0 | 3.2 | 4.9 | 8.28 | 88 | 16.7 | 138.3 | 9.05 | 109 | 21.21 | 192 |
| Tanzania | 2.4 | 7.6 | 5.2 | 8.0 | 9.64 | 55.0 | 5.23 | 50.3 | 11.63 | 82.2 | 9.68 | 112.6 | 2.3 | 6.7 | 4.4 | 6.8 | 13.02 | 102.1 | 13.4 | 174.5 | 14.60 | 126.3 | 18.59 | 271 |
| Madagascar | 1.5 | 4.9 | 3.4 | 5.3 | 5.55 | 112.8 | 8.5 | 47.2 | 6.24 | 146.8 | 12.85 | 80.0 | 2.0 | 5.0 | 3.0 | 4.6 | 6.85 | 171.1 | 16.1 | 110.3 | 7.61 | 195.4 | 20.16 | 153 |
| Uganda | 1.9 | 6.1 | 4.2 | 6.5 | 6.95 | 63.7 | 3.4 | 23.7 | 8.08 | 88.2 | 5.63 | 45.5 | 2.2 | 6.8 | 4.6 | 7.1 | 9.00 | 109.6 | 7.9 | 71.1 | 10.00 | 138.1 | 11.13 | 111 |
| Kenya | 2.4 | 5.4 | 3.0 | 4.6 | 8.60 | 79.2 | 17.4 | 149.5 | 10.30 | 99.9 | 24.93 | 256.8 | 2.8 | 6.0 | 3.2 | 4.9 | 11.80 | 115.7 | 31.7 | 374.1 | 13.60 | 134.4 | 40.27 | 548 |
| Mauritius | 1.7 | 6.4 | 4.7 | 7.3 | 0.70 | 189.6 | 39.7 | 27.8 | 0.84 | 274.3 | 69.75 | 58.6 | 3.3 | 5.0 | 1.7 | 2.6 | 0.95 | 280.0 | 79.3 | 75.3 | 1.09 | 325.0 | 90.16 | 98 |
| Rhodesia | +20% ^x 3.4 | 4.7 | 1.3 | 2.0 | 3.84 | 210.0 | 56.8 | 221.3 | 5.03 | 232.3 | 66.55 | 334.7 | 3.5 | 5.0 | 1.5 | 2.3 | 6.00 | 247.1 | 74.6 | 447.6 | 7.10 | 266.5 | 83.61 | 594 |
| Zambia | +20% ^x 2.9 | 5.6 | 2.7 | 4.2 | 3.38 | 185.0 | 30.2 | 102.2 | 4.23 | 228.0 | 41.97 | 177.5 | 3.0 | 6.4 | 3.4 | 5.3 | 4.90 | 266.7 | 54.3 | 266.1 | 5.70 | 312.8 | 70.30 | 401 |
| Sub-Region | 2.1 | 5.1 | 3.0 | 4.6 | 77.15 | 73.0 | 9.9 | 767.0 | 90.96 | 92.5 | 14.18 | 1,289.8 | 2.3 | 5.8 | 3.5 | 5.4 | 101.95 | 110.0 | 18.4 | 1,875.9 | 114.48 | 130.7 | 23.93 | 2,740 |

ANNEX III

Forecasts of Engineering Goods Consumption by Categories

| Group | Description | Sub-Region | | | | Consumption in 1980 | | | | | | | | | | | | |
|-------|--------------------------------------|------------|--------|--------|--------|---------------------|---------|--------|---------|--------|------------|----------|------------|--------|-------|-----------|----------|--------|
| | | 1962 | 1970 | 1975 | 1980 | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 691 | Finished struct. parts a. struct. | 19.76 | 36.06 | 52.68 | 77.17 | 0.51 | 0.06 | 0.13 | 0.12 | 0.13 | 0.25 | 4.53 | 1.04 | 0.75 | 2.56 | 17.93 | 13.64 | 35.52 |
| 692 | Met. containers for stor. a. transp. | 9.64 | 17.15 | 24.59 | 35.25 | 1.72 | 0.23 | 0.53 | 0.47 | 0.53 | 12.90 | 1.09 | 1.15 | 0.15 | 3.65 | 0.22 | 7.80 | 4.81 |
| 693 | Wire products (excl. electric) | 17.75 | 33.56 | 52.63 | 82.53 | 2.73 | 0.33 | 0.72 | 0.63 | 0.72 | 3.67 | 5.43 | 5.52 | 3.13 | 15.33 | 3.53 | 23.40 | 17.39 |
| 694 | Nails, screws, nuts, bolts, rivets | 12.03 | 25.10 | 37.75 | 56.77 | 1.72 | 0.21 | 0.48 | 0.42 | 0.40 | 2.53 | 3.80 | 3.22 | 1.64 | 7.67 | 2.79 | 18.20 | 13.69 |
| 695 | Tools for use in the hand or mach. | 16.68 | 24.31 | 30.76 | 38.92 | 3.84 | 0.41 | 0.96 | 0.89 | 1.06 | 3.92 | 5.48 | 2.30 | 1.71 | 8.76 | 0.74 | 5.20 | 3.70 |
| 696 | Cutlery | 1.37 | 2.57 | 3.84 | 4.83 | 0.25 | 0.02 | 0.05 | 0.05 | 0.05 | 0.38 | 0.36 | 0.46 | 0.30 | 1.10 | 0.07 | 1.04 | 0.70 |
| 697 | Household equipment | 7.74 | 13.85 | 19.72 | 28.67 | 0.86 | 0.12 | 0.27 | 0.23 | 0.27 | - | 3.98 | 3.45 | 2.31 | 5.84 | 0.96 | 5.20 | 5.18 |
