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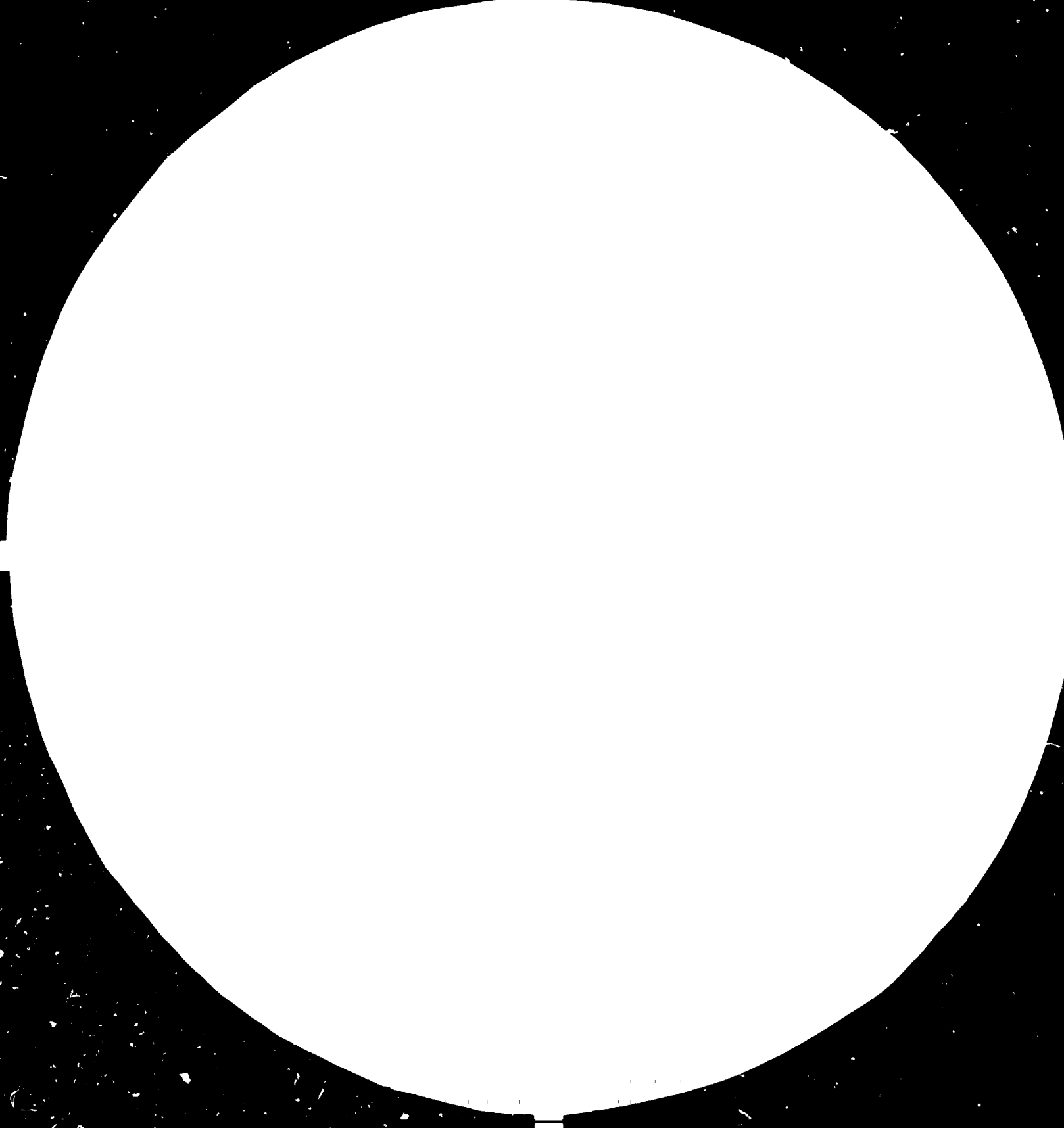

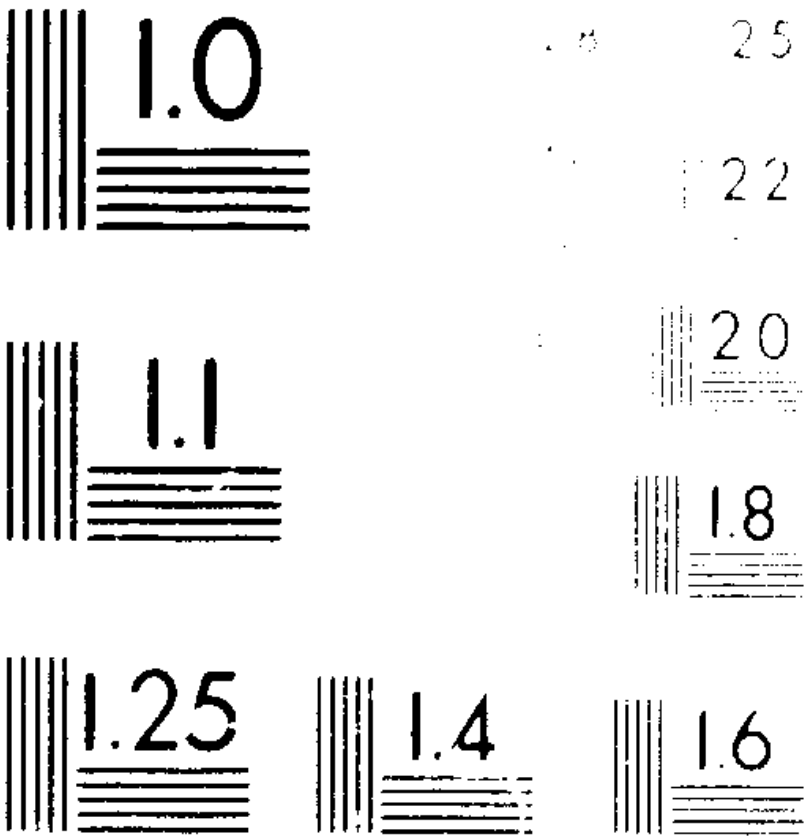
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Karl H. Plaetze-

Peru.

Production of Power Generation and Distribution Equipment in Peru

1984

14361

1. GENERAL REMARKS

1.1 Scope and Classification of Products

Machines, equipment and products for the generation and distribution of electricity form part of the so-called engineering products or, deducing consumer durables from this group of products, and capital goods. The International Standard Industrial Classification of 11 Economic Activities (ISIC) contains the so-called engineering products in Industrial Division 38, "Manufacture of Fabricated Metal Products, Machinery and Equipment." This division consists of the following major groups:

- ISIC No. 381: manufacture of fabricated metal products, handtools and general hardware
- ISIC No. 382: manufacture of machinery except electrical
- ISIC No. 383: manufacture of electrical machinery, apparatus, appliances and supplies.
- ISIC No. 384: manufacture of transport equipment.
- ISIC No. 385: manufacture of professional and scientific, and measuring and controlling equipment not elsewhere classified, and of photographic and optical goods.

Powers generation and distribution equipment is mainly included in Major Group 383 which is subdivided as follows:

- Group 3831: manufacture of electrical industrial machinery and apparatus0
- Group 3832: manufacture of radio, television and communication equipment.
- Group 3833: manufacture of electrical appliances and housewares.
- Group 3839: manufacture of electrical apparatus and supplies not elsewhere classified.

The products of group 3833 are almost exclusively consumer durables (except those cases, where singular products, e.g. vacuum cleaners or air heaters, are used as capital good applied in industry or services), and group 3831 are exclusively capital goods. Whereas groups 3832 and 3839 are consist of both, consumer durables and capital goods.

The compositions of ISIC Groups No. 3831 and 3839 are represented in Annex 1.

Annex 1: Composition of ISIC Groups No. 3831 and 3839.

3831 Manufacture of Electrical Industrial Machinery and Apparatus.

The manufacture, renovation and repair of electric motors; generators and complete turbine-generator and engine-generator sets; transformers; switch gear and switchboard apparatus; rectifiers; other electrical transmission and distribution equipment; electrical industrial control devices such as motor starters and controllers, electronic timing and positioning devices, electro-magnetic clutches and brakes; electrical welding apparatus: and other electrical industrial apparatus.

