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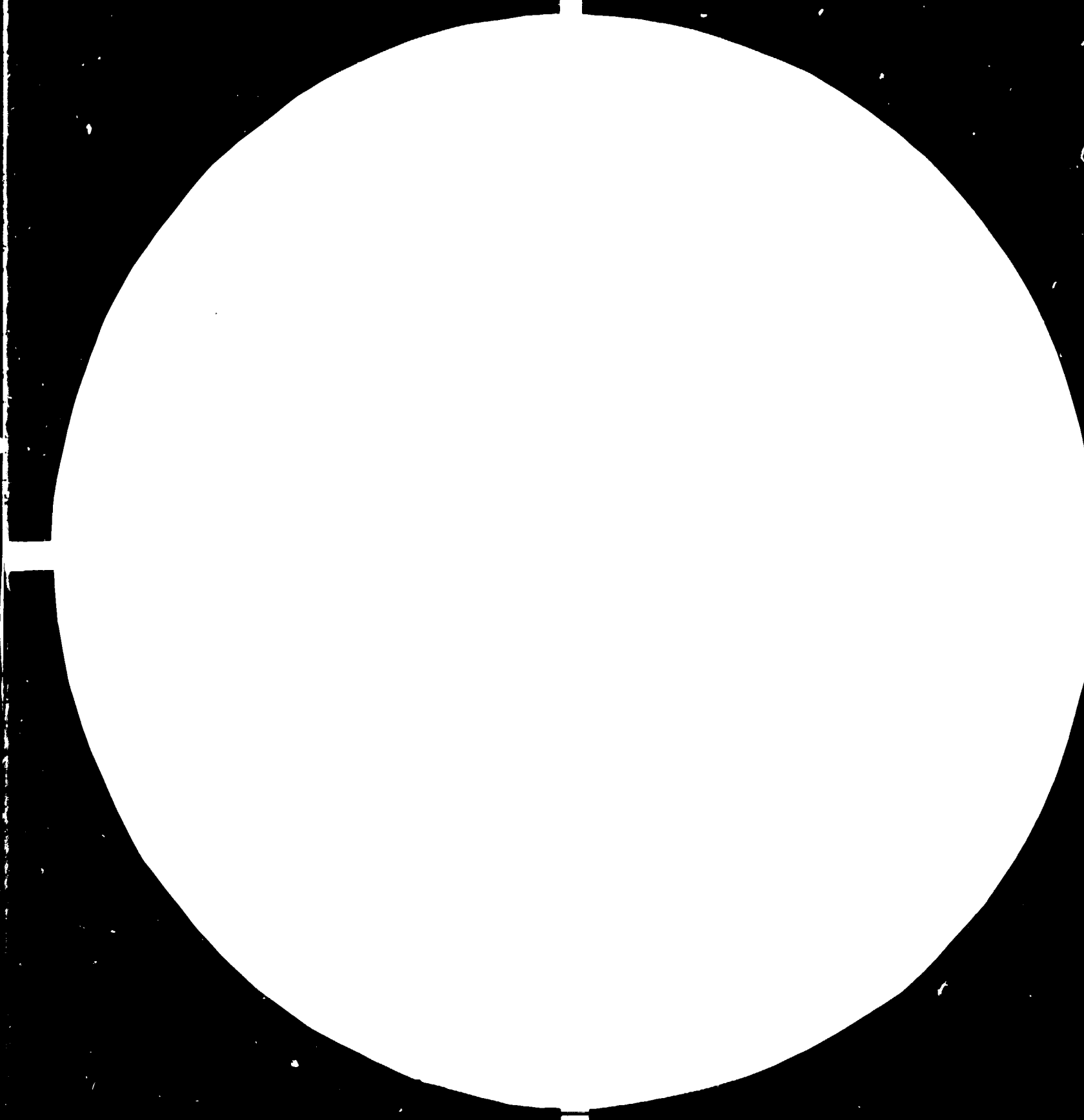

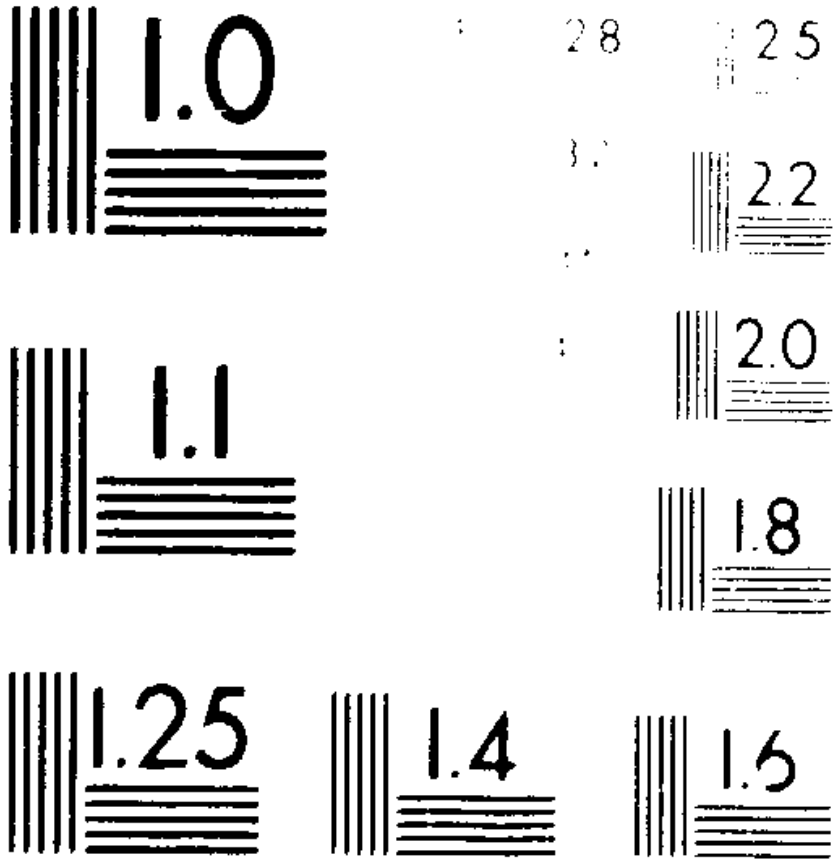

BACKGROUND PAPER

THE BUILDING MATERIALS INDUSTRY IN BRAZIL

14070

PREPARED FOR

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

BY

LUIZ CARLOS MARTINS BONILHA

JULY 1984

THE BUILDING MATERIALS INDUSTRY IN BRAZIL

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I N T R O D U C T I O N

This report, prepared as a background paper for the First Consultation on the Building Materials Industry, is addressed to the situation of this industry in Brazil. Some complementary information is given about research in this field, in Brazil as well as in Latin America.