| 698 | Other manuf. of metal, n.e.s. | 18.69 | 34.56 | 49.52 | 71.03 | 3.43 | 0.40 | 0.91 | 0.79 | 0.91 | 16.95 | 5.07 | 4.95 | 2.83 | 6.57 | 2.65 | 10.40 | 15.17 |
| 711 | Power gener. mach. other than el. | 8.00 | 16.15 | 24.70 | 37.77 | 0.86 | 0.13 | 0.29 | 0.23 | 0.17 | 1.64 | 2.52 | 1.63 | 1.10 | 5.49 | 1.96 | 12.00 | 9.75 |
| 712 | Agricultural mach. a. implem. | 14.46 | 26.00 | 37.50 | 54.11 | 2.97 | 0.35 | 0.81 | 0.70 | 0.76 | 3.73 | 5.22 | 2.24 | 2.12 | 10.61 | 1.84 | 13.40 | 9.36 |
| 714 | Office machines | 0.74 | 1.23 | 1.68 | 2.31 | 0.11 | 0.02 | 0.04 | 0.04 | 0.03 | 0.13 | 0.09 | 0.15 | 0.04 | 0.55 | 0.05 | 0.80 | 0.26 |
| 715 | Metalworking machinery | 3.06 | 5.52 | 7.98 | 11.53 | | 0.13 | 0.29 | 0.25 | 0.29 | - | 4.05 | 0.19 | 1.31 | 2.01 | 0.05 | 1.60 | 1.04 |
| 717 | Textile a. leather mach. | 4.36 | 7.73 | 11.05 | 15.30 | 0.81 | 0.09 | 0.22 | 0.19 | 0.22 | 0.39 | 1.89 | 2.24 | 0.80 | 5.31 | 0.59 | 2.40 | 0.65 |
| 718 | Mach. for special industr. | 33.02 | 54.67 | 74.98 | 102.80 | 4.37 | 0.82 | 1.87 | 1.65 | 1.44 | 3.03 | 10.35 | 2.62 | 8.50 | 10.30 | 0.19 | 26.00 | 31.20 |
| 719 | Mach. a. appliances (other than el.) | 32.79 | 54.15 | 74.10 | 101.40 | 4.37 | 1.01 | 2.30 | 2.03 | 1.87 | 13.10 | 5.04 | 4.18 | 1.57 | 15.56 | 3.53 | 27.60 | 19.24 |
| 722 | El. power mach. a. switchgear | 9.50 | 16.09 | 23.06 | 33.81 | 1.57 | 0.20 | 0.43 | 0.38 | 0.39 | 2.10 | 3.06 | 1.52 | 1.24 | 5.86 | 1.30 | 9.00 | 6.76 |
| 723 | Equip. for distributing electricity | 12.15 | 21.82 | 31.60 | 46.03 | 1.78 | 0.22 | 0.49 | 0.43 | 0.40 | 2.55 | 3.78 | 2.05 | 1.61 | 7.87 | 1.96 | 13.40 | 9.49 |
| 725 | Domestic electr. equipment | 4.05 | 6.80 | 9.40 | 13.00 | 0.81 | 0.09 | 0.22 | 0.19 | 0.22 | 0.13 | 1.17 | 1.14 | 0.47 | 2.56 | 0.44 | 4.00 | 1.56 |
| 726 | El. appar. for medical purposes | 0.37 | 0.64 | 0.91 | 1.28 | 0.03 | - | - | - | - | 0.13 | 0.18 | - | 0.11 | 0.18 | - | - | 0.65 |
| 729 | Other el. mach. a. apparatus | 10.20 | 17.48 | 24.81 | 34.93 | 1.62 | 0.19 | 0.43 | 0.38 | 0.29 | 1.70 | 3.51 | 2.85 | 1.57 | 6.59 | 4.07 | 6.40 | 5.33 |
| 731 | Railway vehicles | 16.76 | 28.98 | 40.81 | 57.47 | 3.51 | - | - | - | 1.44 | 9.69 | 9.63 | 0.95 | 1.02 | 15.01 | 0.12 | 12.20 | 3.90 |
| 732 | Road motor vehicles | 96.78 | 167.00 | 233.00 | 328.18 | 21.06 | 2.21 | 5.04 | 4.45 | 5.04 | 19.65 | 34.83 | 15.88 | 14.78 | 89.70 | 6.93 | 70.00 | 38.61 |
| 733 | Road veh. other than motor veh. | 11.24 | 16.00 | 19.92 | 24.83 | 2.43 | 0.27 | 0.63 | 0.57 | 0.68 | 2.75 | 3.69 | 1.37 | 1.46 | 0.73 | 0.61 | 6.00 | 3.64 |

| | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia | |
|-------------------------------------|----------|---------|--------|---------|--------|------------|----------|------------|---------|----------|-----------|----------|---------|---------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Wire ropes a. cables works | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 10-15000 | | 15000 | 15000 | |
| Inv.: mil. US \$ | | | | | | | | | | 1.2-1.5 | | 1.5-1.7 | 1.5-1.7 | |
