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PROSPECTS OF AN INTEGRATED DEVELOPMENT OF THE IRON AND STEEL INDUSTRY AND CAPITAL GOODS: EAST AND SOUTHERN AFRICAN COUNTRIES*

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Part I

1.1 Introduction

In the present study the aim is to develop a conceptual framework and the identification of modalities of de elopment based on some experience of developing countries that would promote an integrated development between the iron and steel industry and capital goods sector in the Eastern and Southern African countries. The existing and potential development of iron and steel industry will be analysed in relation to the supply factors and demand "pull" of the capital goods industry and other sectors of the economy, namely: the manufacture of machinery and equipment by the engineerng industries, mining , agriculture, transport, energy and telecommunication sectors.

From the supply side the study tries to identify the resource structure for the production of iron and steel and the principal iron and steel products at present produced in these countries including new products and their use. On the basis of the results obtained a typology of the countries studied is established, according to the type and level of integration between the iron and steel industry and other sectors of the economy at the national and regional levels and taking into account the level of dependence on the international economy. The end-use structure of intermediate and capital goods in Zimbabwe and selected countries of the East and Southern African region is discussed in relation

to the structure of metals and metals products sector or engineering-based industries.

The study also aims at identifying policies and strategies for achieving increased integration between the iron and steel industry and the capital goods sector. The pertinent issues of selecting the "appropriate" technological alternatives that would achieve a more independent and self-reliant development path, the mobilisation of financial resources and training of an appropriate cadre for this industry will be discussed.

Finally the study aims at proposing possibilities for co-operation and/or complementarity between the countries of Africa in the development of iron and steel industry.

1.2 Iron and Steel Production in the East and Southern African Region

The importance of the iron and steel production in the region has often been given the highest priority by African leaders. At the sixth meeting of the Council of Ministers of the Lusaka based MULPOC held in Mbabane, Swaziland in February 1983 the following projects were approved:

(a) Upgrading and diversification of products from ZISCOSTEEL to meet the present iron and steel requirements of the subregion up to the year 2000.

(b) Expansion of existing and development of new electric

and arc furnace (EAF) steelmaking plants based on available scrap and sponge iron to be made available within the subregion to meet the crude steel requirements of the subregion up to the year 2000.

(c) Construction of direct reduction (DR) plants to produce sponge iron in Angola and Mozambique to meet the subregional demand for sponge up to the year 2000.

(d) Integration of EAF steel plants with rolling mills to ironmaking units of the region where demand will have reached a high enough level to justify integration.

As Table 1 shows eleven countries in this region have among them about 8 400 million tonnes of iron ore. As also shown in Table 1 the iron ore content in the region is fairly high, especially in the cases of Tanzania, Uganda, Zambia and Zimbabwe. Table 2 shows that coal reserves under exploitation in the region amount to nearly 30 000 million tons. However, as shown in Table 1, coking coal totals 778 million tons, and is only found in Mozambique and Zimbabwe. Virtually every country in this group has hydroelectric potential which amounts to slightly over 163 000.

Zimbabwe has known reserves of iron ore estimated at 3 700 million tonnes. Around 133 million tons of iron-ore with ore content varying between 40-66% Fe. are at present exploitable. The reserves are found around Zvishavane, Kwekwe and Harare areas, but currently mining is only taking place at Bukwe and

TABLE 1.

IRON AND STEEL INDUSTRY RAW MATERIALS.

COUNTRY	IRON ORE m tons	FE content in %	COAL m tons	GAS	PETROLEUM m tons	HYDRO-ELEC (m watts)
ANGOLA	3 292	32 & 40	_	42	164	11 031
ETHIOPIA	24		_	_	_	12 790
KENYA	32		_	_	_	12 274
MADAGASC.	551	35 & 40	_	_	_	73 059
MALAWI	_		_	_	_	91
MAURITIUS	_		_	_	_	13
MOZAMBIQ.	309		300	17	_	10 310
TANZANIA	125	50	_	3	_	18 995
UGANDA	98	62 & 68	_	_	_	16 439
ZAMBIA	306	40-60	_	_	_	3 500
ZIMBABWE	3 678	40-69	478	_	_	4 566
TOTAL	8 415		778	62	164	163 068

SOURCE: ECA Metal Industry Development Programme.
paper presented to second meeting of ESASDC Addis Ababa, October 1983, and country sources.

TABLE 2.

COAL - RESERVES IN ESASDC COUNTRIES. (i)

Not under exploitation		Commercial reserves under exploitation	
Country	Quantity mill tons	Country	Quantity mill tons
Botswana	708	Zimbabwe	22 500
Angola	8	Zambia	20
Ethiopia	10	Tanzania	1 511
		Swaziland	5 150
		Mozambique	700
		Madagascar	50

NOTES:
(i) ESASDC represents East and Southern African Steel Development Committee.

Source: United Nations ECA/MULPOC/LUSAKA/IV/6, 4 December 1980

Ripple Creek in the Midlands. The ore contents at Bukwa (61%) and Ripple Creek (54%) are considerably higher than the ore content found in some European countries of about 38%. At the projected rate of exploitation Zimbabwe's iron-ore reserves is expected to last another 35 years.

Zimbabwe has known reserves of coal estimated at 22 000 million tonnes, about 6 500 million tons of which are commercially exploitable. Coking coal resources amount to 478 million tons. The latter is purchased from Hwange Colliery and transported by unit trains to Redcliff, the site of ZISCOSTEEL, Zimbabwe's iron and steel plant.

Zimbabwe is also endowed with over 200 million tons of limestone reserves adjacent to the plant and a good quantity of other fluxing materials. The latter includes manganese, fluorspar, corrundum and dolomite. Clay for the production of refractories is also available in Zimbabwe. At present a narrow range of refractories is being manufactured locally while the rest are imported from South Africa, Europe and North America.

Tanzania has an estimated 49 million tonnes of titanic-ferrous iron-ore at Liganga and coal reserves in Mchuchuma estimated at about 1,500 million tons. Some quantities of limestone and fluorspar have been recorded. Energy supply is, therefore, not a conscraint to the exploitation of iron and steelworks in Tanzania. Zambia also has iron ore occurences all over the

country, coal depots and major fluxing and refractory materials such as limestone, fluorspar, ferro manganese and quartz.

Uganda's iron-ore deposits are mainly of magnetite type in Sukulu mines - Tororo in Eastern Uganda and in Western and Southern Uganda there are substantial deposits of high grade ores whose content is about 68% Fe. In addition Uganda has sufficient hydro-electric power, limestone and charcoal for the establishment of an iron and steel industry. As yet there are no studies carried out to determine the existence of sufficient deposits of fluxes and raw materials for the refractory industry.

Kenya's known iron ore deposits are less than 40 million tons. The deposits are generally of very low grade. Other raw materials in support of an iron and steel industry are limestone deposits (6 - 10 million tons), fluorspar (15 million tons), silica (1,4 million tons) and manganese (443,000 tons). = Kenya, thus faces the problem of importing large amounts of iron-ore from the world market. Yet another problem facing Kenya is developing an alternative fuel energy source such as charcoal from Eucalyptus trees since metallurgical coal is not available in Kenya.

The only existing integrated iron and steel plant in the subregion is the Zimbabwe Iron and Steel Company (ZISCO) at Redcliff in Zimbabwe. ZISCOSTEEL is an integrated producer of semi-finished and finished steel products. It has a capacity of one million tons per year. The maximum capacity of one million

tonnes stated in the Rehabilitation Study [3] is considered to be an overestimate. The best annual production achieved in 1980 was 804 000 tonnes. The more recent British Steel Corporation (Overseas Services) Ltd review of the Rehabilitation plan suggests that hot metal and oxygen supplies constrain current output to a realistically estimated maximum level of 850 000 tons.