The difficulty of obtaining data which could be interpreted for the purpose of this work necessarily limited the number of materials to be surveyed, as well as the depth of the study.

These materials are: Portland cement, aluminum, plane glass, steel, glazed ceramic tiles and wood. Although not complete, the study of these materials shows some of the successes and problems which face the building materials industry in Brazil at this moment and so can help in the decision process for the future.

FOREWORD

This work is incomplete in scope and detailing mainly because the statistics necessary either were not available or were aggregated in a way in which it was not possible to extract the information pertaining the sector of interest, namely the building materials industry. This lack of acessible information is, by the way, one the main reasons why planning and planning implementation are so badly carried out, not only in Brazil but in the developing countries as a whole.

Main sources for this paper were Brazilian CNICC (National Commission for the Building Construction Industry) and IBGE (Brazilian Institute of Geography and Statistics). Much of the treated information was taken from a preliminary report on the construction industry in Brazil, prepared by Fundação João Pinheiro, to which the author wants to give his thanks.

REVIEW OF SOCIO-ECONOMIC DEVELOPMENT

The last two decades have seen the so called "Brazilian Miracle" and its end as well, in the sense that Brazil's enormous external debt has led the Government to take severe recessive measures. Inasmuch as the "miracle" reflected itself strongly in the building materials industry and the construction industries (large dams, roads, industrial plants, and an ambitious housing program) its end also reversed the high growth rate of these sectors, forcing many of the firms to reduce their size and, in some extreme cases, to close.

At the present moment what one can see is still a pessimistic vision: large civil works depended in the past of external funds and these funds are no longer available; on the other hand the national housing program, which depends essentially on internal savings and a special compulsory fund paid by employers on behalf of each employee is adversely affected by the economic recession.

The housing shortage is very large still and of course some funds will also have to be provided for high priority large works. However there is not, at this moment, a clear guideline to follow. Matters are not helped by the turmoil in the political scene but as soon as presidential elections have taken place undoubtedly the new development strategies will appear.

One can see, however, some tendencies: there will be more concern for quality and durability; users will have more to say in what refers to their interests, particularly in the housing field; decision decentralization will become more common. In short, one can expect with some certainty a more conservative approach to development.

DISTRIBUTION OF THE ECONOMICALLY ACTIVE POPULATION IN BUILDING AND TRANSFORMATION INDUSTRIES ACCORDING TO SEX

	1960			1970			1980		
	TOTAL	MALE %	FEMALE %	TOTAL	MALE %	FEMALE %	TOTAL	MALE %	FEMALE %
BRAZIL	22 750 028	82,1	17,9	29 557 224	79,1	20,9	43 796 763	72,5	27,5
TRANSFORMATION INDUSTRY	1 954 187	64,66	24,75	3 241 861	81,2	18,8	6 858 598	75,5	24,5
BUILDING INDUSTRY	781 247	99,1	0,9	1 719 714	99,1	0,9	3 151 094	98,2	1,8
	(3,5%)			(5,8%)			(7,2%)		

ESTIMATE OF HOUSING NEEDS, BY REGION

PERIOD: 1980 - 85

(Thousands of Units)

REGION	DEMOGRAPHIC DEMAND	REPLACEMENT	TOTAL
North	244	110	354
Northeast	944	916	1 860
Southeast	2 591	629	3 220
South	914	90	1 004
Center-West	581	96	677
Brazil	5 274	1 841	7 115

SOURCE: JOÃO PINHEIRO FOUNDATION. PRELIMINARY DATA

CONTRIBUTION OF THE CONSTRUCTION INDUSTRY TO THE GROSS DOMESTIC PRODUCT AND THE GROSS FIXED CAPITAL FORMATION

The available data show that the Construction Industry contributes with 4% to 5% of the Gross Domestic Product which oscillations have generally followed the variations of the country's economy and the industrial sector.

Attention must be paid to its high participation in the Gross Fixed Capital Formation, around 20%.

CONTRIBUTION TO GROSS DOMESTIC PRODUCT (GDP)

YEAR	GROSS DOMESTIC PRODUCT (A) CURRENT PRICES (Cr$10^6)	INDEXES 1970 BASIS	INDEXES YEARLY VARIATION (%)	INTERNAL REVENUES (B) INDUSTRIAL SECTOR (Cr$10^6)	INDEXES 1970 BASIS	INDEXES YEARLY VARIATION (%)	(C) BUILDING INDUSTRY (Cr$10^6)	INDEXES 1970 BASIS	INDEXES YEARLY VARIATION (%)	CONTRIBUTION (%) C/A	CONTRIBUTION (%) C/B
1970	210,117.9	100,0	-	60,548.9	100,0	-	9,933.8	100,0	-	4,7	16,4
1971	279,515.0	112,0	12,0	81,155.3	111,8	11,8	12,554.6	112,5	12,5	4,5	15,5
1972	368,400.5	124,5	11,1	107,817.8	126,0	12,7	16,649.4	122,2	8,6	4,5	15,4
1973	508,745.8	141,9	14,0	151,650.6	146,2	16,0	22,944.4	140,6	15,1	4,5	15,1
1974	740,503.7	155,4	9,5	231,341.4	159,6	9,2	34,987.8	157,6	12,1	4,7	15,1
1975	1.052,062.2	164,1	5,6	327,843.0	168,5	5,6	47,397.9	178,5	13,3	4,5	14,5
1976	1.680,232.7	180,0	9,7	500,168.8	189,6	12,5	73,078.1	197,8	10,8	4,4	14,6
1977	2.523,100.8	189,8	5,4	719,939.8	197,0	3,9	107,286.0	210,9	6,6	4,3	14,9
1978	3.729,798.4	198,9	4,8	1.046,289.3	211,5	7,4	157,624.6	225,7	7,0	4,2	15,1
1979	6.239,402.3	212,2	6,8	1.726,161.1	225,5	6,6	268,277.1	233,6	3,5	4,3	15,5
1980	13.104,284.8	228,9	7,9	3.778,060.0	243,4	7,9	643,623.6	251,9	7,8	4,9	17,0
1981*	26.832,943.0	-	-1,9	-	-	-5,9	-	-	-4,2	-	-
1982*	53.150,747.0	-	1,4	-	-	1,2	-	-	-0,4	-	-