| Empl.: No | | | | | | | | | | 200-250 | | 200-250 | 200-250 | |
| Energy: mil kWh/year | | | | | | | | | | 3-3.5 | | 3-3.5 | 3-3.5 | |
| Wire gauze a. netting works | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 7-8000 | | | 7-8000 | |
| Inv.: mil US \$ | | | | | | | | | | 1.0-1.5 | | | 1.0-1.5 | |
| Empl.: No | | | | | | | | | | 200-300 | | | 200-300 | |
| Energy: mil kWh/year | | | | | | | | | | 2-2.5 | | | 2-2.5 | |
| Fencing grills works | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | | | 8-10000 | | |
| Inv.: mil. US \$ | | | | | | | | | | | | 1.0-1.2 | | |
| Empl.: No | | | | | | | | | | | | 200-300 | | |
| Energy: mil kWh/year | | | | | | | | | | | | 2.5-3 | | |
| 694 Nails, screws, nuts....works | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 10000 | | 10000 | 10000 | |
| Inv.: mil US \$ | | | | | | | | | | 1.5-1.7 | | 1.5-1.7 | 1.5-1.7 | |
| Empl.: No | | | | | | | | | | 150 | | 150 | 150 | |
| Energy: mil kWh/year | | | | | | | | | | 2.6-3 | | 2.6-3 | 2.6-3 | |
| 695 Hand tools for agr. a. forestry | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 2000 | | 2-3000 | 5000 | |
| Inv.: mil US \$ | | | | | | | | | | 0.6-0.8 | | 0.8-1.0 | 1.5-1.8 | |
| Empl.: No | | | | | | | | | | 3-400 | | 450 | 6-750 | |
| Energy: mil kWh/year | | | | | | | | | | 1-1.5 | | 1.5-3 | 2-2.5 | |
| 696 Cutlery works | | | | | | | | | | | | | | |
| Cap.: tons | 100-150 | | | 20-25 | 20-25 | 20-25 | 100-150 | 100-150 | 100-150 | 100-150 | 300-400 | 20-25 | 300-400 | 250-300 |
| Inv.: 1000 US \$ | 120-180 | | | 30-40 | 30-40 | 30-40 | 120-180 | 120-180 | 120-180 | 120-180 | 250-300 | 30-40 | 250-300 | 230-270 |
| Empl.: No | 40-60 | | | 10-15 | 10-15 | 10-15 | 40-60 | 40-60 | 40-60 | 40-60 | 120-170 | 10-15 | 120-170 | 100-150 |
| Energy: 1000 kWh/year | 35-50 | | | 8-10 | 8-10 | 8-10 | 35-50 | 35-50 | 35-50 | 35-50 | 90-120 | 8-10 | 90-120 | 80-100 |

| | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia | |
|--|----------|---------|--------|---------|--------|------------|----------|------------|--------|----------|-----------|----------|----------|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 697 Hollow-ware a. Enamelware | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | 2-3000 | 2-3000 | | 2-3000 | | 2-3000 | 2-3000 | |
| Inv.: mil US \$ | | | | | | | 0.6-0.9 | 0.6-0.9 | | 0.6-0.9 | | 0.6-0.9 | 0.6-0.9 | |
| Empl.: No | | | | | | | 100-150 | 100-150 | | 100-150 | | 100-150 | 100-150 | |
| Energy: mil kWh/year | | | | | | | 0.5-0.7 | 0.5-0.7 | | 0.5-0.7 | | 0.5-0.7 | 0.5-0.7 | |
| Domestic stoves | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | 1-1500 | | | 1-1500 | | | | |
| Inv.: 100 US\$ | | | | | | | 70-100 | | | 70-100 | | | | |
| Empl.: No | | | | | | | 80-100 | | | 80-100 | | | | |
| Energy: mil kWh/year | | | | | | | 0.3-0.4 | | | 0.3-0.4 | | | | |
| 711 Internal comb. engine | | | | | | | | | | | | | | |
| Cap: thous. eng to 50 b.h.p. | | | | | | | | | | 8-10 | | | 8-10 | |
| Inv.: 1000 US \$ | | | | | | | | | | 1.8-2000 | | | 1.8-2000 | |
| Empl: No | | | | | | | | | | 500-650 | | | 500-650 | |
| Energy: mil kWh/year | | | | | | | | | | 2.5-3 | | | 2.5-3.0 | |