Already by 1960 colonial Zimbabwe could support an iron and steel industry to meet a significant part of its own needs and those of the surrounding countries and in addition, such overseas export markets as could be secured for pig iron, steel billets and rolled steel. The products were being diversified to include sections, sheets and light plates, reinforcing roads and galvanized roofing. By the time of the Unilateral Declaration of Independence (UDI) in 1965, Zimbabwean production capacity had reached 400 000 tons per year with a significant export market in the region and Japan.

During the 1970s the Rhodesian regime undertook a major sanctions busting expansion programme and introduced advanced processes through collaboration with Voest Alpine (Austrian) as the license holder for the best tried modern steel making process (the LD process) and a continuous casting unit. The LD process, which is an oxygen blast process lowers capital costs by 33% and the production costs by 4% over the traditional open hearth techniques for a 500 000 ton unit. Payment was to be made in

steel, but because of the disclosure of the deal, the government had to salvage the situation by advancing a massive loan totalling some $92 million, which resulted in raising the state share to 50%. As a result of this ZISCO became the largest investment in the ecoomy with a shareholders' equity capital of $91 million, a state share capital of $60 million, and fixed investment valued at over $142 million. In 1980 the government offered financial guarantees for ZISCO. The present government shareholding is 49.3%. In 1980 ZISCO's output reached a record level of 804 000 tons but by 1982 the output had dropped to 700,000 tons. Of the 1980 output 75% was exported.

ZISCO's output includes wire rods, flats, sections (not the larger H-sections) and probably some gauges of tube and pipe as well. ZISCOSTEEL's steels are made in rimming, semi-killed and killed qualities which can be supplied to chemical analysis in SAE, DIN and British standards. See Appendix A for a detailed specification of ZISCO'S products. Zimbabwe has an ongoing iron and steel project involving the following:

(i) Upgrading of existing bar/rod mill;

(ii) Installing a new light and medium section mill to replace the existing one with a view to extending the range of sections to be produced;

(iii) Conversion of the existing bloom caster to a new slab/bloom caster;

(iv) Installing a new plate and strip coil mill;

(v) Production of high alloyed steels.

Plates and sheets are not produced at present, nor is stainless steel.

The other countries in the region (notably, Angola, Kenya, Madagascar, Mozambique, Tanzania and Zambia) have in recent years been developing varying projects for the production of primary steel (pig iron) and secondary steel production. Angola has a plant with an installed capacity of 30 000 tons per year. In addition Angola has plans for a project of crude steel production envisaged to expand from 30 000 to 500 000 tons per annum. Kenya envisages installing crude steel production of 300 000 to 500 000 tpa. This capacity will mainly be produced by semi-integrated plants melting scrap in electric furnaces and rerollers operating on rolling of imported billets producing such products as bar steel, wire and light sections.

Zambia is one of the few countries in the East and Southern African region with iron and steel production. In 1978 production was slightly over 31,800 tons. The performance existing plants are based on scrap.

In the second meeting of the Eastern and Southern African Steel Development Committee (ESASDC) a framework for the development of iron and steel industry in Angola and

Mozambique is outlined as follows:

(i) For Angola short-term measures would involve the rehabilitation and reactivation of iron ore mines, and the rehabilitation of the existing scrap based steelworks in Luanda. In the long- term Angola would develop a pelletising plant project including integration with DR plant and an EAF steelmaking.

(ii) In the short-term Mozambique proposed a mining project, DRI, EAF steelmaking, continuous casting and rolling mills which would boost their present production from 45 000 tons per year to 200 000 tons per year by 1986 and to 400 000 tons per year by 1990.[5]

Uganda's existing steelplant has an annual capacity of 25 000 tonnes producing bars, rods and sections. The internal steel production depends on imported billets, and ingots and local scrap. At present the only alternative to using scrap which presents difficulties in its collection, is the production of sponge-iron. Uganda has tentative plans for producing sponge-iron from small-scale electro-steel making. This is based on the assumption that the blast furnace oxygen convertor route would be preferable for large-scale production. [6]

Uganda has plans to increase capacity to 100 000 tons per year, utilising local high grade (over 68% Fe) iron ore deposits. There are also plans to begin the expanded

programme from 1986 possibly with the local participation of approximately 30% and the remaining share being taken by multinational sources through subregional cooperation programmes under the auspices of the Industrial Development Decade for Africa (IDDA).

Ethiopia's iron and steelworks accounts for 35% of the output with the remaining 65% feedstock being made up of imported billets, coils and small amount of bedstead angles. Ethiopia's product range consists of reinforcing bar (deformed) 8mm - 30mm, fencing wire, bedsprings and bedstead bases and nails. The steel-plant is based on scrap. Its rod mill has a rated capacity of 24 000 tons per annum and a best performance to date of 18 000 tons, a wire drawing capacity of 4 500 tons per year.

If we take the ISIC 371 as a proxy for the domestic steel production, figures for seven countries belonging to SADCC (Cf. Table 3) show that only US$420 million of steel was produced in these countries. This is compared to an import figure of iron and steel products US$235 million which shows a surplus production of iron and steel products in the region.

94 per cent of this production comes from Zimbabwe, with Zambia producing 4% and Tanzania - 1,5% and the remaining countries (Botwana, Lesotho, Malawi and Swaziland) not

TABLE 3.

SUPPLY AND DISPOSITION OF MANUFACTURES BY ISIC CATEGORY, 1980
(US$ mill in current prices

COUNTRY	ISIC	DOMESTIC PROD.	IMPORT	TOTAL	EXPORTS	DOMESTIC CONSUMP
BOTSWANA	371	_	22,4	22,4	_	22,4
	381	1,3	52,8	54,1	0,3	53,3
	382	12,1	78,7	90,8	1,9	88,9
	383	0,6	39,2	39,8	0,4	39,4
	384	_	78,3	78,3	7,8	70,5
LESOTHO	371	_	11,1	11,1	_	11,1
	381	0,4	21,3	21,7	_	21,7
	382	_	16,8	16,8	_	16,8
	383	_	43,9	43,9	0,7	43,2
	384	_	2,1	2,1	0,1	2,0
MALAWI	371	_	30,3	30,3	0,5	29,8
	381	_	19,3	19,3	0,1	19,2
	382	_	40,1	40,1	5,8	34,3
	383	_	40,3	40,3	_	40,3
	384	_	67,9	67,9	4,4	63,5
SWAZI.	371	_	18,9	18,9	_	18,9
	381	14,8	27,4	42,2	11,9	30,4
	382	2,3	23,5	25,8	0,3	25,5
	383	13,8	15,1	28,9	12,5	16,4
	384	_	60,8	60,8	_	60,4
TANZAN.	371	6,4	42,1	48,5	_	48,5
	381	15,2	40,0	55,2	1,2	54,0
	382	_	212,5	212,5	_	212,5
	383	17,2	66,1	83,3	2,7	80,7
	384	_	152,2	152,2	0,2	152,2
ZAMBIA	371	17,5	53,1	70,6	0,1	70,5
	381	136,8	33,8	170,6	0,3	170,3
	382	44,2	191,2	235,4	2,0	233,4
	383	54,5	64,2	118,7	0,7	118,0
	384	36,0	131,9	167,9	1,1	166,8
ZIMBABWE	371	396,0	57,3	453,3	187,6	265,6
	381	228,6	17,4	246,0	16,9	229,1
	382	98,0	175,2	273,2	14,5	258,7
	383	99,4	115,2	214,6	7,0	207,6
	384	90,5	222,9	313,4	8,4	305,1

producing steel products. In terms of direct steel consumption, in crude steel equivalents per capita in 13 ESASDC countries (Cf. Table 4) Zimbabwe's average was 106 in the years 1975-1980, Kenya - about 15 and the remaining countries below 10.