Armature manufacturing
Armature winding and repairing
Automatic electric overload release manufacturing
Automatic switch, electric, manufacturing
Automotive distributor manufacturing
Automotive generator manufacturing
Booster, electric transformer
Capacitors manufacturing, except electronic
Charger, battery, manufacturing
Circuit breaker manufacturing
Control panel, electric, manufacturing
Cut-out, transformer, manufacturing
Distribution board, electric, manufacturing

Dynamo manufacturing
Electric automotive equipment manufacturing
Elecric condenser manufacturing
Electric controlling instrument manufacturing
Electric equipment, aircraft, manufacturing
Electric equipment, motor vehicle manufacturing
Electric equipment, railway, manufacturing
Electric generator manufacturing
Electric motor manufacturing
Electric power switchboard and part manufacturing
Electric power switching equipment manufacturing
Electro-magnetic brake manufacturing
Electro-magnetic clutch manufacturing
Frequency converter manufacturing
Generating apparatus and part manufacturing
Ignition apparatus manufacturing
Industrial apparatus, electric, manufacturing
Magneto, automotive, manufacturing
Mercury Arc rectifier manufacturing
Motor, electricr repair shop
Oil switch manufacturing
Panel, elecric current controlling manufacturing
Power equipment, electric, manufacturing
Railway motor control equipment, electric, manufacturing
Rectifier, industrial, manufacturing
Relay manufacturing
Resistance unit, electric, manufacturing
Rheostat manufacturing
Spark plug, internal combustion engine, manufacturing
Starter, for motors, manufacturing
Transformer, for electric meter, manufacturing
Transformer manufacturing
Transmission accessory, electric, manufacturing
Turbo-generator manufacturing

3839 Manufacture of Electrical Apparatus And Supplies Not Elsewhere Classified

The manufacture of other electrical apparatus, accessories and supplies not elsewhere classified, such as insulated wires and cables; storage and primary batteries, wet and dry; electric lamps and tubes; fixtures and lamp sockets and receptacles; SNAP switches, conductor connectors, and other current-carrying wiring devices; conduits and fittings; electrical insulators and insulation materials except porcelain and glass insulators which are clasified in group 3610 (manufacture of pottery, china and earthenware) and 3620 (manufacture of glass and glass products), respectively.

Arc lamp, except therapeutic, manufacturing
Armoured cable manufacturing
Beacon, lighthouse, flashing, electrical
Beacon, lighthouse, non-Flashing, electrical
Box, outlet, electric, manufacturing
Carbon products, for electric industry, manufacturing
Christmas novelty, electric, manufacturing
Conductor manufacturing
Contact brush, electric, manufacturing
Cut-outs, electric wiring device, manufacturing
Dry battery manufacturing
Electric battery manufacturing
Electric bell manufacturing
Electric light bulb, complete, manufacturing
Electric lighting fixture manufacturing
Electric wiring device manufacturing
Electrode, carbon, manufacturing electrode, graphite, manufacturing
Lamp, carbide,manufacturing
Lamp socket on receptacle manufacturing
Lead-in wire, for electric bulb, manufacturing

Lighting fixture manufacturing
Lightning arrester or coil manufacturing
Locomotive headlight manufacturing
Motor vehicle headlight manufacturing
Motor vehicle lamp manufacturing
Ornament, christmas tree, electric, manufacturing
Outlet, electric manufacturing
Photoflash or photoflood lamp manufacturing
Photographic flashlight bulb manufacturing
Photographic lamp, electric, manufacturing
Plug, electric, manufacturing
Pole-line hardware, electric, manufacturing
Primary battery manufacturing
Rail bond for propulsion and signal circuit, manufacturing
Snap switch, electric, manufacturing
Socket, electric, manufacturing
Spotlight manufacturing
Stage lighting equipment manufacturing
Storage battery manufacturing
Street lighting fixture manufacturing
Strobotron manufacturing
Switch box manufacturing
Terminal lug manufacturing
Vapour lamp manufacturing
Wiring device, snap switch, manufacturing

Source: Indexes to the International Standard Industrial Classification of All Economic Activities, United Nations, Statistical Papers, Series M, No.4, Rev.2, Add.1, New York, 1971

It is noteworthy that complete power generator sets, e.g. diesel generators or hydropower generators, are included in ISIC No. 3831 while the driving devices alone, diesel motors and hydraulic turbines, form part of ISIC Group No. 3821, manufacture of engines and turbines.

The major portion of electricity generation and distribution equipment contained in ISIC Group No. 3831 of ISIC Group No. 3839 is only a few products, such as manufacturing of insulated cable, insulated wire and electric insulators and insulating materials. Porcelain and glass insulators are included in ISIC Group No. 3610 and 3611 respectively.

Thus, the electricity generation and distribution equipment is mainly classified in ISIC Group No. 3831 to which the few mentioned products of other groups have to be added, namely

- porcelain and glass insulators and
- insulated cables and wires.

The statistical analysis in the following chapter will therefore concentrate on ISIC Group No. 3831 while the description of the results of the field work and other relevant chapters will include the two product groups of the other ISIC groups.

1.2 Place of the Subsutor in the Industrial Environment of Peru

The manufacturing industry contributed 25.4% Peruvian GDP in 1981. In 1965 the share stood at 23.7%, rose to a maximum of 26.6% in 1976 and fell constantly to the present value.

A similar development experienced ISIC - group 38 and an indicator for the performance of the Peruvian capital goods industry. In 1971 its share in the manufacturing value added (see table 2) was 14.7%, grow to a second high of 19.6% in 1976 and dropped to its lowest level in the past decade in 1979 (14.6%).

Table 2: Performance of value added of the Peruvian manufacturing industries (by industrial divisions according to ISIC division), 1971 - 1979 in percent

ISIC Industrial Division	1971	1975	1976	1977	1978	1979
31. Food, beverages and tobacco	28.3	27.9	26.0	26.4	24.7	25.3
32. Textiles, garments and leather	16.9	14.7	16.1	13.7	13.0	15.5
33. Wood and furniture	2.6	2.5	2.1	2.2	1.4	2.0
34. Paper printing and editing	5.8	5.5	4.9	4.9	4.2	4.9
35. Chemicals and petroleum derivatives	20.7	18.0	20.8	21.4	28.6	20.1
36. Non-metalic minerals	5.1	4.2	4.3	4.4	4.4	4.3
37. Basic metal industries	4.5	5.1	4.9	6.8	7.4	12.5
38. Metal products, machinery and equipment	14.7	18.1	19.5	19.1	15.5	14.6
39. Other manufacturing industries	1.4	1.3	1.4	1.1	0.8	0.8
	100.0	100.0	100.0	100.0	100.0	100.0

Source: MITI, quoted by ITINTEX[1]/

1/ Evolucion Economica y Social de la Industria Manufacturer en el Peru, April 1983.

In 1979, MITI had registered 9,631 enterprises with a workforce of more than 5 persons employing in total approximately 267,000 people (see table 3). It can be seen that industrial division 38 has a similar share in the number of companies and in the workforce which indicates that the average size of companies is in line with the average of the whole manufacturing sector.

Table 3: Number of Industrial establishments and workforce, 1979

ISIC Industrial Division	Number of enterprises	Percent	Number of employers	Percent
31. Food, beverages and Tobacco	2,141	22.2	51,656	19.4
32. Textiles, garments and leather	2,050	21.3	58,737	22.1
33. Wood and furniture	994	10.3	15,385	5.8
34. Paper printing and editing	622	6.5	17,554	6.6
35. Chemicals and petroleum derivatives	951	9.9	39,680	14.9
36. Non-metalic minerals	567	5.9	16,856	6.3
37. Basic metal industries	114	1.2	11,972	4.5
38. Metal products, machinery	1,849	19.2	50,794	19.1
39. Other manufacturing	343	3.5	4,248	1.6
TOTAL	9,631	100.0	266,882	100.0

Source: ITINTEC, op. cit.

The wood and furniture industries have, for a comparison, a share in the number of enterprises almost twice as high as in the workforce, which indicates that small enterprises are predominant in this industrial division, on the contrary, basic metals has an employment share almost 4 times as high as the share in number of establishments indicating that the average size of this sector is by far above the overall industrial average.

Table 4 gives an overview of the development of gross production value and value added in current prices for selected years from 1976 to 1981. In gross production output ISIC group 384, manufacturing of transport equipment, is the most important one of industrial division 38, with a share of approximately 37 per cent in 1976 and 34 per cent in 1981. During the same period the second strongest group, ISIC 383, electrical machinery and equipment, had 2 share of 25 per cent in 1976 and 24 per cent (1979: 27 per cent). A relative increase shows ISIC No. 381 from a share of 21 per cent in 1976 to 25 per cent in 1981 and ISIC group No. 385.