| Steam generating boilers | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 6-8000 | | | | |
| Inv.: 1000 US \$ | | | | | | | | | | 500-680 | | | | |
| Empl.: No | | | | | | | | | | 150-200 | | | | |
| Energy: mil kWh/year | | | | | | | | | | 1.6-2.2 | | | | |
| 712 Tractors fact. | | | | | | | | | | | | | | |
| Cap.: thous. of tract (25 b.h.p.) | | | | | | | 14-16000 | | | | | | | |
| Inv.: 1000 US \$ | | | | | | | 4.5-6000 | | | | | | | |
| Empl.: No | | | | | | | 3-4000 | | | | | | | |
| Energy: mil kWh/year | | | | | | | 8-10 | | | | | | | |
| Agric. mach. a. appliances (Metal plows, harrows..) | | | | | | | | | | | | | | |
| Cap.: tons | | 600-700 | | | | | 600-700 | | | 600-700 | 600-700 | 600-700 | 600-700 | |
| Inv.: 1000 US \$ | | 90-100 | | | | | 90-100 | | | 90-100 | 90-100 | 90-100 | 90-100 | |
| Empl.: No | | 60-70 | | | | | 60-70 | | | 60-70 | 60-70 | 60-70 | 60-70 | |
| Energy: mil kWh/year | | 0.2-0.4 | | | | | 0.2-0.4 | | | 0.2-0.4 | 0.2-0.4 | 0.2-0.4 | 0.2-0.4 | |

| | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia | |
|---|----------|---------|--------|---------|--------|------------|----------|------------|----------|---------|-----------|----------|----------|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Agric.mach. - for harvesting threshing,sowing.. | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 7-8000 | | | | |
| Inv.: 1000 US \$ | | | | | | | | | | 800-960 | | | | |
| Empl.: No | | | | | | | | | | 150-170 | | | | |
| Energy: mil kWh/year | | | | | | | | | | 1.6-1.8 | | | | |
| 714 Office mach. typewriters a. simple calculating machine | | | | | | | | | | | | | | |
| Cap.: 1000 pieces | | | | | | | | | | 200-250 | | | | |
| Inv.: 1000 US \$ | | | | | | | | | | 300-400 | | | | |
| Empl.: No | | | | | | | | | | 300-400 | | | | |
| Energy: mil kWh/year | | | | | | | | | | 0.5-0.6 | | | | |
| 715 Drilling mach. | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | | | | 2000 | |
| Inv.: 1000 US \$ | | | | | | | | | | | | | 300-320 | |
| Empl.: No | | | | | | | | | | | | | 130-150 | |
| Energy: mil kWh/year | | | | | | | | | | | | | 0.6-0.8 | |
| Metal-cutting saw | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | 1000 | | | | | | | | |
| Inv.: 1000 US \$ | | | | | | 100-120 | | | | | | | | |
| Empl.: No | | | | | | 50-60 | | | | | | | | |
| Energy: mil kWh/year | | | | | | 0.3-0.4 | | | | | | | | |
| Tools grinding mach. | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | 200 | | 200 | 200 | | | 200 | 200 | |
| Inv.: 1000 US \$ | | | | | | 50-60 | | 5-60 | 50-60 | | | 50-60 | 50-60 | |
| Empl.: No | | | | | | 15-20 | | 15-20 | 15-20 | | | 15-20 | 15-20 | |
| Energy: mil kWh/year | | | | | | 0.07-0.1 | | 0.07-0.1 | 0.07-0.1 | | | 0.07-0.1 | 0.07-0.1 | |
| Lathes | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 3000 | | | | |
| Inv.: 1000 US \$ | | | | | | | | | | 450-500 | | | | |
| Empl.: No | | | | | | | | | | 300-350 | | | | |
| Energy: mil kWh/year | | | | | | | | | | 0.8-1.0 | | | | |

| | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia | |
|--------------------------------|----------|---------|--------|---------|--------|------------|----------|------------|--------|----------|-----------|----------|---------|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 717 Textile machinery | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 8-10000 | | | | |
| Inv.: mil US \$ | | | | | | | | | | 1.2-1.6 | | | | |
| Empl.: No | | | | | | | | | | 800-1000 | | | | |
| Energy: mil kWh/year | | | | | | | | | | 2.8-3.2 | | | | |
| Household sewing mach. | | | | | | | | | | | | | | |
| Cap.: 1000 pieces (à 50 kg) | | | | | | | | | | 50-60 | | 50-60 | | |
| Inv.: mil US \$ | | | | | | | | | | 0.5-0.6 | | 0.5-0.6 | | |
| Empl.: No | | | | | | | | | | 250-300 | | 250-300 | | |
| Energy: mil kWh/year | | | | | | | | | | 1.5-1.8 | | 1.5-1.8 | | |
| 718 Excavating mach. (lp. 10t) | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | 5-6000 | | | 5-6000 | | 5-6000 | 5-6000 | |
| Inv.: mil US \$ | | | | | | | 0.8-1.0 | | | 0.8-1.0 | | 0.8-1.0 | 0.8-1.0 | |
| Empl.: No | | | | | | | 150-180 | | | 150-180 | | 150-180 | 150-180 | |
| Energy: mil kWh/year | | | | | | | 1.5-1.8 | | | 1.5-1.8 | | 1.5-1.8 | 1.5-1.8 | |
| Milling mach. | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 4-5000 | | 4-5000 | | |
| Inv.: mil US \$ | | | | | | | | | | 0.6-0.7 | | 0.6-0.7 | | |
| Empl.: No | | | | | | | | | | 130-160 | | 130-160 | | |
| Energy: mil kWh/year | | | | | | | | | | 1.2-1.4 | | 1.2-1.4 | | |
| Stone Crushers | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 6-10000 | | | | |
| Inv.: mil US \$ | | | | | | | | | | 1-1.3 | | | | |
| Empl.: No | | | | | | | | | | 130-180 | | | | |
| Energy: mil kWh/year | | | | | | | | | | 2.3-2.5 | | | | |
| 719 Cocks, taps, valves works | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | | | | 3-5000 | |
| Inv.: mil US \$ | | | | | | | | | | | | | 0.5-0.7 | |
| Empl.: No | | | | | | | | | | | | | 120-170 | |
| Energy: mil kWh/year | | | | | | | | | | | | | 1.0-1.4 | |

| | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia | |
|---|----------|---------|--------|---------|--------|------------|----------|------------|--------|----------|-----------|----------|----------|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 719 Light pumps a household pump. stat. | | | | | | | | | | | | | | |
| Cap.: tons | 2-3000 | | | | | | 2-3000 | | | 2-3000 | | 2-3000 | 2-3000 | |
| Inv.: mil US \$ | 0.4-0.55 | | | | | | 0.4-0.55 | | | 0.4-0.55 | | 0.4-0.55 | 0.4-0.55 | |
| Empl.: No | 140-180 | | | | | | 140-180 | | | 140-180 | | 140-180 | 140-180 | |
| Energy: mil kWh/year | 0.6-0.8 | | | | | | 0.6-0.8 | | | 0.6-0.8 | | 0.6-0.8 | 0.6-0.8 | |
| Medium pumps | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | 3-4000 | 3-4000 | | | 3-4000 | | 3-4000 | 3-4000 | |
| Inv.: mil US \$ | | | | | | 0.6-1.1 | 0.6-1.1 | | | 0.6-1.1 | | 0.6-1.1 | 0.6-1.1 | |
| Empl.: No | | | | | | 160-200 | 160-200 | | | 160-200 | | 160-200 | 160-200 | |
| Energy: mil kWh/year | | | | | | 1.0-1.2 | 1.0-1.2 | | | 1.0-1.2 | | 1.0-1.2 | 1.0-1.2 | |
| Weighing mach. | | | | | | | | | | | | | | |