TABLE 4.

APPARENT DIRECT STEEL CONSUMPTION, IN CRUDE STEEL EQUIVALENTS PER CAPITA IN SELECTED AFRICAN COUNTRIES

	1975	1978	1979	1980
ZIMBABWE	80 a	130 a	104 a	110 a
BOTSWANA	–	–	–	–
MALAWI	7 a	4 a	3 a	6 a
MOZAMBIQUE	6 f,e	7 f	3 f,e	7 f,e
ZAMBIA	14 a	6 a	6 a	5 a
ETHIOPIA	1 a	1 a	2 a	2 a
KENYA	9 a	18 a	16 a	15 a
TANZANIA	5 a	8 a	5 a	5 a
ANGOLA	9 a	6 a	6 a	11 a
MADAGASCAR	5 a	6 a	8 a	8 a
MAURITIUS	–	–	–	–
SOMALIA	–	–	–	–
UGANDA	1 a	0 a	0 a	1 a

Notes:
a UN Statistical Yearbook 1981
e Estimated.
f Ministerio de Industria e Energia.

PART II

2. The Market and Demand Patterns of Iron and Steel Products

2.1 The arguments for the domestic market

The majority of national steel companies in the world rely upon their domestic markets for the greater part of their turnover. The domestic sales have the advantage of providing the local steel industry with continuity of business, stable prices, lower freight costs and close contact with the customer. However, because of the small size of the market of the sub-Saharan African countries, the development of their steel industries has to look into extra regional market or be co-ordinated at the sub-regional level.

Though the Zimbabwean market for iron and steel products has taken between one quarter and one third of the output of ZISCOSTEEL, the industry enjoys a captive market in which end-users are prohibited from importing materials within the local product range. Domestic users are also encouraged to adapt designs or dimensions to acommodate ZISCOSTEEL products, e.g. square bar has been twisted to provide a substitute for deformed reinforcing bar.

Results of research undertaken by the author show that most users of ZISCOSTEEL products were found to be reasonably satisfied with the products and service provided.[7] There were, however, some customers who considered that the product range, product quality and delivery could and should be improved. On a broad

policy level the primary responsibility of ZISCOSTEEL is to supply as far as possible the requirements of Zimbabwe's manufacturing and construction industries. The domestic market has a further incentive in that it is more remunerative than exports, which incur the heavy freight and port charges.

Thus, the first priority of ZISCOSTEEL is the development of the domestic market for finished steel products in every possible way. At present the steel consumption comprises of 141 000 tons of ZISCOSTEEL products (average of the 1981 - 1984 domestic sales in Table 5), 11 000 tons of heavy sections and 100 000 tons of sheet and plate giving a total of 252 000 tons. Both heavy sections and sheet & plate are imported. As shown in Table 6 domestic sales were only 29 percent and 22,6 percent in 1982 and 1983 respectively which left over 70 percent of output for the export market.

The main products for the local market are semis mainly for the production of wire and rod, medium sections used in the building and construction, light sections for the manufacture of light agricultural implements and rod & bar. The introduction of deformed reinforcing bars by ZISCOSTEEL is particularly appreciated by the construction industry in both local and the regional markets. It is estimated that 80% of the reinforcing bar used in Zimbabwe will be of deformed quality which is the same proportion as in the world trade.

TABLE 5.

ZISCOSTEEL SALES ('000 Product tons)

	1981	1982	1983	1984	1985 (i)
Domestic sales	184	134	112	134	139,2
Exports	319	373	395	253	679,2
TOTAL	503	507	507	387	824,0

Notes:

(i) These figures are estimates based on sales assumpitions for 1985 by ZISCOSTEEL.

TABLE 6.

ZISCOSTEEL SALES ('000 tons)

	LOCAL		EXP. OVERSEAS		OTHER AFRICA		TOTAL	
	1982	1983	1982	1983	1982	1983	1982	1983
Blooms	0,2	0,2	4,5	56,7	_	_	4,7	56,9
Billets	46,7	43,9	246,9	186,1	43,6	52,4	337,2	282,4
Medium Mill	28,3	16,6	4,9	12,5	3,8	3,8	37,0	32,9
Light Mill	33,4	21,8	_	4,4	0,5	3,3	33,9	29,5
Rod Mill	25,8	29,5	65,7	44,8	11,7	19,2	103,2	93,5
TOTAL	134,4	112,0	322,0	304,5	59,6	78,7	516,0	495,2
%	29,0	22,6	62,4	61,5	11,6	15,9	100	100

SOURCE: ZISCOSTEEL DATA.

Even if the domestic market of steel products within the product range of ZISCOSTEEL increases from about 160 000 to 320 000 tpa over the next ten years there will still be a surplus of over half a million tonnes of steel available for export. This is based on the projected production of between 850 000 tpa and 1 000 000 tpa.

2.2 The ESASDC regional market in iron and steel products

All the countries in East and Southern Africa stretching from Djibouti in the north to Lesotho in the south, including as well as the islands off the ccast consider themselves as an economic area which should be developed gradually and in conformity with an overall strategy. The governments of these countries have created several organisations which should facilitate the achievement of this objective, namely: SADCC, PTA and ESASDC.

As shown above the countries in this region already have planned projects for the production of iron and steel products. In the long-term the subregional demand for iron and steel in the ESASDC is projected at a level of 3,5 million tpa in 1990 and 8.3 million tpa by the year 2000.[5] The main product groups to be produced are bars, rods section, strip, hoop skelp, plate and sheet.

The ESASDC countries invariably have small steel producing plants. Thus, for instance, the plants in Angola, Ethiopia, Kenya, Tanzania, Uganda, are equipped with very small electric-arc furnaces using mainly scrap collected in the country concerned and/or imported from third countries. The mills in the region also depend on billets as input material. Some of the billets needed are locally produced but the bulk of them are imported from third countries with ZISCOSTEEL providing a small part.

Thus ZISCOSTEEL's second priority is the development of sales of pig-iron and billets within the East and Southern African region. This strategy is based on the assumption that the development of iron and steel industry, and the related metallurgical facilities in the ESA region is fundamental to the establishment of an industrial base in the subregion. It was on this premise that the ECA secretariat fielded a mission in 1980 to eight countries of the subregion (Angola, Botswana, Kenya, Madagascar, Mozambique, Tanzania, Zambia and Zimbabwe), to investigate ways and means of harmonizing and co-ordinating plans for developing the iron and steel industry and related metallurgical facilities taking into account the fact that development of the iron and steel industry should be conceived within the framework of subregional co-operation. [7]

At its first meeting in Redcliff, Zimbabwe, in November 1982, the ESASDC proposed for the adoption by the Sixth Meeting of the Council of Ministers of the Lusaka based MULPOC in Mbabane,

Swaziland, in February 1983 that member states agree in principle to obtain their needs of pig-iron and billets for their foundries and re-rolling mills from ZISCOSTEEL until they are in a position to produce these inputs themselves.

It has been suggested elsewhere that even if the home market grows, ZISCOSTEEL will be faced with the need to find markets outside Zimbabwe for more than double its 1984 tonnage, i.e. for an additional 300 000 tons .[10] ZISCOSTEEL sales plan for 1985 envisages exports of 590 000 tons of semis, i.e. 87% of all exports. Sales of semis have the advatanges of low steelmaking costs compared with the relatively high rolling costs of making sections. Rail and port handling costs are also slightly lower for billet and blooms particularly through the Mozambiquan ports.[11] Semis are particularly needed by developing country markets to feed their rolling mills until such time that their steel production come on stream. Though almost all the East and Southern African countries making up the PTA have plans for steel plants and some have scrap melting and re-rolling facilities, they will still the ZISCOSTEEL supply of ingots and billets for at least the next ten years

As shown in Table 7 countries under the PTA have taken very small proportions of total ZISCOSTEEL exports averaging about 10% between 1982 and 1984. The bulk of these sales, over 70% in

TABLE 7.