Table 4: Gross production value and value added of major ISIC groups of industrial division 38 in Peru, 1976 - 1981 (selected years), in million soles at current prices

Major ISIC - Group	Gross Production 1976	1977	1979	1980	1981	Value added 1976	1977	1979	1980	1981
381	16,113	20,680	68,972	125,796	170,300	7,571	8,748	27,952	49,067	63,046
382	10,989	11,690	36,615	68,462	96,423	4,974	4,953	12,603	22,759	35,564
383	18,981	23,801	64,356	118,388	165,076	9,018	10,817	27,892	50,853	71,822
384	28,087	33,983	65,214	136,031	233,332	10,015	11,875	18,633	41,882	68,386
385	1,113	1,533	4,360	8,763	13,404	483	586	2,017	3,728	5,636
38	75,283	91,687	239,517	457,440	678,535	32,066	36,979	89,097	168,289	244,454

Source: MITI

Table 5: Share in value added of product groups in industrial division ISIC 38

ISIC group	1976	1977	1979	1980	1981
381	23.6	23.7	31.4	29.2	25.7
382	15.5	13.4	14.1	13.5	14.6
383	28.2	29.2	31.3	30.2	29.4
384	31.2	32.1	20.9	24.9	28.0
385	1.5	1.6	2.3	2.2	2.3
38	100.0	100.0	100.0	100.0	100.0

Source: calculations based on table 4

Table 6: Value added in percent of gross production in ISIC 38 1976 - 1980

ISIC group	1976	1977	1979	1980	1981
381	47.0	42.3	40.5	39.0	37.0
382	45.3	42.4	34.4	33.2	36.9
383	47.5	45.4	43.3	43.0	43.5
384	35.7	34.9	28.6	30.8	29.3
385	43.4	38.2	46.3	42.5	42.0
38	42.6	40.3	37.2	36.8	36.0

Source: calculations based on table 4

A similar development shows the share in value added of the different groups in the total of division 38 (table 5). It is noteworthy that the share of ISIC group no. 383 develops from second place in 1976 (behind group 384) to first place in 1981.

a comparison with table 6 which gives the value added in percent of gross production shows that the shares of all groups have dropped from 1976 to 1981, but especially strongly in group 381, 382 and 384. There seem to be several reasons for this development: a stronger competition on the domestic market which required cuts in sales prices, an increase in the cost structure which could above all be caused by rising prices of imported raw materials, and possibly a lesser degree of production integration within one group; with continuing specialisation of enterprises the sub-contracting of parts and components increases, and these parts might be produced by companies of other ISIC groups. Another reason should be the lower capacity utilisation due to downward developments on the sales markets.

The relatively low figure for group 384 seems to indicate that a larger proportion of its output is assembled instead of manufactured within the group (e.g. assembly of motor vehicles). The two groups least affected by these negative developments of the share of value added in gross production output were group 383 the value added of which was approximately 9 percent lower in 1981 than in 1976 and group 385 which lost only 2 percent of its value added between 1976 and 1981. During the same period group 381 lost 21 percent, group 382, 19 percent and group 384, 18 percent, and the whole of industrial division 38, 15 percent of its value added.

The volume of production of industrial division 38 experienced an increase of almost 87 percent between 1971 and 1975, a decrease by shortly 29 percent from 1975 to 1979 and showed an increase of almost 20 percent from 1979 to 1980 (see table 7). Electrical machinery grew by 140 percent in the second half of the past decade to recover from 1979 to 1980 with a growth rate of 10 percent.

However, the development of recent years (see table 4 of main report, page 2.3.2) shows strong decreases by approximately 11 percent from 1981 to 1982 and by approximately 35 percent from 1982 to 1983. Electrical machinery was even stronger affected: a decrease of 16 percent (1981/1982) and a decrease of 40 percent (1982/83) brings the production volume down to 75 percent, half as much as 1981 and the lowest level after 1971.

Table 7: Index of the volume of production of industrial division 38, metal products (1973 =100)

		1971	1972	1973	1974	1985	1976	1978	1979	1980	1981			
38	Metal products	69.2	84,8	100.0	109.3	129.3	127.2	112.2	93.5	92.4	110.5	86.9	- 28.5	19.6
381	Metal products	90.6	92.7	100.0	108.0	115.3	109.1	103.6	97.0	92.0	99.4	27.3	- 20.2	8.0
382	Non-electrical machinery	65.1	92.4	100.0	118.9	150.6	151.7	142.1	122.3	134.6	160.8	131.3	- 10.6	19.5
383	Electrical machinery	62.7	80.8	100.0	123.9	149.7	145.7	140.9	125.7	115.1	126.8	138.8	- 23.1	10.2
384	Transport equipment	58.1	77.2	100.0	89.1	109.1	109.7	72.2	38.4	43.4	73.2	87.7	-60.2	68.7
385	Scientific equipment	82.0	83.8	100.0	92.5	107.0	127.3	109.6	112.6	98.1		30.5	- 8.3	

Source: Peru - development and policy issues of the manufacturing sector, World Bank/UNIDO Cooperative Programme, Report No. 13, April 19,1981 (UNIDO/IO.432/Rev. 1)

1.3 Some Comparative Data on Capital Goods in Latin America

A regrouping of table 2 into consumer goods, intermediate goods ad engineering products of industrial division 38, and a subdivision of ISIC No. 38 are shown in table 8. Grouping A includes the industrial divisions 31 to 33 and 39, the division 34 to 37 in grouping B and the division 38 in grouping C as can be seen from the subdivisions.

Table 8: Structure of Peruvian manufacturing by product groups, 1971 to 1979 (in per cent of value added)

	1971	1975	1976	1977	1978	1979
Grouping A	49.2	46.4	45.6	43.4	39.9	43.6
Grouping B	36.1	32.8	34.9	37.5	44.6	41.8
Grouping C	14.7	18.1	19.5	19.1	15.5	14.6
(381)	-	-	(4.6)	(4.5)	-	(4.6)
(382)	-	-	(3.0)	(2.6)	-	(2.1)
(383)	-	-	(5.5)	(5.6)	-	(4.6)
(384)	-	-	(6.1)	(6.1)	-	(3.1)
(385)	-	-	(0.3)	(0.3)	-	(0.3)

Source: Tables 2 and 5

Even though the time series in table 7 is too short for exact long - term determinations the following conclusions can be drawn:

- the share of consumer goods in manufacturing in Peru has dropped considerably in the past decade;
- the share of intermediate goods has increased its share in the same order of magnitude;
- while the share of the engineering industries (industrial division 38) has dropped to its original value at the end of the period after having passed through a peak from 1975 to 1977.

A comparison with the industrial development of the Andean Group countries (table 9) shows the relatively well developed intermediate sector of Peru. The whole of industrial division 38 has a higher share in Peru than in the total of the Andean Group which is mainly due to the higher share of ISIC No. 383 and 384 in manufacturing value added.

Compared to Brazil (table 10), however, one notes that the Braziian transport equipment production (ISIC 384) and machinery except electrical (ISIC 382) have a share in manufacturing of more than 3 times as high as the Peruvian one. Fabricated metal products have in both countries approximately the same share, and the Peruvian electrical machinery was comparable to the share of the Brazilian one in the mid 70ies but it then fell back again towards the end of the decade. Th total share of industrial division 38, is approximately twice as high in Brazil than in Peru.

This comparison shows that the capital goods industry as a whole was, generally speaking by interpreting statistical figures alone, a good growth potential. The electric machinery and equipment production should be able to increase its share again to the figure of 1977 (5.7 percent) or grow beyond this mark.

Table 9: Andean Group: Structure of the Manufacturing Industries, 1950 - 1977
(Percentages of the value added)