| Cap.: tons | 1.5-2000 | | | | | | | | | 1.5-2000 | | 3-4000 | 3-4000 | |
| Inv.: mil US \$ | 0.3-0.7 | | | | | | | | | 0.3-0.7 | | 0.5-0.6 | 0.5-0.6 | |
| Empl.: No | 100-120 | | | | | | | | | 100-120 | | 180-220 | 180-220 | |
| Energy: mil kWh/year | 0.5-0.7 | | | | | | | | | 0.5-0.7 | | 0.9-1.1 | 0.9-1.1 | |
| Winches hoisting | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | 4-5000 | | | 4-5000 | | 4-5000 | 4-5000 | |
| Inv.: mil US \$ | | | | | | | 0.5-0.6 | | | 0.5-0.6 | | 0.5-0.6 | 0.5-0.6 | |
| Empl.: No | | | | | | | 140-180 | | | 140-180 | | 140-180 | 140-180 | |
| Energy: mil kWh/year | | | | | | | 1.0-1.3 | | | 1.0-1.3 | | 1.0-1.3 | 1.0-1.3 | |
| 731 Railway freight cars | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | 12-15000 | | 12-15000 | | |
| Inv.: mil US \$ | | | | | | | | | | 1.0-1.2 | | 1.0-1.2 | | |
| Empl.: No | | | | | | | | | | 200-250 | | 200-250 | | |
| Energy: mil kWh/year | | | | | | | | | | 4-5.0 | | 4-5.0 | | |
| Wheel sets w. | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | | | | | | 8-10000 | | |
| Inv.: mil US \$ | | | | | | | | | | | | 2.0-2.3 | | |
| Empl.: No | | | | | | | | | | | | 100-150 | | |
| Energy: mil kWh/year | | | | | | | | | | | | 3.4-3.8 | | |

| | Ethiopia | Somalia | Rwanda | Burundi | Malawi | Mozambique | Tanzania | Madagascar | Uganda | Kenya | Mauritius | Rhodesia | Zambia | Sub-Region |
|--|----------|---------|-----------|-----------|-----------|------------|----------|------------|----------|-----------|-----------|----------|---------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 732 Cars | | | | | | | | | | | | | | |
| Cap.: 1000 units | | | | | | | 60-70 | | | | | | | |
| Inv.: mil US \$ | | | | | | | 20-25 | | | | | | | |
| Empl.: No | | | | | | | 6-8000 | | | | | | | |
| Energy: mil kWh/year | | | | | | | 4-6.0 | | | | | | | |
| Buses and heavy comerc. veh. and lorries assembly | | | | | | | | | | | | | | |
| Cap.: tons | | | | | | | 6-8000 | | 6-8000 | 6-8000 | | 6-8000 | 6-8000 | |
| Inv.: mil US \$ | | | | | | | 0.3-0.4 | | 0.3-0.4 | 0.3-0.4 | | 0.3-0.4 | 0.3-0.4 | |
| Empl.: No | | | | | | | 60-80 | | 60-80 | 60-80 | | 60-80 | 60-80 | |
| Energy: mil kWh/year | | | | | | | 0.1-0.2 | | 0.1-0.2 | 0.1-0.2 | | 0.1-0.2 | 0.1-0.2 | |
| Motor veh. parts (spare parts) | | | | | | | | | | | | | | |
| Cap.: tons | 2-3000 | | | | | | | 2-3000 | 2-3000 | 2-3000 | | 2-3000 | 2-3000 | |
| Inv.: mil US \$ | 0.6-0.9 | | | | | | | 0.6-0.9 | 0.6-0.9 | 0.6-0.9 | | 0.6-0.9 | 0.6-0.9 | |
| Empl.: No | 200-300 | | | | | | | 200-300 | 200-300 | 200-300 | | 200-300 | 200-300 | |
| Energy: mil kWh/year | 0.6-0.9 | | | | | | | 0.6-0.9 | 0.6-0.9 | 0.6-0.9 | | 0.6-0.9 | 0.6-0.9 | |
| 733 Bicycles | | | | | | | | | | | | | | |
| Cap.: 1000 units | 100 | | 20 | 20 | 20 | 100 | 200 | 60 | 60 | 20 | 20 | 300 | 200 | |
| Inv.: 1000 US \$ | 270 | | 60 | 60 | 60 | 270 | 500 | 160 | 160 | 60 | 60 | 700 | 500 | |
| Empl.: No | 200-250 | | 50-60 | 50-60 | 50-60 | 200-250 | 330-360 | 130-150 | 130-150 | 50-60 | 50-60 | 450-500 | 330-360 | |