SOURCE: CNICC

* UNOFFICIAL DATA

CONTRIBUTION TO GROSS FIXED CAPITAL FORMATION

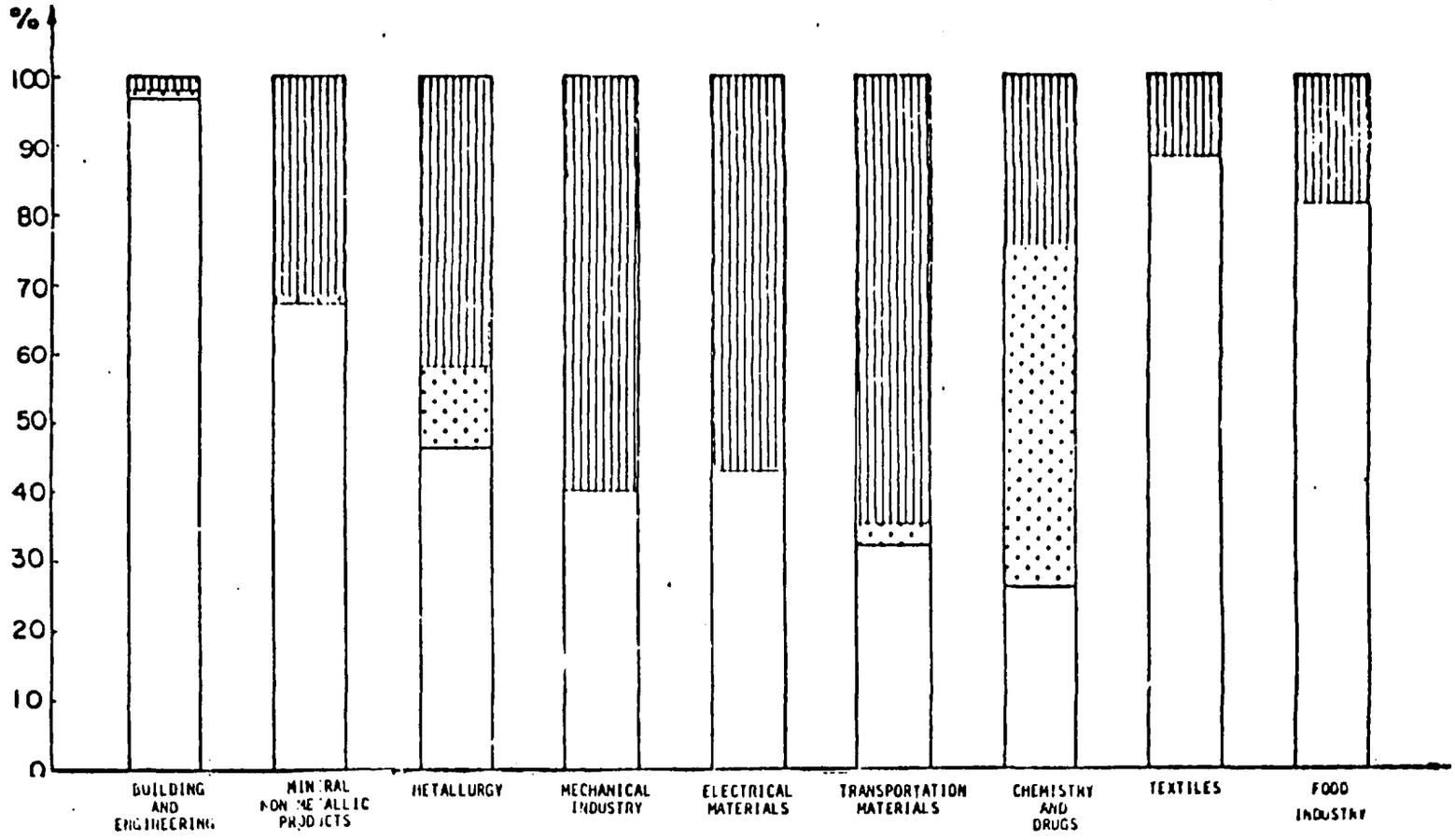
YEAR	(A) GFCF T O T A L ($Cr\$10^6$)	(B) BUILDING INDUSTRY ($Cr\$10^6$)	GROSS FIXED CAPITAL FORMATION		CONTRIBUTION (%)	
			GOVERNMENT SECTOR ($Cr\$10^6$)	PRIVATE SECTOR ($Cr\$10^6$)	A/GDP	B/A
1970	45,123.0	9,933.8	8,587.5	36,535.5	21,5	22,0
1971	61,238.3	12,554.6	11,066.0	50,172.3	21,9	20,5
1972	81,282.5	16,649.4	13,464.1	67,818.4	22,1	20,5
1973	113,956.9	22,944.4	18,988.1	94,968.8	22,4	20,1
1974	176,705.2	34,987.8	28,727.9	147,977.3	23,9	19,8
1975	262,737.5	47,397.9	41,424.0	221,313.5	25,0	18,0
1976	391,152.1	73,078.1	65,893.1	325,259.0	23,3	18,7
1977	537,551.9	107,286.0	90,879.8	446,672.1	21,3	20,0
1978	788,845.5	157,624.6	113,880.8	674,964.7	21,2	20,0
1979	1.269,174.0	268,277.1	147,419.2	1.121,754.8	20,3	21,1
1980	2.768,849.5	643,623.6	286,835.4	2.482,014.1	21,1	23,3