ZISCOSTEEL SALES TO PTA COUNTRIES (TONS).

	1982	1983	1984
Billets	4 223	6 814	2 392
Light sections	3 884	5 017	3 306
Medium sections	4 749	8 112	10 654
Rods & Bars	10 180	24 792	14 769
TOTAL	23 036	44 735	31 121
Proportion of total ZISCO exports	6,2%	11,3%	12,3%

SOURCE: British Steel Corporation (Overseas Study), March 1985

each year went to Mauritius and Indian Ocean Islands. However, the average annual consumption of iron and steel products in the PTA region for the ten years, 1970-1980 excluding Zimbabwe, was around 750 000 tons of which 400 000 were assumed to be long products within ZISCOSTEEL's product range. This demand pattern is expected to double by 1990[12]. According to ZISCOSTEEL sources the current needs of the PTA countries are estimated to be 221 000 tons of billets/blooms, 144 000 tons medium sections, 22 000 tons of light sections, 66 000 tonnes of rod & bars totalling 453 000 tons, indicating that the region can almost absorb almost all ZISCOSTEEL's steel that is presently produced.

Zimbabwe's sales by product specification and end-use for the African region is shown in Appendix B. The most common products with a destination in ESASDC countries are medium mill products: unequal angles, flats, channels, and I-beam for engineering and construction; rounds for grinding mill; rounds, square coils and square bars for reinforcing; rails, grader for mines and road making, and blades and plough shares for agricultural machinery.

The market for flat products in ESASDC countries includes hot and/or cold rolled products such as 73.08 coils, 73.09 universal plates, 73.12 hoop and strip and 73.13 sheets and plates. On its own, Zimbabwe's demand for flat steel products, which could be manufactured by ZISCOSTEEL, is assumed to 100 000 tpa. This

includes the supressed demand, of which about 40% is taken care by hot rolled and about 60% fall upon cold rolled products.

The main factor that determines the consumption of steel and flat steel products is the per capita level of the GNP and its development. The average of the GNP per capita of the ESA countries at about US$300-400 in 1981 is very low. The situation is further aggravated by the recent declines in GNP figures since 1981, and in some case since 1980. The governments of these countries will, however, need to look for the availability of the flat products which are essential for the industrial branches connected with agriculture: manufacture of water and irrigation pipes, agricultural machinery, food stores and warehouses, transport equipment (vehicle bodies and railway trucks), etc. The direction of capital formation in the area intermediate goods and capital goods sectors using both long and flat steel products is an important link between steel industries and the sectoral development of the economy.

As will be shown below the most important determinants of demand for iron and steel products is probably the existence of the capital goods sector and intermediate goods production mainly for the construction and building industry. The construction sector places demand on the production of concrete bars, high and medium sections, rails and grinders most of which are availab[illegible] ... the region mainly from ZISCOSTEEL in Zimbabwe.

Collective self-reliance in the East and Southern African subregion requires the development of a subregional vertical integrated iron and steel industry that has "down-stream" production of metals and metal products. In turn the already existing development of capital goods sector especially in Zimbabwe and to a lesser extent in Zambia, Kenya and Tanzania require the "up-stream" basic metal industries.

Even more important, the capital goods sector provides the horizontal integration with the sectoral structure of these economies as clearly demonstrated by the end-use demand structure of the Zimbabwean intermediate and capital goods, e.g. for the countries of the ESASDC their agricultural sector consumes drawn products like wire and nails, galvanized plate and pipes for irrigation, water supply etc, rods and bars for many types of animal and tractor drawn equipment and implements and plate and sheet for plough shares and other specialized parts of agricultural machinery. This will be discussed under the next section of the structure and composition of capital goods in the region.

2.3 Justification of the Development of the Iron & Steel Industry in the region

The conventional measures for the domestic market for iron and steel consumption are size of population and per capita income. It is often assumed that at an earlier phase of economic development the share of building and civil engineering construction is high, usually around 40 - 60 percent of iron and steel utilisation. This is followed by the next phase of economic development in which building and civil engineering becomes less significant in its utilisation of iron and steel products, falling to 20 - 30 percent. During this phase fabrication and manufacture of transport equipment takes the leading share in the apparent steel consumption at around 40 percent. Only in the higher stage of economic development the major use of steel is in the manufacture of machinery and metal products. At this point the engineering industry has begun self-sustaining development on the basis of domestic production for the home market.

The main factor that determines the consumption of steel and flat steel products is the per capita level of the GNP and its development. The population of the ESA-IDC countries is about 170 million. The average of the GNP per capita of the ESA countries at about US$300-400 in 1981 is very low. The situation is further aggravated by the recent declines in GNP figures since 1981, and in some case since 1980.

Though the population index cannot be minimized in its influence

on iron and steel consumption, it does not constitute a central place in the strategy for self reliance based on the development of iron and steel industry and the capital goods sector. As will be seen below the linkages of the steel industry with the capital goods sector are at the centre of a co-ordinated development in which a capital goods industry plays a major role.

According to this criteria, Zimbabwe's average of 42 kg. per capita consumption of iron and steel is low for a country with a per capita GDP of around US$ 800. On this basis it is, therefore, assumed that Zimbabwe's economy is yet to move into rapid industrialisation that is accompanied by heavy spending on infrastructure improvements, a trend that has so far been delayed by a number of factors, including the colonial racial discrimination in which the country's majority was left out of the developmental infrastructural improvements, and more recently by world depression and the recent prolonged drought. An upturn in the domestic economy following the end of drought, the international depression and improvement in the country's foreign exchange earnings is expected to lead into higher consumption of steel-intensive infrastructural projects and housing affecting the country's majority of citizens. Iron and steel utilisation may be reflected in more production of farm implements such as small-scale agricultural equipment, wire, fence posts, etc. While eventually leading to more intensive use of iron and steel products, this approach is less geared to a structural transformation of the production system using iron and steel as a

"push" factor. Particularly more important is the development of capital goods industry (including intermediate goods) as a "pull" effect in the end-use of steel production producing internal dynamics in the economic system. This will be discussed in more detail in Part III below.

Part III

The Capital Goods Sector in the ESASDC countries

3.1 Background

The industrial priorities set out in the Lagos Plan of Action (LPA) and in the Industrial Development Decade Africa programme (IDDA) identified, inter alia, food and agriculture, transport and communications, building and construction, mechanical, metallurgical and engineering industries. The medium term of the LPA and the second phase of IDDA are also devoted to the creation of a solid base for self-sustained industrialization, the development of the human resource, the production of tools and machines, sufficient quantities of building materials and the development of intermediate and capital goods industries.

The successful implementation of these objectives will depend on the correct identification and selection of core industries, particularly the resource-based and engineering-based core industries. It is argued that once such industries are established they have significant foward/backward linkage effects on other industries and economic sectors. Central to the South-South argument for self reliance and self autonomous development is the development of resource-based core engineering industries.

A rough indicator of the production of capital goods in seven countries belonging to SADCC (Tables 3 and 8) is represented by the ISIC three digit classification 381-384. In this study we are

not going into analysis of trade in capital goods by SITC 69+7 categories since this has been done in a recent UNIDO study "The Capital Goods Industry in Africa: A General Review and Elements For Further Analysis" Sectoral Studies Series No.14. We specifically look at the linkages between actual and potential dynamics of the demand "pull" factors of the capital goods on the products of iron and steel industry, which in turn lay the basis for changes in the product mix used as inputs in these economies' sectoral structure of production.