ISIC	Industry	1950a/	1955a/	1960	1965	1970	1971	1972	1973	1974	1975	1976a/	1977b/
311/312	Food	23.9	21.8	20.1	19.8	20.1	19.4	18.6	17.3	17.6	19.8	18.7	17.5
313	Beverages	12.9	11.3	10.6	9.2	9.0	8.8	8.9	8.6	7.9	9.4	9.8	10.8
314	Tobacco	5.5	4.2	3.5	3.0	2.8	2.8	2.9	2.7	2.6	2.6	2.8	2.7
321	Textiles	12.6	11.8	10.8	9.8	10.0	10.2	10.3	10.3	10.3	8.8	9.2	10.0
322	Wearing apparel	2.7	3.9	3.3	2.9	2.9	3.0	3.0	2.9	2.5	2.8	2.3	2.3
323	Leather	1.4	1.1	1.0	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.7
324	Footwear	1.3	1.2	1.7	1.3	1.2	1.3	1.3	1.3	1.1	1.2	0.9	0.7
332	Furniture	1.9	1.7	1.5	1.5	1.5	1.4	1.4	1.5	1.3	1.6	1.3	1.3
342	Printing and publishing	2.6	3.1	2.4	2.6	2.6	2.5	2.6	2.7	2.2	2.3	2.3	2.2
361	Pottery, china and earthenware	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
390	Other manufactures	0.2	0.2	0.7	0.8	1.0	1.0	1.0	1.0	0.9	1.0	0.8	0.8
	Subtotal Group A	65.7	61.0	56.2	52.2	52.3	51.6	51.0	49.3	46.0	51.1	49.2	49.5
331	Wood and cork products	1.6	1.4	1.1	1.0	1.3	1.3	1.3	1.3	1.1	1.3	1.3	1.6
341	Paper and paper products	0.9	1.6	2.1	2.6	2.8	2.7	2.7	2.8	2.4	2.5	2.5	2.2
351	Industrial chemicals	1.5	1.6	1.8	2.0	2.2	2.2	2.5	2.6	2.5	2.7	2.7	3.3
352	Other chemical products	4.2	4.8	5.1	5.6	5.9	5.9	6.3	6.3	5.9	7.0	7.6	8.3
353	Petroleum refineries												
354	Miscellaneous products of petroleum and coal	12.0	12.9	14.9	13.1	11.5	12.1	10.7	12.0	16.4	7.1	8.5	3.8
355	Rubber products	1.4	1.9	1.9	1.9	2.1	2.1	2.1	2.0	2.5	2.0	2.6	2.8
356	Plastics	1.1	1.2	1.1	1.4	1.6	1.8	1.9	1.8	1.8	2.1	2.4	3.2
362	Glass and glass products	1.2	1.2	4.8	4.9	4.4	4.6	4.5	4.3	4.0	4.5	4.5	4.4.
369	Other non-metallic mineral products	4.5	4.6										
371	Iron and steel	1.5	2.3	3.6	4.3	4.5	3.9	4.5	5.1	5.1	4.7	4.3	5.2
372	Non-ferrous metals												
	Subtotal Group B	29.9	33.4	36.4	36.8	36.4	36.7	36.6	38.1	41.8	33.9	36.5	34.8
381	Fabricated metal products	1.2	1.6	2.8	3.5	3.7	3.8	3.8	3.8	3.6	4.4	4.1	4.8
382	Machinery except electrical	0.8	0.9	1.3	1.9	1.8	1.9	2.2	2.2	2.1	2.6	2.7	3.6
383	Electrical machinery	1.0	1.0	1.3	2.1	2.6	2.7	2.9	2.9	3.0	3.7	3.7	4.1
384	Transport equipment	1.4	2.0	2.0	3.3	3.0	3.1	3.3	3.5	3.2	3.9	3.6	2.8
385	Professional equipment	-	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.4	0.2	0.3
	Subtotal Group C	4.4	5.6	7.5	10.9	11.3	11.7	12.4	12.6	12.2	15.0	14.3	15.7
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: JUNAC, based on official statistics
a/ Excluding Bolivia.
b/ Excluding Bolivia and Venezuela

Table 10: Brazil: Structure of the manufacturing industries 1950 - 1978
(Percentage of the value added)

ISIC	Industry	1950	1955	1960	1965	1970	1971	1972	1973	1974	1975	1976	1977	1978
311/312	Food	18.7	16.9	15.7	14.2	13.5	12.4	12.5	11.6	11.5	11.4	11.2	11.7	11.3
313	Beverages	4.2	4.2	2.9	2.8	2.3	2.1	2.1	2.0	2.0	1.9	2.0	2.2	2.2
314	Tobacco	1.8	2.1	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.1
321	Textiles	22.2	20.3	16.5	13.2	9.6	9.7	8.8	8.0	7.5	7.6	7.1	7.0	6.7
322	Wearing apparel	10.1	9.2	6.2	5.3	3.2	3.8	3.5	3.1	3.0	3.0	2.9	2.7	2.7
323	Leather	-	-	-	-	.6	-	-	-	-	-	-	-	-
324	Footwear	-	-	-	-	-	-	-	-	-	-	-	-	-
332	Furniture	3.3	2.6	2.6	2.4	1.8	2.0	1.9	1.8	1.7	1.8	1.9	1 .8	1.8
342	Printing and publishing	4.0	4.7	4.4	4.1	3.7	3.1	2.8	3.1	2.8	2.7	2.9	2.9	2.8
361	Pottery, china and earthenware	-	-	-	-	-	-	-	-	-	-	-	-	-
390	Other manufactures	1.3	1.3	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	Subtotal Group A	65.6	61.3	51.2	44.9	37.5	35.8	34.4	32.2	31.1	31.0	30.6	30.9	30.0
331	Wood and cork products	4.0	3.7	3.6	3.3	.2.5	2.7	2.7	2.4	2.4	2.5	2.6	2.7	2.7
341	Paper and paper products	2.5	2.3	2.3	2.5	2.6	2.5	2.3	2.2	2.2	1.8	1.9	1.9	2.0
351	Industrial chemicals	2.8	5.4	7.2	9.9	3.2	10.9	11.1	11.5	11.9	11.9	12.8	12.8	13.0
353	Petroleum refineries	-	-	-	-	7.9	-	-	-	-	-	-	-	-
354	Miscellaneous products of petroleum and coal	1.0	2.0	2.5	3.6	3.2 .6	3.5	3.3	3.8	3.8	4.1	3.9	3.8	3.9
355	Rubber products	-	-	-	-	-	-	-	-	-	2.3	2.3	2.2	2.2
356	Plastics	2.6	2.6	3.0	3.1	2.0	3.9	3.9	4.0	4.5				
362	Glass and glass products	-	-	-	-	1.9 -	-	-	-	-	2.2 2.2	2.3 2.3	2.3 2.3	2.7 2.7
369	Other non-metallic mineral products	5.2	6.5	5.8	5.2	5.9	5.5	5.5	5.4	5.9	6.3	6.2	6.6	6.6
371	Iron and steel	5.2	5.1	5.9	6.8	7.5	7.5	7.4	6.8	6.9	7.3	7.2	7.8	7.8
372	Non-ferrous metals													
	Subtotal Group B	23.4	27.5	30.2	34.4	37.3	36.5	36.2	36.1	37.6	38.5	39.2	40.2	40.8
381	Fabricated metal products	-	2.9	3.4	3.9	4.3	4.7	5.0	5.4	5.2	5.2	5.2	5.0	4.8
382	Machinery except electrical		5.5	6.4	6.8	7.0	7.6	8.1	8.8	8.4	7.4	7.5	6.9	6.7
383	Electrical machinery	10.9	1.2	3.2	4.3	5.3	5.7	6.0	6.5	5.4	5.6	5.9	5.9	6.0
384	Transport equipment		1.2	5.2	5.1	8.0	8.9	9.6	10.3	11.7	11.5	10.9	10.4	11.0
385	Professional equipment		0.2	0.4	0.5	.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Subtotal Group C	10.9	11.1	18.6	20.6	25.2	27.6	29.4	31.7	31.3	30.5	30.2	28.9	29.2
	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 11: Electrical machinery - gross production value and value added, 1976 - 1981,
(Million sales at current and constant (1975)1/ prices

	Gross Production value					Value Added				
ISIC (3832	1976	1977	1979	1980	1981	1976	1977	1979	1980	1981
Current prices										
3831	3,021	4,503	13,293	20,485	26,017	1,448	2,242	6,614	8,958	11,596
3832	4,042	10,529	20,208	39,615	60,709	4,091	4,548	8,657	15,514	16,466
3833	2,020	2,390	4,803	11,843	13,382	1,063	1,273	2,185	4,587	6,799
3839	4,848	6,379	26,047	46,475	64,969	2,416	2,754	10,436	21,794	26,972
383	18,981	23,801	64,356	118,388	165,076	9,018	10,817	27,892	50,853	71,822
Constant prices (1975 = 100 figures)										
3831	1,705	1,967	2,067	1,966	1,595	817	979	1,028	870	710
3832	5,131	4,600	3,142	3,847	3,722	2,309	1,987	1,346	1,507	1,622
3833	1,140	1,044	747	1,150	820	600	556	340	446	417
3839	2,736	2,787	4,050	453	3,983	1,363	1,203	1,623	2,116	1,654
383	10,712	10,398	10,008	11,496	10,120	5,089	4,725	43,370	4,939	4,403
Price index	177.2	228.9	643.2	1029.8	1631.2	177.2	228.9	643.2	1029.8	1631.2

Source: MITI, price index fr major group 383 published in Indicadores del sector manufacturero 1981 by MITI, December 1982.

The number of enterprises and the personnel employed in 1981 are shown in table 14. There are 325 enterprises with a total workforce of rounded 9,250 people. The arithmetic average employment rate is 28.4 persons per enterprise with the lowest value in ISIC 3831 with 27 persons per enterprise and ISIC 3832 with 30.4 persons per enterprise.