SOURCE: CNICC

PERCENTAGE PARTICIPATION OF ENTERPRISES ACCORDING TO CONTROL OF ASSETS

BUILDING INDUSTRY SECTOR AND SOME OTHER SELECTED SECTORS

- 1970 -



PRIVATE NATIONAL COMPANIES

FOREIGN COMPANIES

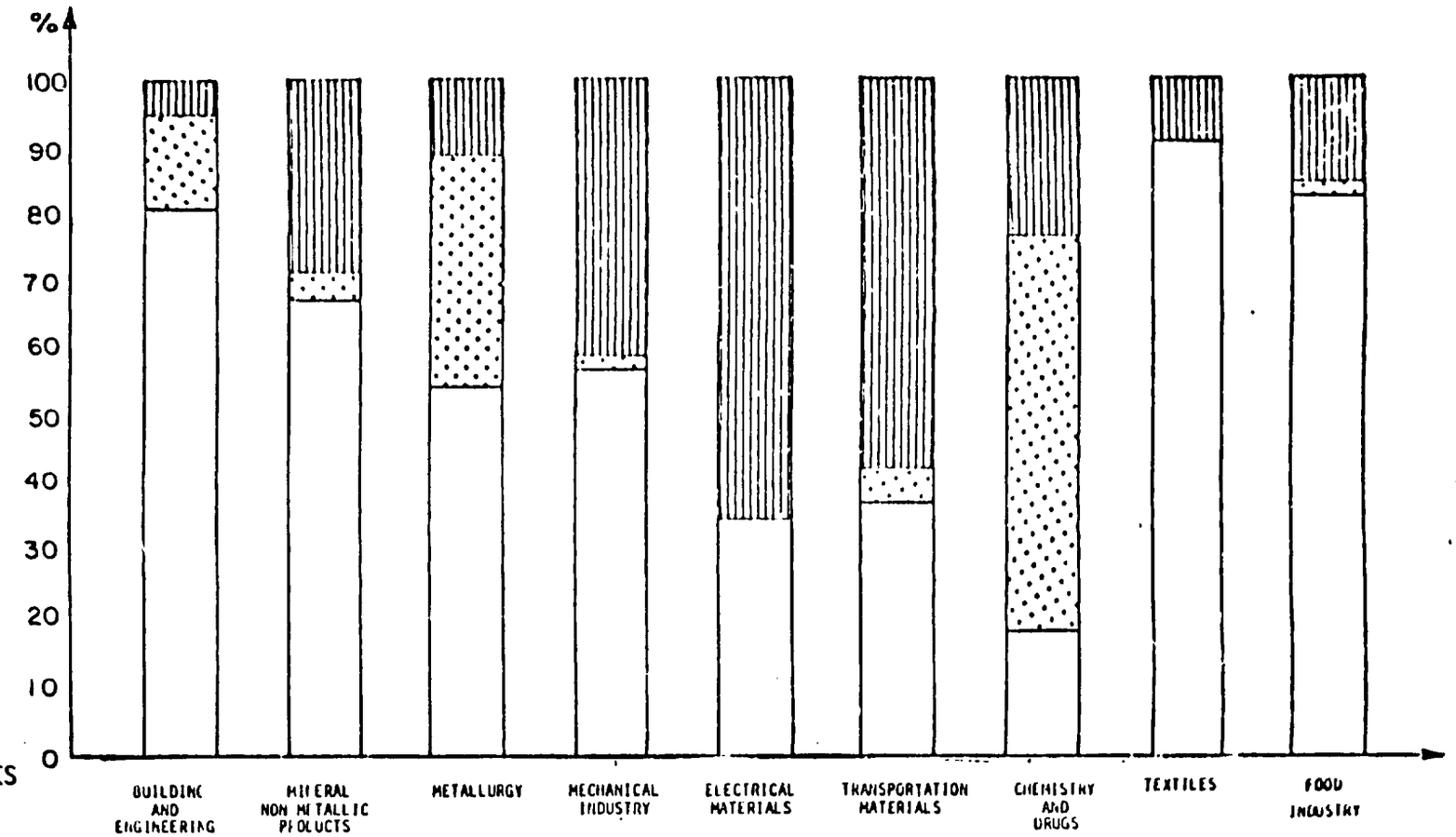
STATE COMPANIES

- SOURCE: JOÃO PINHEIRO FOUNDATION

PERCENTAGE PARTICIPATION OF ENTERPRISES ACCORDING TO CONTROL OF NET ASSETS

BUILDING INDUSTRY SECTOR AND SOME OTHER SELECTED SECTORS

- 1975 -

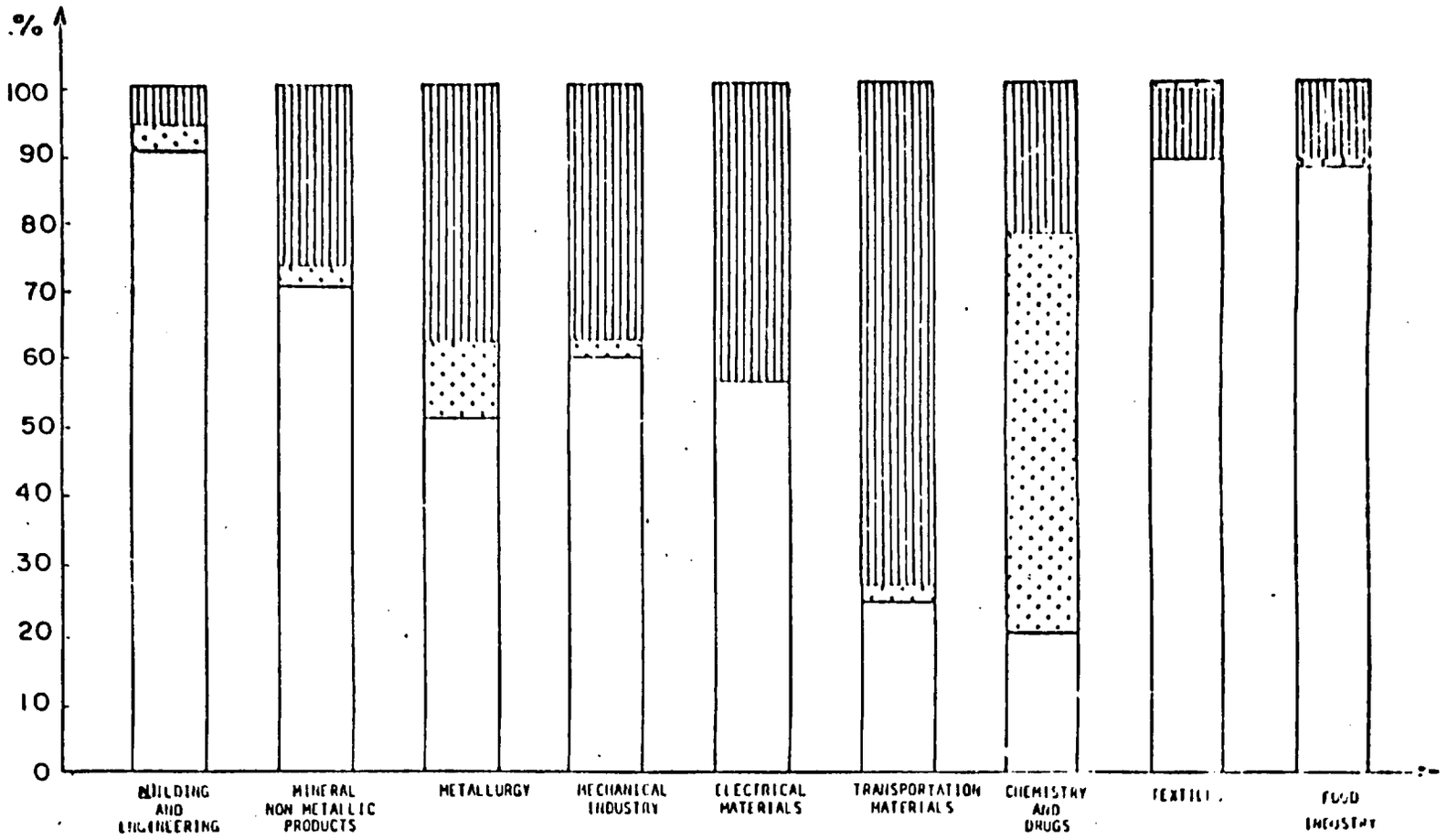


SOURCE: JOÃO PINHEIRO FOUNDATION

PERCENTAGE PARTICIPATION OF ENTERPRISES ACCORDING TO CONTROL OF NET ASSETS

BUILDING INDUSTRY SECTOR AND SOME OTHER SELECTED SECTORS

- 1980 -



SOURCE: JOÃO PINHEIRO FOUNDATION

PRODUCT \ YEAR	1954	1965	1966	1967	1968	1969	1970
BASIC LIST							
GYPSUM (T)							
GRANITE (m^3)							
MARBLE (m^3)							
BROKEN STONE (m^3)							15.7
HYDRATED LIME (T)	174.051						7
NON-HYDRATED LIME (T)	360.293						1.1
DECORATED WALL TILE (GLAZED) (m^2)							
NON DECORATED WALL TILE (GLAZED) (m^2)							
STONEWARE PIPES (THOUSANDS OF UNITS)							
BURNT CLAY FACING BLOCKS (THOUSANDS OF UNITS)							1
CLAY FLOORING TILES (m^2)							14.6
CLAY ROOFING TILES (THOUSANDS OF UNITS)							
CLAY BRICKS (THOUSANDS OF UNITS)							
STONEWARE SANITARY BOWLS (UNITS)							1.3
PREMIXED MORTARS (m^3)							17
ASBESTOS CEMENT FIXTURES (UNITS)							
CONCRETE FIXTURES (UNITS)							
FIBER CEMENT FIXTURES (UNITS)							
GYPSUM PLASTER COMPONENTS (UNITS)							
CONCRETE BLOCKS (m^2)							
CONCRETE PIPES (T)							
ASBESTOS CEMENT PIPES (T)							
ASBESTOS CEMENT SHEETS (T)							
CONCRETE TILES (m^2)							1.7
CONCRETE SLABS (m^2)							
CONCRETE BRICKS (THOUS. UNITS)							
GLASS ROOFING TILES (THOUSANDS OF UNITS)							
PLANE GLASS (m^2)	7.855.737	5.579.721	6.226.864	8.256.912		11.507.621	15.