The existence of iron and steel and metallurgical industries in the ESASDC countries provides "down-stream" industries with a continuous supply of metals needed by the capital goods. As the hub of engineering industry the capital goods provides a base for self-sustaining industrialization, and serves as a focal point for the accumulation and the development of technical skills. It contributes immensely to the training of people in technical and managerial skills, in creating production and design capabilities and improving organisational methods of production.

The engineering core industries for the manufacture of capital goods service both industry and other priority sectors, e.g agriculture, construction, transport, mining and energy and telecommunications. They are required for the production, inter alia, of building and construction materials, agricultural tools, spare parts, implements and machinery, and other products which are essential for the development of a diverse mix and comple>

production covering a wide range of sectors in the economic system. It can be argued that the capital goods sector is important in determining the viability of the economic system as a whole, technological change and absorption and displacement of labour. This is because an economy or region without well developed metal products, machinery and subsidiary industries cannot produce enough capital goods and thus invest a high proportion of its income, however high its potential saving propensity may be. Such an accumulation path is not only meant for closed economies as is often the case in models of the Feldman- Mahalanobis type. Open and trading economies have shown to be vulnerable to the adverse terms of trade resulting from their lack of capacities in the production of capital goods and the associated deficiences of shortage of skilled manpower, facilities of the learning processes and externalities.

What use can be made of the economic surplus depends on the material structure of the productive system. Even if savings in developing countries are improved to quite substantial levels, there is still the structural inability to convert these savings or economic surplus into investment. This situation results in the usual phenomena of "conspicuous" consumption, hoarding, capital flights, etc. Thus, the existence of a capital goods sector is crucial for the physical technical aspects, that cannot be replaced by purely financial aspects of savings and investment. If this sector is to be understood as necessary though not sufficient condition for autonomous industrialization,

it should be considered a political issue of the highest order, involving a strategy of "selective delinking" and the time horizon over which technological autonomy can be achieved.

Basic support facilities such as foundry, heat treatment, forging, machine tool shop will be needed for the production of components, spare parts and other products required for the manufcture of capital goods.

3.2 Structure and Composition of Capital Goods Sector in Zimbabwe

The structure of output of capital goods in Zimbabwe comes under the metals and metal goods group which is Zimbabwe's largest product group in total manufacturing sector in terms of gross output, net output, number of firms and employment. This is also the most diversified in terms of the range of commodities produced, product specifications, product designs and different end-users of the products and processes in the economy. The interlinkages between this group and all other sectors of the economy are probably the most developed and yet the subsector still has the greatest potential for further development of linkages.

The group's products are used as intermediate goods, machinery

and equipment by the manufacturing sector itself, agricultural sector, mining, construction, transport, energy and telecommunication. Zimbabwe's capital goods sector provides "backward integration" for ZISCOSTEEL feedstock as these units use blooms, billets, bars, rods and coils.

Examples of machinery production, machine tools and equipment in Zimbabwe include the production of agricultural machinery, construction machinery, mining and other areas of activity. The manufacture of railway rolling stock represents a significant and important import substitution in the production of capital goods. The two companies involved in freight type of rolling stock are ZECO in Bulawayo and Morewear Limited in Harare. Only in the last five years ZECO undertook the refurnishment of approximately 80 steam locomotives which was necessary to cushion the National Railways of Zimbabwe against massive increases in the prices of diesel oil until the electrification project of the railways is completed. Another company that has made important contribution to the railway rolling stock is F. Issels Limited, who manufacture bogies and cast steel railway wheels. This facility is unique in Africa outside South Africa.

Statistically, Zimbabwe's capital goods sector includes a significant part of the products enumerated under the Census of Production of the Central Statistical Office (CSO) as follows:

A. Metals and Metal Products:

(i) Non-ferrous metal and iron and steel basic industries

including smelting (iron and steel only);

(ii) Metal products, machinery and equipment other than electrical except vehicles;

(iii) Electrical machinery and equipment and communication equipment.

B.Transport Equipment

(iv) Motor vehicles including reconditioning; and

(v) Other vehicles and equipment including repairs.

Products unders (i) consists of iron and steel products produced by ZISCO. ZISCO's main products for both the local and export markets are blooms/billets, medium mill, light mill and bar rod mill. Around 80 percent of ZISCO's products are exported which means that efficiency of production is of major importance from the mining of the ore through processing, mainstream production processes and transporting of the products. Whilst products listed under (iv) and (v) donot necessarily come under capital goods as most of the output of these subsectors represents the manufacture of durable consumer goods, there is also a significant manufacture of machinery and equipment that comes under capital goods.

The metal products, machinery and equipment other than electrical subsector is the largest subesctor in metals and metal products group with gross output in 1982 representing 47 percent of the group's total output, 54 percent of total net output, 48 percent of wages and salaries and 51 percent of employment. Firm activity

in this subsector includes the heavy engineering firms involved in design and production of machinery equipment and spares for other industries. There is also a great deal of general jobbing and maintenance activity.

Agricultural implements production includes a wide variety of products including tractor-drawn implements for the large-scale commercial farming sector, irrigation equipment, agricultural boilers for tobacco farmers, coffee processing machines, tobacco curing equipment and implements for the small-scale peasant sector. Zimbabwean firms have built up a reputation of original design in production of agricultural implements and equipment that is suitable to local conditions. Firms in this group have been exporting to neigbouring countries. Most of the steel used in the production of agricultural implements is locally produced. Imported sheet steels are used for the manufacture of specialised parts of implements but this represents a small proportion of the implements both by mass and value.

The electrical machinery and equipment and communications equipment subsector's production includes electrical machinery, industrial electrical goods including geysers, cookers and stoves, communications equipment, and electric cable and wire which come under capital and intermediate goods.

In 1982 the motor vehicle including reconditioning subsector accounted for 78 percent of both total gross output and employment of the Transport equipment group. Its major commodity outputs were motor vehicle bodies (61 percent), trailers for trucks and other vehicles (15 percent), motor spares and accessories (10 percent), metal products, machinery and spares (6 percent), and assembled motor vehicles (5,5 percent) and caravans (2 percent). The main activity of the subsector is motor vehicle bodies, which has a high local content.

The most expensive inputs going into the subsector are motor spares, accessories including completely knocked down (CKD) kits, which were 38 percent of the subsector's total inputs in 1982. CKD kits do not come under capital goods. For local content to be further increased, continuous policy assessment could be maintained to assess those elements of input components for every model that is manufactured or assembled locally in order to improve on the local content. What is probably of greater importance, however, is to consider reducing the range of models assembled so as to be able to standardise on spare parts, maintenance equipment and skills. There can be no doubt that the present wide proliferation of the number of tractor and private fleet vehicle models militates seriously against increasing local content.

Other major inputs used in the subsector, e.g. iron and steel products (19 percent) and industrial rubber products (9 percent)

will in turn increase their local content as they improve their scale of operations in response to increases in the demand of their products.

Other Vehicles and Equipment including Repairs

The other vehicle and equipment subsector includes the manufacture of railroad equipment, and other transport equipment especially heavy equipment and machinery coming under the capital goods. Whilst the subsector's growth rate was more or less on par with that of other sectors in the 1967 - 1974 period, it was one of the worst hit by the intensification of the liberation war and sanctions in the post 1974 period.

There is great scope for growth in this sector if the railways programme of electrification is allowed to proceed as soon as possible, and if the exports of rolling stock are sustained in the PTA and other other African countries outside of the PTA area.