Table 14: Number of enterprises, personnel employed and value added per employee in the production of electrical machinery by subsector, 1981

ISIC group	Enterprises Number	%	Employment Number	%	Value added per employed (mil. sales per person
Source: MITI					
3831	81	24.9	2,183	23.6	5.31
3832	99	30.5	3,011	32.5	8.79
3833	36	11.1	875	9.5	7.77
3839	109	33.5	3,177	34.4	8.49
TOTAL 383	325	100.0	9,246	100.0	7.77

While the figures of valu added per employee are rather similar for three of the product groups (highest value: 8.79 million sales per employee in ISIC 3831; lowest and also overall average value: 7.77 million sales for ISIC 3833) it is only roughly two thirds of the average value in ISIC 3831. This difference will be treated more in detail in the following paragraph.

2.2 THE PRODUCTION OF INDUSTRIAL ELECTRICAL MACHINERY (ISIC 3831)

2.2.1 Enterprises and employment

The number of enterprises registered under this ISIC group 3831 in the Ministry of Industry, Tourism and Integration (MITI) has increased from 46 in 1976 to 81 in 1981, a surprising development due to the reduction of volume of output for the overall electrical industrial subsector. Table 15 shows the development of number of enterprises,

employment and average size of company from 1976 to 1981. The decreasing number of persons employed per enterprise from 46.7 in 1976 to 27 persons per enterprise in 1981 seem to indicate two developments:

- the registration at MITI has increased its coverage of the active industries by including a substantial number of small enterprises in their records; this is apparent for 1977 to 1979 when the number of companies increased by 54 percent, the work force by only 16 percent which led to a drop in average employment per enterprise by 25 percent

- This good performance in registration continued until 1981

- overlappingly, the decrease in orders and sales volume led to the reduction of workforce by 15 percent between 1979 and 1981 bringing total employment in 1981 back to the order of magnitude of 1976

- primary investigations with the Peruvian industry indicate that in 1983 the workforce was further reduced by an approximate 15% in relation to 1981 thus giving an employment figure of rounded, 1900 persons in 1983 for ISIC 3831.

Table 15: Number of enterprises, employment and average size of enterprises of ISIC 3831, 1976 - 1981

	1976	1977	1979	1980	1981
Number of enterprises	46	48	74	74	81
Total employment	2,141	2,227	2,578	2,387	2,183
(employees)	(813)	(821)	(1,089)	(961)	(914)
(workmen)	(1,328)	(1,400)	(1,489)	(1,426)	(1,269)
Number of persons per enterprise	46.7	46.4	34.8	32.3	27

Source: MITI

The enterprises are concentrated in the metropolitan area of Lima, i.e. Lima and Callao.

Table 12: Value added in percent of gross production output of ISIC group 383, 1976 - 1981

ISIC group	1976	1977	1979	1980	1981
3831	47.9	49.8	49.7	43.8	44.5
3832	45.0	43.2	42.8	39.2	43.6
3833	52.6	53.3	45.5	38.7	50.8
3839	49.8	43.2	40.1	46.9	41.5
383	47.5	45.4	43.3	43.00	43.5

Source: calculations based on table 10

Over the years, the subsectors radio, TV and communication equipment ISIC 3832) and general electrical apparatus (ISIC 3839) are the two most important subsectors representing joints about 75 percent of the total value added in th production of electrical machinery (table 13). The share of industrial electrical machinery which includes electricity generation and distribution equipment oscillates between 16 and almost 24 percent. This maximum value was achieved in 1979 but could not be sustained. In 1981 the share of ISIC 3831 dropped again to the level of 1976.

Table 13: Share of product groups in the value added of ISIC 383, 1976 - 1981

ISIC group	1976	1977	9179	1980	1981
3831	16.1	20.7	23.7	17.6	16.1
3832	45.3	42.0	31.1	30.5	36.8
3833	11.8	11.8	7.8	9.0	9.5
3839	26.8	25.5	37.4	42.9	37.6
383	100.0	100.0	100.0	100.0	100.0

Source: calculations based on table 10

The number of enterprises and the personnel employed in 1981 are shown in table 14. There are 325 enterprises with a total workforce of rounded 9,250 people. The arithmetic average employment rate is 28.4 persons per enterprise with the lowest value in ISIC 3831 with 27 persons per enterprise and ISIC 3832 with 30.4 persons per enterprise.

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- this good performance in registration continued until 1981;

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Number of persons per enterprise	46.7	46.4	34.8	32.3	27

Source: MITI

The enterprises are concentrated in the metropolitan area of Lima, i.e. Lima and Callao.

2.2.2 Scope of production

The main products of the enterprises registered under ISIC - group 3831 are: power transformers up to 220KV and 50 MVA, distribution transformers, electric generators up to 500 KW, electric motors up to 300 KW "motores de velocidad electricos", repair of electric motors, diesel generator sets, hydraulic generator sets (turbines up to 2MW), switchgears up to 24 KV and 630 A, current rectifiers and regulators, current transformers power and distribution switchboards, relais, low voltage switchgears and battery chargers.

2.2.3 Gross production and value added

The gross production as well as value added per employee (table 16) were the highest in 1977 and decreased then until 1981 constantly except for 1980 where gross output per worker rose slightly from the year before, yet value added continued decreasing. The production value per employee expressed in US$, is in the order of US$ 19,000 to US$ 23,000 p.a. which compares with figures from other developing countries.

According to the primary investigations in early 1984 the production value remained more or less stable in 1982 compared to 1981 with rather downward than an upward tendency and decreased strongly again in 1983.

Table 16: ISIC 3831 - production value and value added per employee at constant 1973 prices 1976 - 1981 (in thousand soles)

	1976	1977	1979	1980	1981
Production value per employee	798	883	803	832	731
Value added per employee	382	440	399	364	325

Source: calculations based on table 11 and 15

2.2.4 Assets

The fixed assets, investments in machinery and fixed assets per employee are given in table 17. The value in constant 1973 soles of the fixed assets of 1981 is 27 percent lower than in 1976. In 1979 the investment in machinery and equipment was 52 percent higher than two years before. This is partly due to the increase in the number of companies registered (see table 15), but also, as primary investigations indicated, a result of additional investments realized by the industry in expectation of an upward business trend. In 1981, assets in machinery and equipment were slightly lower than in 1976 (4 percent) but considerably lower than in 1979 (26 percent).

While in 1976 the fixed assets per worker stood at 326,000 soles (constant 1973 prices) this figure declined in an irregular manner to 233,000 soles in 1981 down to 29 percent. The expectations on reversing the negative business trend in 1979 brought the investment per employee in machinery and equipment to a record high of 160,000 soles per employee up to 36 percent from the 1976 value, and this of a record employment level during the years considered. In 1981, this figure fell even 7 percent below the original (1976) mark.

The investment per employee ranges from US$ 5,600 (in 1980) to US$ 8,400 (in 1976) and compares with similar enterprises in other developing countries. The annual investments of constant 1973 prices shown at the bottom of table 17, went down from 115 million soles (1976 and 1979) to 64 million soles in 1981. Investment in machinery and equipment in 1981 is only approximately third of the figure of 1976.

Table 17: Fixed assets at current and constant prices and investment per employee 1976 - 1981 (in million soles)

	1976	1977	1979	1980	1981
Current prices					
Fixed assets	777	1,110	4,418	5,286	8,288
of which: machinery and equipment	448	622	2,655	2,624	3,950
Constant prices (1973)					
1) Fixed assets	699	485	637	513	508
2) of which: machinery and equipment	253	272	413	255	242
% (2):(1)	36.2	56.1	60.1	49.7	47.6
Fixed assets per employee (thousand soles per person)	326	218	266	215	233
Machinery and equipment per employee (thousand soles per person)	118	122	160	107	110
Current prices					
Total annual investment	203	243	741	815	1,046
of which: machinery and equipment	148	138	442	501	476
Constant prices					
Total annual investment	115	106	115	79	64
of which: machinery and equipment	84	60	69	49	29

Source: MITI, own calculations.

2.2.5 Production inputs

The major part of the production input is of domestic origin (see table 18), varying between a minimum of approximately 53 to a maximum of approximately 59 per cent.

However, considering raw materials alone the foreign supplies dominate: local raw material inputs have a share of 36 (minimum, 1977) to 47 (maximum, 1978) percent; in general it can be assumed that 40 percent of the raw materials are of domestic origin. According to the results of the primary investigations the share of domestic raw materials has increased strongly in the last two years since 1981.

The local content has remained relatively stable during the period of time considered in table 18, oscillating around two thirds of the value of production output. This can be considered as a positive achievement of the industry.