COPPER PIPES (T)							
METALLIC ROOFING SHEETS (T)							
IRON AND STEEL DOOR AND WINDOW FRAMES (m^2)							
OTHER METALLIC DOOR AND WINDOW FRAMES (m^2)							
COPPER ELETRIC WIRE, ISOLATED (T)		331.485.720m	19.802	27.233		27.121	
ELECTRIC WIRE, ISOLATED (T)							
ELECTRIC SWITCHES (THOUSANDS OF UNITS)							
LIGHTING FIXTURES (THOUSANDS OF UNITS)							
ELECTRIC CONNECTORS (THOUSANDS UNITS)							
WOOD FOR FLOORING (m^2)							
WOOD BEAMS AND RAFTERS (m^3)							
PRE-FABRICATED WOOD HOUSES (UNITS)							
WOOD PARTITIONS							5.
WOOD FRAMES FOR WINDOWS AND DOORS (m^2)							
WOOD STRUCTURES FOR BUILDINGS (m^2)							
WOOD PANELING (m^2)							
OIL PAINTS (T)		50.538	58.935	89.232		44.495	
WATER BASED PAINTS (T)	16.860						
OIL BASED PAINTS (T)	23.741						
PLASTIC PAINTS (T)							
POWDERED PAINTS (T)							
PLASTIC SANITARY PIECES AND FIXTURES (UNITS)							
PLASTIC COMPONENTS FOR BUILDING (UNITS)							
STONE FOR BUILDING (m^2)							1.
DECORATED AND PLAIN GLAZED WALL TILES (m^2)							
COMPLEMENTARY LIST							
PLASTIC PIPES (T)						21.238	
UNWELDED STEEL PIPES (T)	61.893						
SYNTHETIC PAINTS (T)		55.205	28.652	34.950		19.633	
LUMBER (m^3)		1.406.126	1.222.447	1.288.305			
BRICKS (THOUSANDS OF UNITS)		55.609					
CEMENT (T)		5.088.823	5.500.935	6.342.479		14.816.878	
PIG IRON (T)		2.139.191	2.582.513	2.455.586		2.541.353	
STEEL INGOTS (T)		2.448.204	2.959.424	3.122.135		3.860.404	
LAMINATED STEEL, PLANE (T)		1.257.651	1.733.855	1.548.130			
LAMINATED STEEL, NOT PLANE (T)		1.113.579	1.216.384	1.313.740		1.111.467	
ALUMINUM INGOTS (T)		32.472	40.571	44.893		48.718	
THIN STEEL PLATES (T)						764.970	
THICK STEEL PLATES (T)						461.764	
STEEL RODS FOR REINFORCED CONCRETE (T)						525.218	
WELDED STEEL PIPES (T)							