3.3 Capital Goods Sector in Other ESASDC countries

Domestic production and exports of capital goods in the ESASDC countries, as measured by the three digit classification ISIC 381-4 is insignificant. Thus in seven ESASDC countries (Botswana, Lesotho, Malawi, Swaziland, Tanzania, Zambia and Zimbabwe) the 1980 domestic production of the ISIC 381-4 only amounts to US$865,7 million compared to imports of US$2 050,1 million. (Cf. Table 3) Nearly 60 percent of this production is concentrated in Zimbabwe and about 31 percent in Zambia and the rest thinly spread in the remaining five countries. However, judging from the high level of imports and total domestic consumption of the products of the capital goods, of about US$1 949 million, there is scope and potential for the production of this class of products in the region. Also in terms of manufacturing value added of metal products, machinery and equipment Zimbabwe is leading with about US$165 million in 1980 compared with about US$87 million for Zambia and US$20 million for Tanzania. (Cf. Table 8)

Kenya has relatively developed metal engineering workshops and foundries in the region. In a study of the undercapacity utilization of the Kenyan foundries and metal engineering workshops over 90 firms in this sector were interviewed.[13] The capacity utilization of only 25 perce for foundries and 34 percent for metal engineering worksahops was found. There were many reasons cited for this undercapacity utilization including lack of planning of both investments and demand, shortage of

material inputs used in production. [13]

The Kenyan capital goods sector also needs selective investments to improve the scope of the metal production, casting and engineering. It is, however, clear that the availability of resin-and-sand and shell-mould casting and some iron moulds for mass production of non-ferrous castings provide the basis for foundry industry. The largest foundry and workshop in Kenya is the Railway Nairobi Workshop which employs some 2600 people. But the rest of the foundry and engineering sector its facilities are grossly underutilized. [13] It has about 9 percent of the centre of lathes in the country and 60 percent of the turret lathes which are designed for the production of mass producing items.

The railways workshop has produced 6-10 tonne sugar crusher rollers. However, this is not done on a regular basis because the Kenyan Railways Act does not allow the workshops to engage in commercial production unless specifically directed to do so by government. Another thing that inhibits the production of capital goods in Kenya as "down" stream industries is the proliferation of makes and models. There are too many makes and models of trucks, cars, tractors, water pumps and other machinery and equipment that are imported into the country. Kenya assembles more than 90 models of trucks and buses and has about 60 makes of sedan cars. Kenya also imports more than 260 models of water pumps. The existence of too many models inhibits the local manufacture of components and spares, increases inventory costs

and encumbers labour training.

In the case of Uganda steel consumption and demand is still low and the domestic market has limited product mix. Local production is mainly for the construction industry. Consumption of direct and indirect steel was 57 477 in 1980 and this was projected to 90 000 tons in 1990.[10]

The Uganda Steel Corporation established in 1974 was charged with the responsibility of manufacturing steel from iron and steel products. Though there is no production of capital goods in Uganda, the import structure of indirect steel as engineering products indicates a potential for the manufacture of metal products, agricultural machinery and equipment, and transport equipment and machinery. These categories of production are possible at the early stages of the development of capital goods industry.

An integrated development of iron and steel industry and capital goods is schematically represented in Figure 1. From a dynamic perspective, the capital goods sector further provides the organic link between the engineering industries and the sectoral structure of the economy as demonstrated by the Zimbabwean case. Dynamic efficiency can also be understood from the viewpoint of the transfer of technology. This requires capturing advances in the accumulation of physical capital and skills in the form of learning process on one hand, and the development of

FIGURE 1

INTEGRATED DEVELOPMENT OF THE IRON AND STEEL INDUSTRY IN EASTERN AND SOUTHERN AFRICAN COUNTRIES

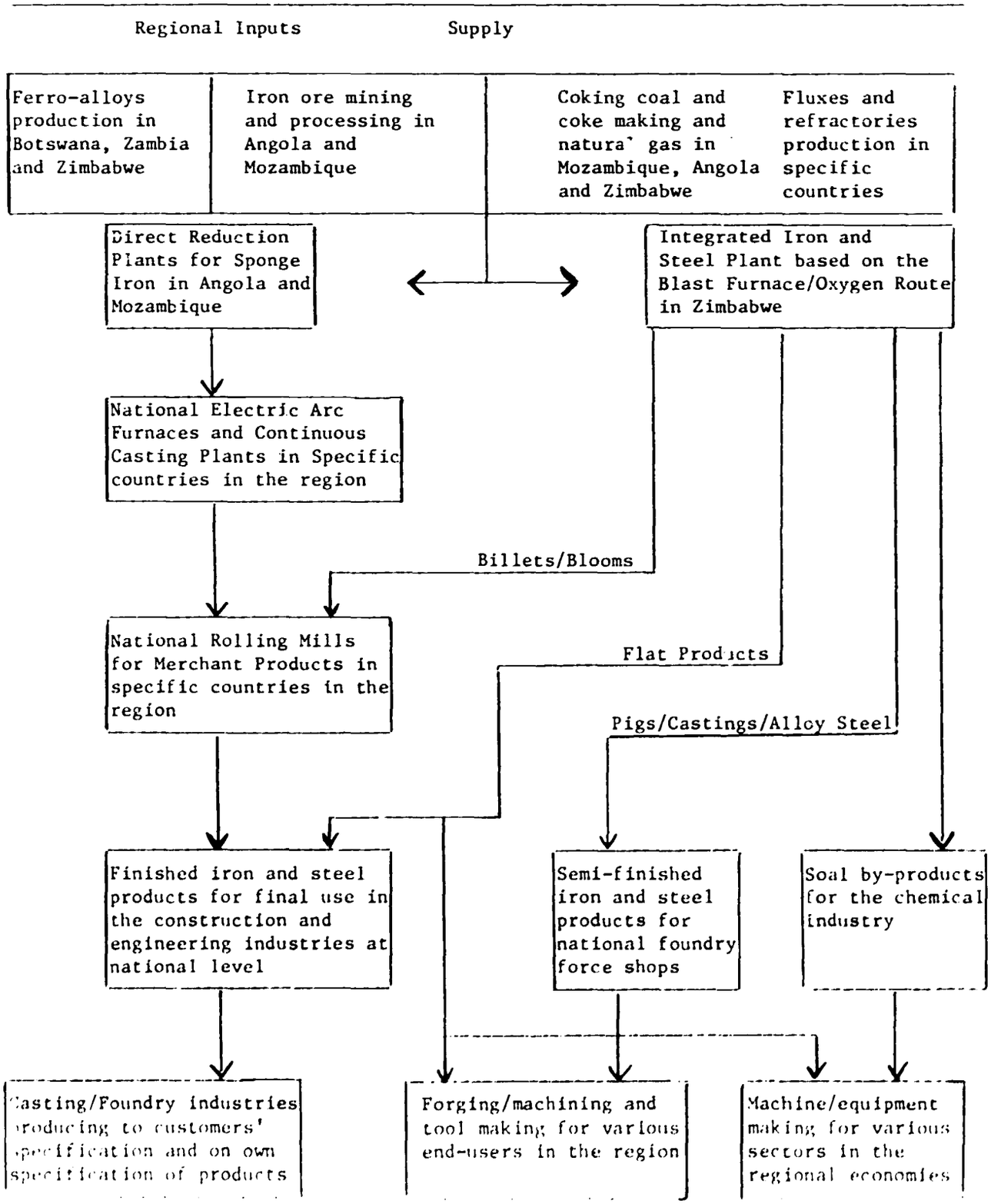

TABLE 8.