2.2.6 Labor costs

As regards with the cost of employment (see table 19) it is noteworthy that the total cost per employee at constant prices also decreased from 1976 to 1981. In 1979 the labor cost per employee fell by 26%. This was certainly due to the strong increase in employment (see table 15) in the course of that year which presumably has a lower qualification than the existing staff of the enterprises and therefore received a lower remuneration. Nevertheless, years 1980 and 1981 did not bring a recovery of gross labor costs per employee at constant prices to the former level.

Table 18: ISIC 3831 - Production inputs (in million soles) at current and constant prices of 1973, 1976 - 1981

	1976	1977	1979	1980	1981
Total production inputs, current prices	1,573	2,261	6,684	11,497	14,431
Total production inputs constant prices	888	988	1039	1116	885
Domestic inputs (%)	57.9	52.5	59.0	59.2	57.3
(Raw materials)	(36.8)	(27.2)	(27.9)	(32.2)	(26.2)
(Parts and accessories)	(0.2)	(0.3)	(0.6)	(0.1)	(1.3)
(Industrial services)	(12.1)	(16.0)	(19.8)	(15.2)	(17.8)
(Others)	(8.8)	(8.4)	(10.7)	(11.7)	(12.0)
Imported inputs (%)	42.1	47.5	41.0	40.8	42.7
(Raw materials)	(41.4)	(47.4)	(40.2)	(40.1)	(41.6)
(Parts and accessories)	(0.1)	(0.1)	(0.3)	(0.3)	(0.4)
(Others)	(0.6)	-	(0.5)	(0.4)	(0.7)
Share of domestic raw materials in total raw materials consumed (%)	47.0	36.4	41.0	44.5	38.6
Local content 1/(%)	68.1	63.4	67.1	66.4	67.2

1/ Calculation based on the formula applied by the Funta de Acuerdo de Cartagenena: Aprociacion global de la industria de bienes de capital de Peru, 17.2, 1983.

Source: MITI

Table 19: Salaries, wages and other personnel costs (in million soles), current and constant 1973 prices

	1976	1977	1979	1980	1981
Salaries and wages, fixed personnel	427	565	1,321	2,079	3,591
Salaries and wages, non-fixed personnel	11	19	67	92	187
Other personnel costs	67	93	261	310	560
Total, current prices	505	677	1,649	2,481	4,338
Total, constant prices	285	296	256	241	266
Total employment cost/ employee (constant prices, 000 soles	133	133	99	101	122

Source: MITI

2.2.7 Mark-up

The statistical mark-up[1/] of the industry of ISIC group 3831 is shown in table 20. In 1979 the highest value was achieved, up 59 percent from the 1976 value; it then dropped in 1981 below its original value.

Table 20: ISIC 3831 - statistical mark-up of the industry in current and constant 1973 prices (in mill soles)

	1976	1977	1979	1980	1981
Mark-up at current prices	699	1,183	4,055	5,007	5,491
Mark-up at constant prices	395	517	630	482	337
Mark-up in % of gross production output	23	26	30	24	21
Mark-up in % of fixed assets	90	107	92	95	66
Mark-up in % of gross labor cost	139	175	256	200	127
Mark-up per employee (100 soles per person)	184	232	244	202	154

1/ By MITI statistics "excedente de explotacion" defined as the remainder of the following substractions; gross production minus total production inputs minus value added without mark-up; value added is made up of: total employment costs, depreciations, direct tributes and taxes and mark-up.

It is noteworthy that in 1979, which had the highest number of employees of the years considered in the comparison, the mark-up per employee also showed the highest value. The mark-up per employee was lowest in 1981, 16 per cent below the figure of 1976 and 37 per cent below the maximum figure of 1979. According to the primary investigations this downward trend has continued since 1981.

2.3 THE ENTERPRISES PRODUCING ELECTRICITY GENERATION AND DISTRIBUTION EQUIPMENT

2.3.2 General remarks

The electricity generation and distribution equipment manufacturers in Peru can, according to the results of the primary investigations and on the background of the ISIC - classification of all economic activities, be subdivided into the 4 following groups:

- producers of diesel and hydraulic generator sets, motors and alternators (part of ISIC group No. 3831);
- producers of power and distribution transformer (part of ISIC group 3831);
- producers of switchgears and switchboards and erection of them (part of ISIC group 3831);
- producers of insulated wires and cables (part of ISIC No 3839);
- producers of forged parts for high voltage transmission lines (part of ISIC group No. 3819).;

Electric motors have been included in the first set of producers even though they are electricity consumers instead of producers. Yet the technology of producing motors and alternators is very much the same so that in many cases with minor technical changes on electric motor can be used as an alternator.

2.3.2 Enterprises

During field work the following number of companies were identified (some companies were engaged of several of the products):

Production of:	
- electric motors	1 company
- electric generating sets (diesel and hydraulic incl. hydraulic turbines and alternators	1 company
- transformers	5 company
- switchgears	1 company

- low voltage switches	1 company
switchboards and installation of switchboards	15 companies
- cables	5 companies
- forged parts	1 company

Regarding these products the production environment can be described as follows:

The electric motors are produced in a company which also manufactures other products like speed reducers, ventilators for industrial applications, transformers and switchboards. There is one company specializing on the production of electricity generating sets; it manufactures alternators up to 500 KVA, diesel generating sets up to the same power range (the diesel engines are mainly purchased from the Foreign manufacturer), small hydropower stations up to 2 MW with turbines of the Pelton, Francis or Mitchell type.

Transformers are manufactured by 5 companies, of which 2 companies produce power transformers and distribution transformers and 3 smaller companies engage in transformer repairs and fabrication of distribution transformers. The power range of the transformers manufactured goes up to 50 MVA and 220 kV.

One of the major transformer producers also fabricates switchgears up to 630 A and 24 KV. Low voltage switch are produced by another company.

there are approximately 15 producers of switchboards, among which the companies manufacturing alternators (switchboards as required for the generator sets), 2 of the transformer producers and the manufacturer of low voltage switches. The production of switchboards can be discriminated as follows:

- low voltage distribution of switchboards relatively simple technology: approximately 15 producers
- switchboards for industrial uses, e.g. motor control centers: approximately 7 producers

The producers of the medium voltage switchboard cover the whole product range.

Cables are manufactured by 2 relatively big, 1 medium sized and 3 small sized companies. The copper used for the cable and wire production is of domestic origin. It is relatively brittle because of its content of arsenic and silver impurities and causes problems in the production process (occasional ruptures occur during manufacturing) but possesses good electric conductivity characteristics even though the silver content is minimal. The cables produced cover the power range of up to 15 KV, the demand of cable for higher voltages is too limited to allow production economically. Forged parts for uses in electric transmission lines, e.g. for fixing insulators or joining cables, are produced by the sole Peruvian company fabricating forged products.

In the past years enterprises have, according to their statements in many cases, increased the local content of their production inputs. In some cases imported raw materials and parts have now a lower share than domestic ones.

In general terms, the existing Peruvian production of electricity generating and transmission equipment covers a relatively wide range of products and can supply a good portion1/ of the domestic consumption. Some products have been discontinued like aluminium transmission lines as the drawing of aluminium using imported intermediate products proved to be uneconomic and not competitive to the imported finished product.

2.3.3 Sales markets

The predominant part of the production is normally sold to the state-owned electricity companies, Electrolima and Electroperu. Because

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1/ e.g. in cables approx. 95-97 percent of annual demand, in power and distribution transformers = 100%; in the cases of the other products market coverage depends on possible specific requests of the purchaser, however, in general terms, coverage can be above 80 percent.

of the reduction in public investment programs the sales to these clients were reduced considerably so that the manufacturers were forced to open up additional markets. At present an average sales distribution of the enterprises covered in the field work is:

- approximately 50 % of sales goes to the public electricity companies;
- approximately 15 % is sold to industrial clients, mainly mining industry;
- approximately 35 % goes into export.

However, there are companies with only very low export shares and others where exports are the predominant sales outlets. Products with a high export share are alternators, power and distribution transformers, switchgears and cables.

In the case of cable manufacturing, approximately 40 % of the production is power cables, the remainder is telephone cables, cables for building installations and non-insulated cables and wires, e.g. for electric motors and alternators.

2.3.4 Capacity utilisation

All companies complained about the low utilisation of their installed capacity due to reduced domestic market volumes. While in normal years the domestic switchboard market volume is in the order of US$ 20 million it is, since 1981, only in the order of US$ 3 million, giving an overall utilisation of 15 per cent as export markets hardly exist for this type of product. In transformer production the capacity utilisation is 40 per cent, in switchgear production (low and high voltage) around 20 per cent, in electric motor and alternator production approximately 60 per cent and in cable manufacturing around 50 per cent. Some companies have taken up subcontracting orders where technologically possible.