SECTION 1

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
								518.723	454.375	575.124	602.333	703.462	511.516
								14.741	9.433	12.358	15.375	65.216	35.936
								72.052	61.603	56.725	105.152	85.169	86.545
				15.744.973				26.441.079	27.878.591	35.317.360	56.711.099	44.604.497	3.370.579
				736.954				1.084.567	1.774.676	1.574.602	1.549.557	1.761.247	46.152.820
				1.112.451				1.977.891	1.719.625	2.252.703	2.593.471	2.939.973	1.931.556
								15.366.045	16.734.443	23.837.020	32.660.277	38.164.354	2.944.046
								24.637.705	19.387.335	26.436.047	22.225.678	20.992.726	43.438.012
								41.305	44.247	31.825	32.075	33.932	27.021
				16.474				12.553	21.216	23.072	33.542	23.242	22.830
				14.650.441	12.492.501	12.514.129	13.654.559	23.633.993	28.635.406	35.406.562	41.561.367	41.444.772	43.513.735
								356.340	1.001.027	795.575	839.592	903.782	974.696
								793.512	5.412.908	3.219.367	3.670.943	3.890.421	3.900.520
				1.352.615				1.437.958	2.068.708	2.135.120	2.570.713	2.629.324	2.728.654
				179.321				436.975	475.910	380.562	417.914	642.734	429.595
								NA	NA	NA	NA	NA	NA
								NA	NA	NA	NA	NA	NA
								NA	NA	NA	NA	NA	NA
								NA	NA	NA	NA	NA	NA
								35.230	871.334	538.724	787.622	1.050.673	4.556.565
								715.932	779.493	1.226.760	1.352.035	1.550.252	1.818.64
								53.149	42.246	45.822	32.760	2.193	41.485
					24.150.206[2]	309.095	360.165	320.331	536.552	856.295	938.461	1.176.450	1.339.890
				1.779.068				1.129.761	3.972.350	1.560.389	1.605.015	1.575.047	1.616.213
								2.010.636	3.559.345	3.961.834	7.024.346	4.771.91	4.977.497
								7.667	18.473	5.930	24.737	21.362	24.765
				582				NA	8	178	NA	303	712
.694	8.256.912		11.507.601	15.169.394	16.695.452	16.428.219	17.454.174	16.495.073	24.061.141	30.646.661	32.454.970	33.623.537	3 702.449
				2.071				8.456	1.258	9.234	9.533	10.236	10.532
								NA	NA	3.356	4.674	11.534	.560
								4.768.404	8.631.010	6.159.131	9.066.812	7.243.010	6.719.264
								1.767.186	2.314.703	2.330.910	3.946.648	3.213.664	2.060.80
.502	27.233		27.121	30.501	39.480	50.643	69.055	4.627	36.161	72.456	197.699	65.361	214.808
				26.809				729.000	7.567.000	148.325	10.000	17.000	12.667.000
								38.801	52.034	15.320.569	131.510	63.000	73.450
								4.013	3.753	5.618	13.401	10.402	10.220
								14.724	48.922	19.344	27.203	62.098	62.804
								3.607.913	4.483.302	4.727.393	6.015.765	6.500.787	6.312.077
				88.859				1.258	27.282	10.465	6.917	5.385	6.780
				190				2.008	2.246	2.503	2.451	6.175	6.559
				5.055.632				549.396	934.069	1.220.066	1.044.727	945.496	1.561.735
								10.132.958	13.328.397	11.147.244	13.785.047	13.762.135	14.120.443
								3.071	28.936	31.698	93.711	[illegible]	69.027
				708.071				2.197.863	2.283.111	4.021.494	4.486.040	5.016.105	4.752.936
.935	89.232		44.495	123.364	95.206	114.135	172.555						
								116.168	212.188	343.072	301.285	330.692	347.669
								54.550	61.591	121.237	85.959	104.158	120.636
								68.263	24.359	28.731	30.607	40.710	54.735
				36.449				20.610	27.196	32.832	62.361	33.358	69.951
				NA				NA	NA	NA	NA	NA	NA
								62.037.611	6.551.397	4.057.625	15.441.740	115.561.170	49.278.845
				1.108.968				79.342	371.770	521.060	486.260	246.230	258.735
					19.183.569	19.805.422	24.269.171						

SECTION 2

	1967	1968	1969	1970	1971	1972	1973
			21.238				
						121.156	150.018
28.652	34.950		19.633		50.651	67.265	83.913
2.447	1.288.905						
.935	6.342.479		14.816.879				
.513	2.455.586		2.541.253		3.185.336	3.548.556	3.760.916
9.424	3.122.135		3.860.404		5.136.509	5.604.564	5.814.627
3.855	1.548.130						
6.384	1.313.740		1.111.467				
40.571	44.893		48.718		48.692	60.834	97.208
			764.970				
			461.764				
			525.218				
						614.366	677.493
						163.092	277.591

- PORTLAND CEMENT -

Basic raw materials for Portland Cement industry are lime and clay, both of which are found abundantly in Brazil. Portland cement can be made through two different manufacturing processes: dry process and wet process. The wet process, the first to be conceived, is much less used today, due to high needs of fuel oil. In Brazil, according to recent statistics, cement produced by in this way corresponds to less than 21% of the domestic output.

The dry process, widely used, has on the other hand, large advantages in fuel oil economies and so constitutes about 75% of the total production.

Even so, compared to other industrial sectors, the cement industry is highy demanding of oil; in total production costs, 40% to 70% are due to energy costs, and in the total Brazilian oil needs, Portland cement industry is responsibile for using 12% (1982 data).

Generally speaking, cement industry is highly capital intensive, since labor participation in the global production costs is, in both processes, less than 3.5%. This sector is extremely important for the building industry, where more than 90% of its production is used. This characteristic strongly ties its development to the building industry rhythm and consequently to government's policies on large civil works, transportation and housing. It is worth stressing the fact that more than 2/3 of the total cement production is used in projects directly or indirectly related to the public sector.

In 1980 Brazil occupied the ninth place in the world as cement producer. Brazilian cement output increased 161% in the 1971-1982 period, growing an average 9.1% yearly, much superior to the whole of the transformation industry in the same period.

More than half the companies in the sector were established in the last two decades and more than one third in the seventies.

In what refers to the sector being able to attend domestic needs the production has folowed, step by step, the evolution of demand, and, beginning in 1979, there was a small surplus quantity which was exported until 1981 when it ceased.