| Energy: mil kWh/year | 0.3-0.4 | | 0.06-0.08 | 0.06-0.08 | 0.06-0.08 | 0.3-0.4 | 0.5-0.7 | 0.1-0.15 | 0.1-0.15 | 0.06-0.08 | 0.06-0.08 | 0.6-0.8 | 0.5-0.7 | |
| Trailers | | | | | | | | | | | | | | |
| Cap.: 1000 units | | | | | | | 15-20 | | | | | | | |
| Inv.: mil US \$ | | | | | | | 1.4-1.8 | | | | | | | |
| Empl.: No | | | | | | | 300-350 | | | | | | | |
| Energy: mil kWh/year | | | | | | | 4-4.5 | | | | | | | |
| Total production | | | | | | | | | | | | | | |
| Cap.: tons | 20450 | | 195 | 220 | 375 | 6150 | 172550 | 17150 | 33700 | 133500 | 295 | 218300 | 92200 | 695085 |
| Inv.: mil US \$ | 5.33 | | 0.145 | 0.100 | 0.145 | 1.52 | 42.17 | 3.95 | 4.60 | 21.86 | 0.125 | 29.87 | 18.97 | 128.79 |
| Empl.: No | 1710 | | 125 | 75 | 125 | 800 | 15030 | 950 | 1280 | 7010 | 120 | 4260 | 4980 | 36465 |
| Energy: mil kWh/year | 7.9 | | 0.16 | 0.14 | 0.16 | 1.95 | 35.05 | 4.92 | 8.18 | 40.80 | 0.13 | 50.06 | 26.90 | 176.35 |

ANNEX IV

Basic Information regarding Minimum Economic Sizes of European Plants for various Branches of Industry,
Investment needs, labour force, floor area and energy consumption

| Serial Number | Product Group | Minimum Economic Capacity | Maximum weight of piece to be lifted | Investment | | Working hours | | Output per annum | | Total floor area per workman | Production on workmen as percentage of total | | Energy Consumption per unit of production |
|----------------|--|---------------------------|--------------------------------------|----------------------------------|---------------------------------|------------------------------|--|------------------------|---------------------------------------|------------------------------|--|-----------|---|
| | | | | per unit of production per annum | into building as % age of total | Total per unit of production | machinery hours as percentage of total | per production workman | per m ² of production area | | Workmen | Employees | |
| | | 1000 t.p.a. | Kgs | US\$/ton | % | Hrs/ton | % | tons per workman | tons/m ² (2 shifts) | M ² per workman | % | % | kWh/ton |
| 1 | Cast iron pipes and fittings | 4-9 | 500 | 90 | 38 | 40 | 70 | 47 | 1.8 | 30 | 80 | 72 | 240 |
| 3 | Heavy structures | 5-10 | 40,000 | 120 | 60 | 45 | 40 | 42 | 1.2 | 80 | 85 | 75 | 230 |
| 4 | Light structures | 5-10 | 10,000 | 70 | 50 | 35 | 40 | 40 | 3.6 | 30 | 70 | 64 | 260 |
| 5 | Fuel and gas tanks | 5-10 | 10,000 | 60 | 45 | 34 | 45 | 55 | 2.3 | 48 | 70 | 65 | 240 |
| 6 | Metal containers | 2-5 | 3,000 | 120 | 50 | 32 | 45 | 40 | 2.5 | 40 | 70 | 65 | 250 |
| 7 | Boilers, pressure, vessels, etc. | 10-20 | 25,000 | 120 | 45 | 44 | 48 | 43 | 1.8 | 55 | 80 | 72 | 275 |
| 10 | Metal hand tools and implements | 1-1.5 | 30 | 160 | 28 | 220 | 80 | 8.5 | 0.95 | 24 | 93 | 88 | 400 |
| 15 | Ironmongery | 1-2 | 18 | 116 | 30 | 130 | 80 | 14.5 | 1.6 | 16 | 86 | 80 | 300 |
| 19 | Sanitary and plumbing fittings | 6-8 | 300 | 40 | 36 | 30 | 65 | 62 | 4.2 | 35 | 78 | 70 | 250 |
| 23 | Internal combustion engines | 6-10 | 150 | 140 | 40 | 110 | 63 | 17 | 1.0 | 40 | 75 | 65 | 280 |
| 24a | Agricultural machinery for preparing & cultivating the soil | 16-20 | - | 45 | 44 | 23 | 65 | 82 | 3.0 | 66 | 75 | 66 | 230 |