It could be noticed during filed work that many enterprises did not undertake measures to increase productivity in their manufacturing

sections as there was no possibility to sell additional output. At the same time, the industry is trying to keep the present work force as, according to their statements, the trained personnel is an important asset for future operations. The cost of training skilled labour which can take up to 10 years according to the specific job is considered to be so high that a further reduction of personnel is tried to be divided by the industry.

2.3.5 Plant layout and operations

In most cases plant layouts were adequate for the production flows, and possible improvements would only marginally contribute to improved operations or cost savings.

However, a few cases showed considerable defaults in the set-up of machinery, in warehousing and in the flow of semi-finished products between machining and/or assembling centres. At the same time in these cases a relatively common phenomenon could be noticed: the uneven or sometimes disorderly production flow apparently influenced the quality of craftsmanship as shown by unproper welding seams, inaccurate machining or simply in the quality of painting of finished products. These examples showed again that quality of products is strongly influenced by properly planned and executed flow of products during production.

The plant operation consist in general in metal forming operations (e.g. bending) and in some cases in metal cutting or removing operations (e.g. milling, drilling and lathe operations). In general the machines were of good quality and were kept in good conditions. It was obvious by the age of the machinery that lately hardly any investment had taken place. Most companies had installed adequate product testing facilities yet in some cases these important units were unproperly equipped or used.

2.3.6 Subcontracting

The enterprises visited all applied subcontracting in their production operations, especially cast iron parts and components. In a

few cases, the enterprises themselves had taken over orders to improve their capacity utilisation, e.g. for the production of pressed aluminium or machined products.

Statistically subcontracting is included under the item industrial services (see table 18) which had a share of 12 (1976) to 20 (1979) and 18 (1981) per cent of total production inputs.

This wide application of subcontracting will be a strong contribution to further specialisation and quality improvement of the production and will contribute to overall improvement of capacity utilisation. It can be expected that also in the future the value added tax will further enhance subcontracting as taxes paid for purchased products can be deducted from own value added tax liabilities.

2.3.7 Cost efficiency in international perspective

According to the enterprises, their products are competitive on export markets due to the CIEX other incentive scheme. Export markets are mainly the Andean Pact countries, Central America and, especially for cables, also the USA.

On the domestic market there is competition from foreign suppliers in all internationally financed tenders. Because of the high costs the domestic products are normally not competitive with imports on a duty-free basis. The enterpreneurs claim as special cost factors the import duties on their imported raw materials and the relatively high costs resulting out of the industrial community law. Latter payments increase the final product price, according to the enterpreneurs, by 8 per cent, while an average share of imported raw material of 20 % of the production value (calculated for 1979) and an import duty of 60 plus 10 per cent increases the product price by another 14 per cent, giving a total of 22 per cent. In the case of cables, the relative high price of domestic PVC material for insulation purposes has a strong negative effect on international competitiveness while the copper prices from the domestic supplier give no concern.

2.3.8 General aspects

The general impression obtained was that all enterprises tried to open new markets to overcome the downward trend of their traditional domestic markets and also made efforts to include new products in their scope of production. But as industrial and public purchases were at an overall low the market prospects for additional products were also so reduced that even minor investments to start new product lines were not undertaken.

An additional market outlet is seen by the entrepreneurs in the supply of equipment for internationally financed major electricity generating projects. The domestic equipment producers have formed within the framework of activities of the National Association of Industries a working commission on capital goods to promote a stronger domestic participation in the tenders for those projects. Apparently the public power sector welcomes those activities and has no technical objection against the local supplies which is shown by the fact that 50 per cent of sales of the industry goes to the power sector.

The commission is also active in trying to open up bilateral financing agreements between Peru and possible supplier countries for the inclusion of Peruvian supplies into the financing schemes. However, results might only be possible on a case to case basis.

The industry is also partly engaged in own research and development activities. Some of the enterprises take advantage of the possibility offered by ITINTEC to use themselves the 2 per cent surcharge on all salaries and wages paid by the enterprise for own research and product development instead of paying the corresponding amount to ITINTEC. ITINTEC has to approve these activities and is ready to continue doing so as several positive results had been obtained.

3. DEMAND FOR ELECTRICITY GENERATION AND TRANSMISSION EQUIPMENT

3.1 Past trends and present situation

3.1.1 Apparent consumption for products of ISIC 3831

Due to the scarcety and, according to the source, deviations of trade figures it is difficult to establish a statistical overview over production, trade and apparent consumption of the products considered in this study.

The only available time series on exports is given by the Word Bank 1/ on an ISIC major group (3 digit) level. The exports developed as follows for ISIC 383:

- 1976: US$ 1.9 million
- 1977: US$ 3.6 million
- 1979: US$ 13.4 million
- 1980: US$ 19.1 million
- 1981: US$ 13.7 million
- 1982: Jan - June: US$ 4.2 million

For 1977 and 1979 data are available on trade, production and apparent consumption, they are given in table 21. As can be seen, exports of products are relatively little in 1977, approximately 3 per cent of production, and grow to approximately 7 per cent in 1979. Comparing these export figures for 3831 with the figures of World Bank for exports of ISIC 383 it is shown that ISIC 3831 had an export share of 44 per cent in 1977 and 30 percent in 1979 in all exports of electrical machinery.

1/ The Manufacturing Sector

Table 21: Production, imports, exports and apparent consumption of electrical industrial machinery (ISIC 3831) (in above US$), 1977 and 1979

	1977	1979
ISIC No. 3831		
Production	50,827	53,410
Imports	23,060	29,560
Exports	1,609	3,951
Apparent consumption	72,278	79,019

Source: Apreciacion global de la industria de bienes de Capital del Peru, Punta del Acuerdo de Cartagena, 17. 1. 1983,

The apparent consumption is composed of approx. two thirds domestic production and appros. one third imports. These imports partly represent equipment not manufactured in Peru (e.g. high voltage switchgears) and partly represent supplies stemming from international or bilateral financing.

Even if a constant import ratio of 33 per cent for ISIC group 3831 would be assumed a trend in domestic consumption cannot be established by using the figures on post production (table 11) due to the annual variations. The determining factor for the market prospects of this product group is the investment potential and requirement of the power generation sector.

3.1.2 Investment constraints of the public power sector

The investment potential being a type of Electroperu, holding company of all public power companies, is determined by incomes through the sales of Electricity and its access to external sources of financing. Both factors are at present in a critical stage: The income through power sales does not cover the costs as increases in the electricity tariffs during the 10 years did not keep pace with the rate of inflation. In 1983, Peru had the lowest electricity tariffs in Latin America, and

Electroperu welded 65 per cent of its income for debt services as a result of its externally financed investment program. At present the situation is gradually improving through periodical increases of the tariffs.

The availability of external financing is at present not only affected by the weak income situation of Electroperu but also by the external financial problems of Peru. It can be expected that, as regards Electroperu, these negative influences can be overcome once its income situation stabilizes. There are indications that international financing institutions are willing to finance specific projects once Electroperu is able to raise its local contribution.

However, due to the nature of power projects the investment decisions on new projects will only have a medium-term influence on the industry manufacturing power generation and transmission equipment and will not contribute to improve the present low capacity utilization. These parameters have also in the past (see table 11) influenced the performance of ISIC 3831 which, for example, is different from the development of ISIC 3833, a project group of purely consumer goods.

3.2 Future prospects

3.2.1 General power supply system

In October 1983 Electroperu established a Master Plan[1/]. It is a revision of previous, more ambitious plans which were considered irrealistic because of its investment volume for which financing could not be obtained.

The projections of the Master Plan are shown in table 21. The projections assume an annual growth rate of electricity demand of 6.1 per cent and of power generation of 6 per cent. This growth rate, however,

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1/ Plan Maestro de Electricidad, Ministerio de Energia y Minas, Electroperu, S.A., Octuber 1983

is estimated to be too high, and for power generation a 5 per cent annual increase is proposed a more realistic one.2/

However, in the short term (i.e. until 1986) a reduced investment program of Electroperu has to be expected as it will have to establish first of all a sound financial basis before any investment program can be launced.

This means that there most probably will be delays in the tendering of new power plants in the middle of the present decade. If the present readjustment plan for the electricity tariffs can be fully implemented an increase in tendering of new power plants and transmission lines in the order of magnitude of the projections can be expected towards the end of the decade. The projections can therefore be taken as an indicator of the size range of investment of the public power sector for the final part of this decade and beyond.

The future investment plans of Electroperu will require and average annual investment of approx. US$ 450 million of which the domestic counterpart contribution would have to be approx. 30 per cent, i.e. US $ 150 million. The demand impact of these investments on specific products is shown in Annex II.