As to total production capacity, it is presently (1984) of about 35 million tons of clinker and 45 million tons of cement.

In 1982 the sector had 105 factories in operation, all of them belonging to large private groups, Brazilian and foreign, government participation being practically inexistent.

Three of these groups control more than half of the total installed capacity showing a very high degree of industrial as well as financial concentration.

CEMENT INDUSTRY - PRODUCTION CAPACITY

BRAZIL

1983 - 1984

(TONS)

PLANTS	CLÍNQUER		CEMENT	
	1983	1984	1983	1984
Monte Alegre/MG (1)	120 000	330 000	126 000	347 000
Monte Alegre/PA (1)	-	120 000	-	126 000
Fibrasa/PA	594 000	594 000	660 000	660 000
Itapicuru/MA	243 000	243 000	270 000	270 000
Nassau/CE	485 000	485 000	606 000	606 000
Sobral/CE	90 000	90 000	100 000	100 000
Itapetinga/RN	165 000	495 000	200 000	605 000
Cimeper/PB	363 000	363 000	469 000	469 000
Itapessoca/PE	415 000	415 000	500 000	500 000
Poty/PE	594 000	594 000	792 000	792 000
Votel/AL	264 000	594 000	272 000	612 000
Sergipe-Aracaju/SE	146 000	146 000	162 000	162 000
Sergipe-Laranjeiras/SE (1)	207 000	495 000	230 000	550 000
Aratu/BA	366 300	366 300	407 000	407 000
Cisalpa/BA	190 000	216 000	210 000	240 000
Salvador/BA	297 000	297 000	310 000	310 000
Itaú de Corumbá/MS	330 000	330 000	359 000	359 000
Goiás/GO	670 000	670 000	700 000	700 000
Pirineus/GO	297 000	297 000	330 000	330 000
Cimpor/DF	231 000	231 000	241 000	241 000
Tocantins/DF	350 000	525 000	364 000	547 000
Barroso/MG	1 200 000	1 200 000	1 250 000	1 250 000
CNCP - Matozinhos/MG	759 000	924 000	1 184 000	1 366 000
CNCP - Arcos/MG	120 000	120 000	148 000	148 000
Cauê - Pedro Leopoldo e Mesquita/MG (2)	900 000	1 350 000	1 674 000	2 163 000
Cimpas/MG	1 330 000	2 195 000	1 600 000	2 645 000
Itaú - Pratápolis/MG	655 000	1 100 000	720 000	1 210 000
Itaú - Contagem/MG	415 800	415 800	486 000	486 000
Matsulfur/MG	1 230 000	1 230 000	1 450 000	1 465 000
Ponte Alta/MG	150 000	165 000	156 000	172 000
Socicon/MG	1 320 000	1 320 000	1 535 000	1 535 000
Tupi - Carandaí/MG e Volta Redonda/RJ (2)	1 194 000	1 524 000	1 874 000	2 374 000
Itabira - Cachoeiro do Ipapemirim/ES	877 800	877 800	1 095 000	1 526 000
Alvorada/RJ	440 000	440 000	460 000	460 000
Mauá - São Gonçalo/RJ	400 000	400 000	440 000	440 000
Mauá - Cantagalo/RJ	726 000	825 000	896 000	1 018 000
Paraíso/RJ	240 000	270 000	250 000	590 000
Irajá/RJ	232 500	232 500	285 000	285 000
Rio Negro - Cantagalo/RJ e Volta Redonda/RJ (2)	1 039 500	1 039 500	1 849 000	1 849 000
Votorantim - Votorantim/SP e Jaguaré/SP (2)	2 409 000	2 458 500	3 011 000	3 073 000
Camargo Corrêa/SP	907 500	907 500	997 000	997 000
Ipanema/SP	105 000	105 000	126 000	126 000
Maringá/SP	287 100	287 100	302 200	308 700
Perus/SP	106 000	330 000	110 000	345 000
Itabira - Capão Bonito/SP	924 000	924 000	1 015 000	1 015 000
Santa Rita - Itapevi/SP e Cubatão/SP (2)	881 000	881 000	1 361 000	1 361 000
Santa Rita - Salto de Pirapora/SP	660 000	660 000	815 000	815 000
Serrana/SP	720 000	720 000	1 015 000	1 015 000
Itaú/PR	413 000	413 000	490 000	584 000
Itaú do Paraná/PR	660 000	660 000	880 000	880 000
Rio Branco/PR	1 600 500	2 425 500	2 320 000	3 515 000
Catarinense/SC	200 000	200 000	290 000	290 000
Gaúcho - Pinheiro Machado/RS e Esteio/RS (2)	430 000	430 000	623 000	623 000
Bagé/RS	139 000	139 000	210 000	210 000
TOTAL	30 089 000	35 065 500	38 225 200	45 072 700