MANUFACTURING VALUE ADDED OF IRON & STEEL & METAL PRODUCTS, MACHINERY & EQUIPMENT
(at constant 1975 prices)

ISIC	ANGOLA	MOZAMBIQUE		MALAWI			TANZANIA			ZAMBIA			ZIMBABWE		
	1970	1970	1975	1970	1975	1980	1970	1975	1980	1970	1975	1980	1970	1975	1980
371	1,4	4,0	4,8	_	_	_	2,5	3,7	2,4	8,2	7,8	9,0	69,7	114,2	115,3
381	1,7	21,8	13,7	(3,8)	(5,7)	(5,8)	5,6	7,2	(4)	32,0	44,4	36,9	46,7	76,6	77,1
382	0,3	1,3	3,3	(0,5)	(0,7)	(0,7)	2,5	1,9	(2)	11,3	13,0	19,7	19,7	32,2	32,5
383	0,5	3,1	5,4	(0,5)	(0,7)	(0,7)	1,4	4,6	6,6	14,0	19,5	16,2	15,1	24,8	25,0
384	1,0	11,2	10,1	(0,2)	(0,3)	(0,4)	4,1	9,1	(10)	12,0	16,6	13,8	28,1	33,8	31,2
TOTAL	4,9	41,4	37,3	(5)	(7,4)	(7,6)	16,1	26,5	22,6	77,5	101,3	95,6	179,3	281,6	280,1

NOTES:
ISIC 371 basic iron and steel
381 fabricated metal products
382 non-electrical machinery
383 electriccal machinery
384 transport equipment

SOURCE: UNIDO Database.

externalities and linkages over time, on the other. This is provided in the development of the iron and steel industry with "downstream" industries manufacturing intermediate and capital goods, which further provides the most developed forward linkages with the rest of the economies at both the national and regional levels.

Part IV

4 Planning And Co-ordination Aspects in the ESASIC Countries

The concept of core industries under IDDA involves an ongoing programme of the development of national core projects and multinational/subregional core projects that take into account the following:

a) Provides inputs into the priority sectors selected in the Lagos Plan of Action and the Final Act of Lagos, i.e. food, transport, communication and energy.

b) Provides effective integration and linkages with other industrial and economic activities and infrastructures in the subregion.

c) Utilises and upgrades, to the maximum extent, local natural resources (raw materials and energy) so as to benefit first the subregion, secondly other African countries and thirdly non-African countries.

d) Engages in the production of intermediates and engineering goods including parts and components for further processing or fabrication in an increasing number of established and planned industries particularly related to food production and processing, building materials, textiles, energy, transport and mining.

e) Caters, first and foremost, directly and indirectly to the

basic needs of the people in the subregion and, if required for other African countries.

f) Involves

i) economies of scale;

ii) complex technology or upgrading of technology;

iii) large investment and

iv) markets beyond the reach of individual countries in the subregion.

g) Offers scope for co-operation, especially among the African countries, in the long-term supply/purchase arrangements for raw materials; intermediates and final products; subcontracting; barter; equity share holding etc.

h) Contributes to reducing the region's heavy reliance on external factor inputs.

At the national level there are programmes to strengthen national capabilties particularly in the area of increasing the utilisation of installed capacities, promotion of product diversification and upgrading of existing facilities in various engineering products. As seen above the countries in the ESASDC have reached different stages of development in the area of iron and steel production and capital goods.

Zimbabwe is the only sub-Saharan state with an integrated iron and steel plant capable of supplying almost all its needs of long

products with enough surplus which could be channelled into the regional market. The region is endowed with ample raw materials in which co-ordinated and planned programmes on a regional level can lead to rationalized production structures. Until these countries have sufficiently established their own national rolling mills for merchant products, Zimbabwe will supply the regional requirements for finished iron and steel products for the construction sector and other end-uses of such products as intermediates.

Zimbabwe has also developed a capital goods sector in the region. Other countries, like Kenya, Tanzania and Zambia are also at various stages of the development of casting/foundry/forging production activities and production of agricultural tools, implements and machinery. At the present stage of developmert ZISCOSTEEL products will serve as feedstock in the production of intermediates and capital goods in the regional economy as shown in Figure 1.

On a regional perspective planning and co-ordination of iron and steel production is a crucial variable not only for achieving self-reliance but even more importantly if these countries are to avoid over-production and subsequent underutilized capacities in this area of production. In the developed countries such over production has in certain cases resulted in complete steel

plants being closed down with resultant mass unemployment, and associated ripple effects.

Co-ordination and cooperation in the specific areas of training of personnel and developing of specific modalities for regional development are necessary for both the medium- and long-term development strategy. ZISCOSTEEL has undertaken to provide training of personnel in the region involving "shop floor" experise. A part of this programme involving a UNIDO consultant team have already worked on the Ugandan and Ethiopian mills.

Although representing a specific sector approach regional iron and steel sector plans are not independent, self-contained plans but are part and parcel of the national plans. Both in the short- and medium-term sectors act in close relationship with one another as suppliers and consumers and at the same time compete for certain scarce-resources (e.g. skilled manpower, investments and imports). The development of manpower, R&D, investment and market research are necessarily long-term and specific sector oriented.

Industrialisation is understood as a complex task that requires coordination with the whole economy. Therefore, an analysis of the specific sector approach is helpful in making decisions in

concrete problems in the different industries. This approach has the further advantages of determining whether or not the trends which have become recognizable in the sector will prove to be lasting, whether there are possibilities of changes in these trends. The sectoral approach also helps in determining to what extent are aspects of long-term or short-term planning in conflict and the possible and essentially diverging alternative development strategies that could benefit specific sectors considered separately.

Coordinated planning on the level of the ESASDC region as a whole becomes necessary for consistency of the plans. The programme approach is in this sense flexible in response to changing circumstances in the economic system. Both in the short- and long-term perspective harmonized planning of development is absolutely necessary. Within the overall framework of planning rapid industrial development, the planning of inter-industry and inter-sectoral linkages is be encouraged via the creation of intermediate and capital goods sectors. A priority of the growth of these subsectors is not necessarily an end in itself but is meant to create favourable conditions for technical progress and production of basic ('appropriate') products.

From the viewpoint of positive externalities the region's

intermediate and capital goods sectors should be related to the sectoral structure through the pattern of commodities produced within the individual branches or subsectors of the metal-working industries and their end-use in different sectors of the economy. These relationships call for several aspects in the identification of the main problems to be dealt with in perspective planning, namely:

1, the necessity to consider feasible and desirable qualitative changes of the structure of internal demand;

2, the need to evaluate and analyse improvement in quality and reliability of existing products;

3, the planning of the internal dynamics of the introduction of new products which may increase the satisfaction of the internal demand structure and export needs.

As Zimbabwean data shows firms in the intermediate and capital goods sector are directly linked with the development of the sectoral structure of the economy through the supply of products demanded by different sectors. On one hand, the supply conditions of products, including machinery, equipment and spare parts by the metal-working industry are crucial for stability and efficiency of the end-use sectors. On the other hand, planned programmes of the changing structure of demand by end-use sectors provides the basis for continuity and improvement of supply.

The plan for the introduction of new products which may increase

the satisfaction of the internal demand structure and exports constitute the dynamic elements of the development of the intermediate and capital goods sectors. Technical progress in industry is a dynamic element of its growth and that which occurs in other branches of the national economy may help industry since labour previously carried out in other sectors will be transferred to industry. Our concern with growth is with interactions overtime among producers, consumers and investors in interrelated sectors of the economy. Investment are considered more profitable in related sectors because of horizontal and vertical dependence, than in the same sectors considered separately. This approach is particularly more suitable for the sub-Saharan region which has the raw materials for sustaining its own development provided regional co-ordinated programmes are taken more seriously.

NOTES

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4, Preliminary Report, Ibid. p. 4
5, ZISCOSTEEL REPORT on Economic Commission For Africa "Second Meeting of the Eastern and Southern African Steel Development Committee" (ESASDC), Addis Ababa, 24-28 October, 1983
6,Progress Report on the Development of Iron and Steel Industry in Uganda, paper presented to "Second Meeting of the ESASDC 24-28 October, 1983, Addis Ababa
7, Drawn from interviews with capital goods firms done in the

course of 1982 and 1983 by a group of researchers in which the author was a member.