3.2.2 Isolated power generation

Approximately one third of electricity produced is generated in approximately 600 isolated systems. Many of them are operated by Electroperu and will in the future be more and more integrated into the national grid system.

Important industrial power producers are:

mining and oil: approx. 770 MW installed capacity

2/ Peru: Issues and options in the Energy sector, UNDP/World Bank Energy Assessment Program, January 1984

- sugar and fish industry: approx. 200 MW installed capacity
- other industry: approx. 170 MW installed capacity.

There are no indications that there will be an extension of autoproducing systems with the exception of a mining project discussed at present. Yet many of the autoproducers, especially the sugar industry, have a considerable replacement requirement as there have been hardly any investments in the past.

3.2.3 Rural electrification

Approximately 2,000 villages are at present without electricity supply, 60 per cent of the population is affected by this. To improve this situation an electrification program has been established of a total investment of US$ 200 million, US$ 25 million have been spent in 1982. This program receives support by several bilateral and multilateral aid institutions, e.g. the USA, the Federal Republic of Germany and IDB.

In total, 220 small electricity generation, transmission and distribution systems have been identified. Fifty small scale hydropower projects have already been analyzed in a more detailed manner. Electroperu estimates that in the near future annually the following average number of hydropower plants will be installed:

- 50 - 500 KW plant capacity: 10 - 15 hydropowerplants annually
- 500 - 5000 KW plant capacity: 3 hydropower plants annually
- more than 5000 KW plant capacity: less than 1 plant annually

In the past years Electroperu has continuously increased its technical planning capacity to cope with the requirements of such an implementation program of small hydropower systems. As this program is not affected by adverse external financial problems and as its implementation is planned to proceed continuously it represents a relatively stable demand for the domestic industry.

4. Recommendations

4.1 Institutional framework of the capital goods sector

The producers of power generation and transmission equipment in Peru are members of the Committee of Capital Goods Producers of the Society of Industries ("Comite de Fabricantes de Bienes de Capital de la Sociedad de Industrias"), at present the only entity dealing particularly with capital goods sector. It is a private industrial institution.

However, the manifold problems and aspects of capital goods production and sales requires more complex institutional support structures. Examples are given by the industrialized countries which have a complete network of private, public and mixed institutions many of which deal only with specific tasks, be it public relation and promotion functions of the industry, norms and control functions for equipment specifications, research institutions or training facilities etc.

Three other member countries of the Andean Pact, namely Colombia, Ecuador and Venezuela, have lately created public or mixed institutions to stimulate their capital goods industries. UNIDO has given support to these efforts through detailed planning and organisational assistance.

The Ecuatorian "Comision de Bienes de Capital" pursues the objective to achieve the highest possible participation of domestic engineering and industrial enterprises in the execution of investment projects. Among the various programmes executed by the institution are:

- permanent inventory of investment projects of the public sector
- domestic supply and demand comparisons of capital goods
- execution of technological disaggregation of investment projects to determine domestic supply potentials
- design of policy measures to promote goods industry.

The institutions in Colombia and Venezuela have similar objectives, besides the representation of the enterprises in their corresponding industrial associations.

It is recommended to analyze the possibilities of a similar approach to the capital goods sector in Peru. It is a measure which goes by and the scope of the producers of electric equipment yet the creation of such an institution and its active support of the domestic capital goods industry would also be highly beneficial to the electrical equipment subsector.

4.2 Institutional framework in technology matters

All of the Peruvian companies visited had testing laboratories, most of them were at least adequately equipped for the current testing requirements of the industry.

However, in electric equipment production it is quite common that equipment has to be tested under extreme load conditions. These facilities are very costly and would, especially under the present difficult situation of the industry, hardly be justifiable by any of the enterprises. Furthermore, their capacity utilisation by any one of the enterprises would be reduced.

However, a common facility for educational purposes at academic level, for the power utility companies and for the electric equipment producers might prove to be an adequate, investment and cost saving solution to strengthen the capacities according to requirements: It can also stimulate industry to take up additional component and equipment production, especially in the medium and high voltage range.

The institution which appears most appropriate to furthere investigate this concept up to feasibility level is ITINTEC. It has gathered experience in the execution of research in the electric power generation and distribution area as well as in the planning of research institutions and testing laboratories. The planning study shall also indicate the

most appropriate way to organize the institution to be created and to attach it to the most adequate existing public establishment (e.g. university).

One of the most important areas to be covered by either the new or an existing institution is the design of own norms and standards. These should be compulsory both for the power utility companies and the industries. The determination of standards should be combined with regional efforts through the Punta del Acuerdo de Cartagena for which in Peru ITINTEC is also responsible.

Company research, carried out by the enterprises themselves or through personnel of the new facility, should be an important issue during planning and operation of the facility. This would allow the enterprises of directly using their contributions to ITINTEC (2 per cent of total wages paid by the company) for research work which is in their own interest.

4.3 Market orientation

The Peruvian producers have in the past a great deal of flexibility: when the domestic market became stagnant they found sales outlets in export markets. Between 1976 and 1980 exports ISIC 383 rose by the factor 10, until there Peruvian products were also hit by the world wide recession. Exports dropped by 28 per cent from 1980 to 1981. During field work it could be noticed that the producers interviewed were active in searching for new markets in Central America noticing that the other Andean Pact countries did not yet show signs of economic and foreign exchange recovery. Apparently the promotion scheme through CERTEX which allows the electric equipment producers a gross 22 per cent incentive on the sales prices and the interest of the enterprises in obtaining foreign exchange together with a stagnant or decreasing domestic market are strong motives to capture export markets.

The other possibility of diversification, looking for new products of similar production technology for different domestic purchasers, has not been favored by the Peruvian electric equipment producers. It might well be that the differences in business cycles in the late 1970 (see table 11, demand trend of ISIC 3833 from 1976 to 1979 when ISIC 3831 continued growth) and the similar downward tendencies did not represent any attraction to the producers to try to enter shrinking markets.

However, there are market "pockets" in the power sector which have not been covered by domestic producers, namely internationally financed power generation and distribution projects. The entrepreneurs claim that owing to their high production costs (low productivity, low production volume, high labour cost through the industrial community law) and owing to the reference price their offer is not competitive with foreign bidders. Domestic entrepreneurs claim that their cost advantage in participation in bidding of 15 per cent is insufficient to be able to win the bids. Their cost comparisons between domestic and foreign offers incline to criticise that foreign prices include all available export incentives of the foreign supply countries while the own check price does not include any incentive.

A detailed analysis of pricing practices in international tenders by an independent agency is recommended to show possible distortions and determine parameters of action for domestic enterprises or public authorities. Consideration should be given to the fact that purchases financed through international loans represent, financially, an export business while the location of delivery of goods make the sales a domestic delivery. This leads to the point that, similar foreign supply countries in internationally tendered contracts or similar to the CERTEX scheme for exports, an incentive scheme for domestic deliveries should be thoroughly analyzed.

4.4 Production aspects

Once market prospects are more positive the Peruvian producers of power generation and transmission equipment will more closely look at

additional production possibilities. These can arise in the area of increasing the value added of the production through increasing domestic production of intermediate products and components which at present are imported in the start-up of manufacturing new products.

New products with an apparently high sales potential in the power sector are:

- high voltage insulators
- forged or cast steel parts for fixing cables and insulators
- transmission towers
- steel pressure tribes and
- floodgate and canal locks

Indications on the order of magnitude of future demand are shown in the tables of Annex II. All additional products with a high market potential and prima facie, goods prospects for local production for the power sector belong to other ISIC groups than 3831.

In all cases the production technology for the new products is relatively complex. A high quality of raw material (e.g. steel, coaline) and precise manufacturing processes (e.g. rolling or forging of steel intermediates, casting) requiring in some cases additional high precision machinery and equipment and a highly trained workforce for finishing operations have to be guaranteed. Furthermore, testing facilities and control of standards which also will have to be established will have to be created.

At present there are some cases, especially in the iron and steel sector, on which a domestic manufacturing of the mentioned products can be built up. Yet these implementation will require substantive planning and control efforts, both organisational and technical control, for which an operational structure would have to be determined. In this context reference is made to internal operational and technical solutions within large enterprises and to external ways of cooperations, i.e. the establishment of specialized production units forming a subcontracting network.

Possible planning concepts for such an operational structure should be jointly discussed between public authorities, the power sector and the corresponding private and public industries. The results of the discussions shall include the determination of the objectives of this project and additional external inputs in manpower, technology transfer and financing required for its implementation.

Annex I: Product composition of ISIC group No. 3831 and 3839

Annex II: Demand impact of Electroperu's investment program on specific products.1/

1/ Comite Nacional Peruano, Comision de Integracion Electrico Regional, subcomite industrial, Lima, Peru, 1983.


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