| 24b | Agricultural machinery for harvesting, threshing & sorting | 4-6 | - | 42 | 47 | 57 | 72 | 33 | 2.2 | 33 | 80 | 76 | 250 |
| 28 | Machine tools for working metals | 0.7-1 | 210 | 290 | 33 | 188 | 90 | 10 | 0.8 | 30 | 78 | 70 | 450 |
| 28a | Gas operating, welding and cutting appliances | 1.6-2.5 | 1,000 | 140 | 27 | 87 | 70 | 22 | 2.0 | 24 | 80 | 65 | 320 |
| 30 | Pumps and centrifuges | 2-3 | 2,000 | 180 | 31 | 150 | 56 | 13 | 1.0 | 30 | 80 | 72 | 320 |
| 32 | Earth moving machinery | 2-3 | 7,500 | 110 | 46 | 60 | 51 | 32 | 1.0 | 61 | 78 | 73 | 290 |
| 33 | Conveying machinery (Light) | 4-6 | 500 | 58 | 35 | 47 | 60 | 40 | 2.2 | 37 | 80 | 70 | 270 |
| 34 | Mining machinery | 2-4 | 3,000 | 150 | 37 | 130 | 70 | 15 | 0.7 | 49 | 90 | 75 | 330 |
| 35 | Woodworking machinery | 6-10 | 1,000 | 250 | 31 | 255 | 58 | 7.5 | 0.5 | 34 | 87 | 83 | 430 |
| 39 | Sewing, household machinery | 9-10 | 50 | 120 | 30 | 190 | 75 | 10 | 1.5 | 15 | 72 | 60 | 600 |
| 40 | Refrigerating equipment a/ | 20-25 | 110 | 80 | 45 | 95 | 52 | 20 | 1.7 | 36 | 85 | 66 | 300 |
| 41 | Food preparation machinery | 3-5 | 1,500 | 160 | 39 | 135 | 52 | 14 | 0.7 | 37 | 78 | 67 | 300 |
| 44 | Stone and glass machinery | 25-30 | 10,000 | 270 | 39 | 34 | 60 | 56 | 1.7 | 72 | 81 | 72 | 300 |
| 45 | Machinery for plastics | 1-2 | 8,000 | 200 | 36 | 150 | 55 | 12 | 1.0 | 31 | 75 | 65 | 380 |
| 48 | Reheating, annealing and drying furnaces | 3-5 | 1,000 | 85 | 36 | 90 | 51 | 21 | 2.0 | 26 | 87 | 82 | 260 |
| 49 | Ball, roller and needle roller bearings | 0.2-0.3 | - | 410 | 29 | 3,500 | 80 | 0.5 | 0.05 | 34 | 88 | 70 | 16,000 |
| 50a | Brick & ceramic working machinery | 6-10 | 1,500 | 90 | 32 | 75 | 60 | 26 | 1.7 | 35 | 85 | 78 | 300 |
| 50b | Balances | 20-25 b/ | 175 | 80 | 40 | 110 | 53 | 70 | 1.3 | 31 | 81 | 73 | 260 |
| 50c | Valves (industrial) | 4-6 | 800 | 100 | 31 | 63 | 85 | 30 | 1.6 | 37 | 72 | 65 | 280 |
| 51a | Motors, 0.1 to 10 kw | 1.5-2 | 80 | 230 | 31 | 370 | 55 | 5 | 1.0 | 14 | 95 | 80 | 350 |
| 51b | Rotating machinery | 3-5 | 1,400 | 120 | 30 | 87 | 56 | 22 | 2.0 | 20 | 75 | 65 | 260 |
| 52 | Switchgear & transformers | 0.2-0.5 | 600 | 265 | 45 | 385 | 54 | 5 | 0.5 | 32 | 88 | 77 | 255 |
| 58 | Industrial furnaces, electrical | 4-5 | 1,000 | 60 | 52 | 82 | 35 | 25 | 2.0 | 27 | 80 | 60 | 250 |
| 62 | Apparatus for measuring | 0.7-0.9 | 50 | 240 | 42 | 700 | 56 | 2.7 | 0.5 | 14 | 84 | 74 | 370 |
| 65 | Insulated cables | 20-25 | - | 90 | 26 | 22 | 90 | 87 | 1.7 | 89 | 77 | 75 | 220 |
| 67a | Domestic refrigerators | 20-25 b/ | 110 | 80 | 45 | 95 | 52 | 20 | 1.7 | 36 | 85 | 66 | 300 |
| 67b | Domestic washing machines | 20-25 b/ | 100 | 80 | 45 | 90 | 50 | 20 | 1.6 | 35 | 85 | 66 | 300 |
| 67c | Electromechanical domestic appliances | 1.5-2 | 50 | 100 | 30 | 115 | 55 | 16 | 2.0 | 20 | 75 | 68 | 250 |
| 68d } 68e } | Railway and tram cars, whether mechanically propelled or not | 20-25 | 10,000 | 100 | 39 | 60 | 45 | 32 | 2.0 | 37 | 72 | 65 | 240 |

a/ Basis of size is competition in the international markets.

b/ Unit is 1,000 pieces.