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10, British Steel Corporation (Overseas Survey) Ltd Study, on Rehabilitation of ZISCOSTEEL, March 1985

11, Ibid. p. 99

12, Ibid, p. 104

13, Coughlin, P. "Converting Crisis to Boom For Kenyan Foundries and Metal Engineering Industries: Technical Possibilities versus Political and Bureaucratic Obstacles" paper presented to the Review of African Political Economy Conference on the World Recession and the Crisis in Africa, Keele, England, September 29-30, 1984

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16, Progress Report on the Development of Iron and Steel Industry in Uganda, Ibid. p. 14

APPENDIX A

SPECIFICATIONS

Ziscosteel produces a wide range of manufactured steel for both domestic and export markets to national and international standards. Steels are made to the following specifications, but other qualities will be considered upon application.

STRUCTURAL STEELS:

BS 4360:
43A, 50B, 50C
DIN 17100:
ST33, ST37, ST44, ST50, ST52, ST60, ST70
ASTM (AISI):
A6, A36, SAE 1008, 1010, 1012, 1015...to1095
J.I.S.:
SS41

WIRE DRAWING STEELS:

Carbon and carbon-manganese wire-drawing steels in grades up to 1.0% C and 1.4% Mn as specified in national and international specifications. Alloys steels up to 5% alloy content by agreement.

REINFORCING STEELS:

BS 4449/DIN 448/SI 893/
ASTM (AISI):
A615-78
J.I.S.:
ST 24

SPECIAL STEELS (ALLOY):

NS970: 526M60 (EN11), 605M36 (EN16), 709M40 (EN19), 817M40 (EN24), 604M40 (EN111)

SPECIAL PURPOSE STEELS:

(Plough Beams, Grader Blades, Axles, Grinding Mill Rods, Rail Steel, Wire Rope Steel)
BS 970: 080M40 (EN8), 060A52 (EN43), 060A57 (EN9)
ASTM (AISI): SAE 1040, 1085, 1095)

SPRING STEEL:

BS 970:250M07 (EN45)

FREE CUTTING STEEL:

BS 970:250M07 (EN1A)or equivalents

FORGING STEEL:

(mm) 127 x 127
High carbon
High tolerance
Upon Application

LIST OF PRODUCTS

ROD MILL:

ROUNDS and COILS (DIN 59110);

(mm)5,6,0,6,5,7,5,8,0,9,4,10 12, 14, 15, 16, Standard coil approximately 610 kg.
BARS (DIN 1013):

(mm, 10,12,15,16,18,20,22, 24, 25, 26, 28, 30.
SQUARES (DIN 1014):
SQUARE CORNERS:

(mm) 10,12,14
RADIUSED CORNERS:

(mm) 16, 20, 22, 25

LIGHT MILL:

ROUNDS (DIN 1010):

(mm) 10, 12, 14, 15, 16, 18, 19 20, 22, 24, 25, 26, 28, 30, 32, 34, 36, 38, 40
SQUARES (DIN 1914/BS 4360)

SQUARE CORNERS

(mm) 10, 12,14
CHAMFERED CORNERS:

(mm) 16, 20, 22, 25. 30, 35, 40
WINDOW SECTION:

F7, FX7
FENCING SECTION:

Double V
PLOUGHBEAM:

(mm) 13, 9.5
FLATS:

(mm) 20x6 , 20x5, 25x5, 25x6, 25x8, 25x10, 25x12, 30x5, 30x6, 30x8, 30x10, 30x12, 40x5, 40x6, 40x8, 40x10, 40x12, 40x16, 50x5, 50x6, 50x8, 50x10, 50x12, 50x16, 50x20, 65x6, 65x6, 65x10, 65x12, 65x16, 80x6, 80x8, 80x10, 80x12, 80x16, 80x20, 80x25, 80x30
EQUAL ANGLES/DIN 1028):

(mm) 25x25x4, 25x25x5, 30x30x4, 30x30x5, 40x40x3,5 40x40x4, 40x10x5, 40x40x6, 50x50x4, 50x50x5, 50x50x6, 50x50x8.

MEDIUM MILL:

FLATS (DIN 1017/BS 1501):

(mm)(100x) 6,8 10, 12 15 20 25
(130x) 8, 10, 12, 15, 20, 25
(150x) 8, 10, 12, 15, 20, 25
(DIN 5520/30):
(180x) 10, 12, 16, 20, 25
(200x) 8, 10, 16, 20, 25
(250x) 10, 12, 16, 20, 25
EQUAL ANGLES (DIN 1029):

(mm) 50x50x5, 60x60x8, 60x60x10, 80x80x6, 80x80x8, 80x80x10, 80x80x12, 100x100x8, 100x100x10, 100x100x12.
UNEQUAL ANGLES (DIN 1029):

(mm) 75x50x6, 75x50x8, 80x65x6, 90x65x8, 90x65x10, 100x75x8, 100x75x10,
CHANNELS (BS4/DIN 1026):

(Inches) 3x1-1/2, 4x2, 5x2-1/2, 6x3
IPN BEAMS (DIN 1025)

(mm) 100x50, 120x58, 140x66
RAILS (ZISCO SPEC):
15 YD, 20, 30, 45

PLOUGH SHARE (ZISCO SPEC):

(Inches) 4-1/4
GRADER BLADE (ZISCO SPEC):

(Inches) 6-5.3ROUNDS (DIN 1013):

(mm) 47, 52, 57, 60, 62, 68.5, 75, 80
DEFORMED BARS
(mm) 10, 12, 14, 16, 18, 20, 22, 25

BILLETS AND BLOOMS:

(mm) 55x55, 60x60, 63,5x63,5 70x70, 80x80, 92x92, 100x100, 110x110, 150x150, 155x155, 160x160, 180x180, 200x200.

The above are available in the following standard lengths: 6m, 9m, 12m, Other non-standard sizes and lengths by negotiation.

APPENDIX B.

ZISCO SALES FOR LOCAL AND OTHER AFRICAN COUNTRIES.

	Section	End-Use	Destination
Blooms	150-250mm	Forging/ Engineering	Local
Billets	55mm	Wire Drawing	Local
	92mm	Pipe Manuf.	Local
	92mm	Axles	Local
	60,63.5 80,100, 110mm	Rerolling	Nigeria, Kenya, South Africa.
			APPENDIX B.
Medium Mill	Equal Angles 60-100mm	Engineering/ Construction	Local
	Unequal Angles 75-100mm	dito	Malawi, Botswana, Mozambique, Kenya, Zambia.
	Flats 100-230mm	dito	
	Rounds 52-90mm	Grinding Mill Rods/Engineering	
	Channels 3*1-0,5, 6*3 in.	Eng./Constr.	
	I-Beam 100-140mm	Ditto	
	Rails 18/YD, 20 30, 45	Mines	
	Grader Blade	Road Making	
	Plough Share	Agricultural Machinery	

APPENDIX B contd.

ZISCO SALES FOR LOCAL AND OTHER AFRICAN COUNTRIES.

	Section	End-Use	Destination
Light Mill	Flats 20-80mm	Engineering	Local
	Window Sect.	Windows	Botswana, Kenya, Zambia
	Fencing Sect.	Fencing	
	Equal Angles 25-50mm	Engineering/ Construction	
	Plough Beam	Agricultural Machinery	
	Rounds 20-40mm	Reinforcing/ Engineering	
	Squares 10-40mm	Reinforcing	
Rod Mill	Rounds & Coils 5,5-16mm	Reinforcing/ Wire Drawing	Local
	Round Bars 10-30mm	Reinforcing	Malawi, Botswana, Swaziland
	Square Coils 8-10mm	Ditto	
	Square bars 10-30mm	Ditto	