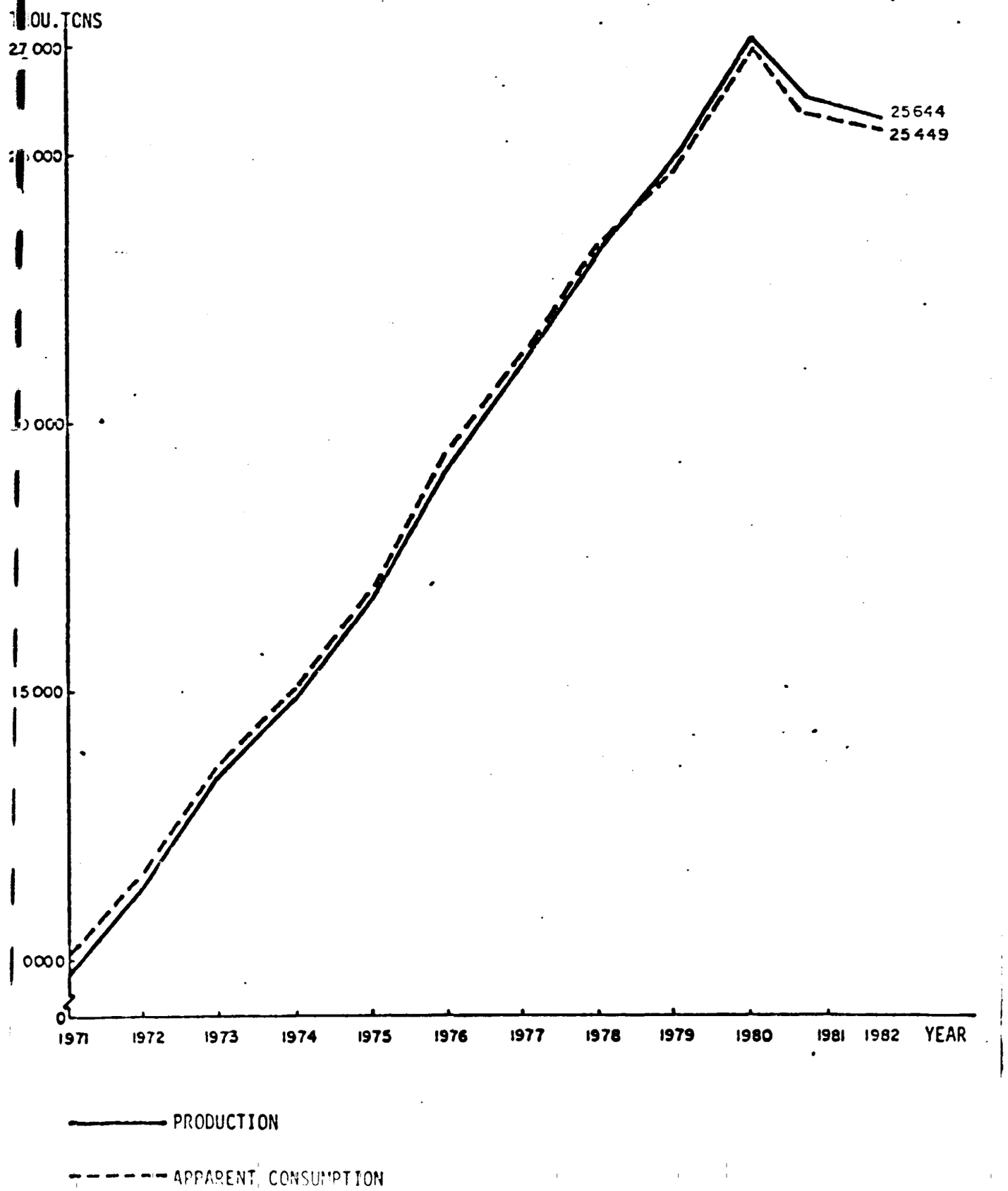
Source: Sindicato Nacional da Indústria do Cimento.

(1) PLANT UNDER CONSTRUCTION

(2) GRINDING UNIT

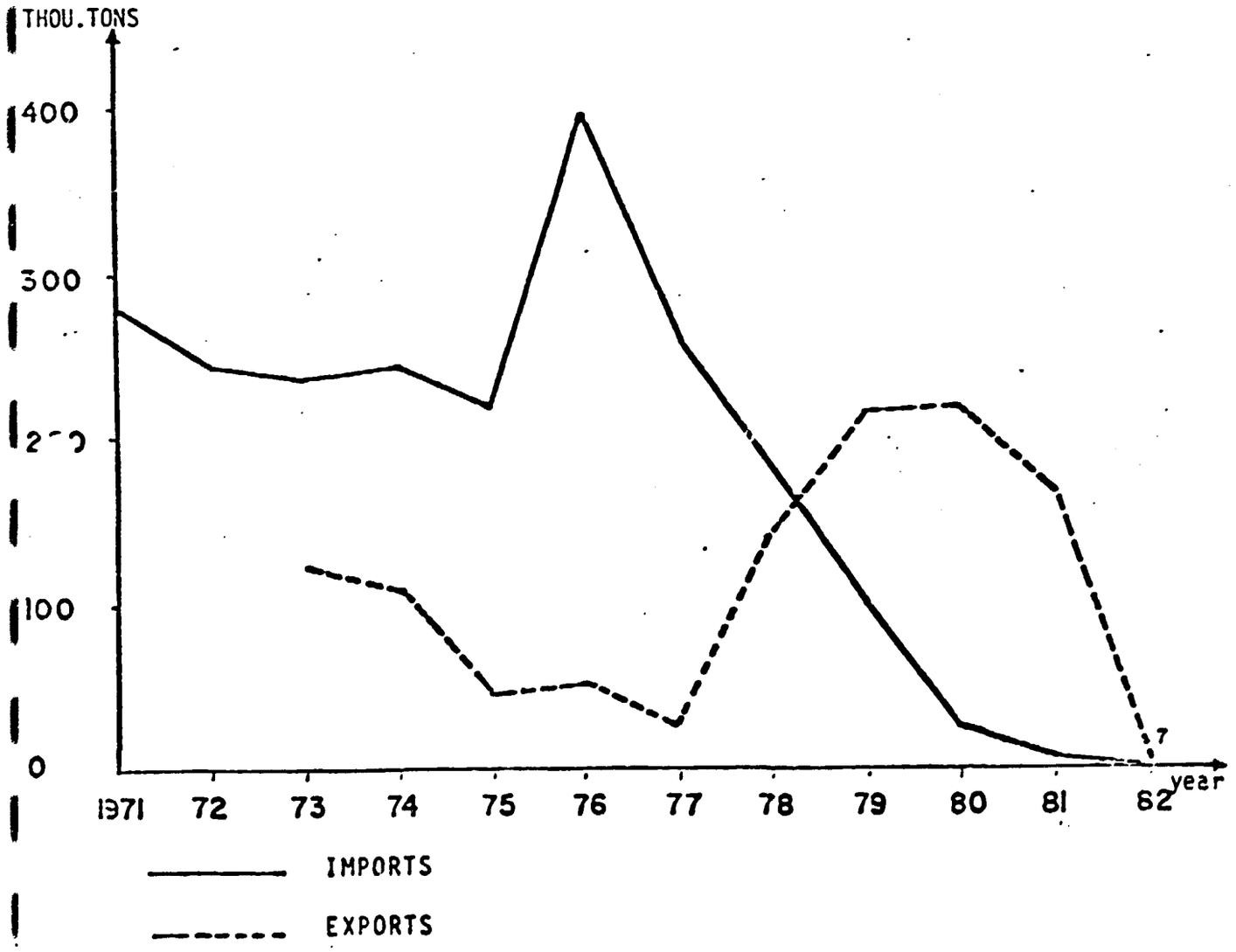
BRAZIL - PRODUCTION AND APPARENT CONSUMPTION OF CEMENT

1971 - 1982

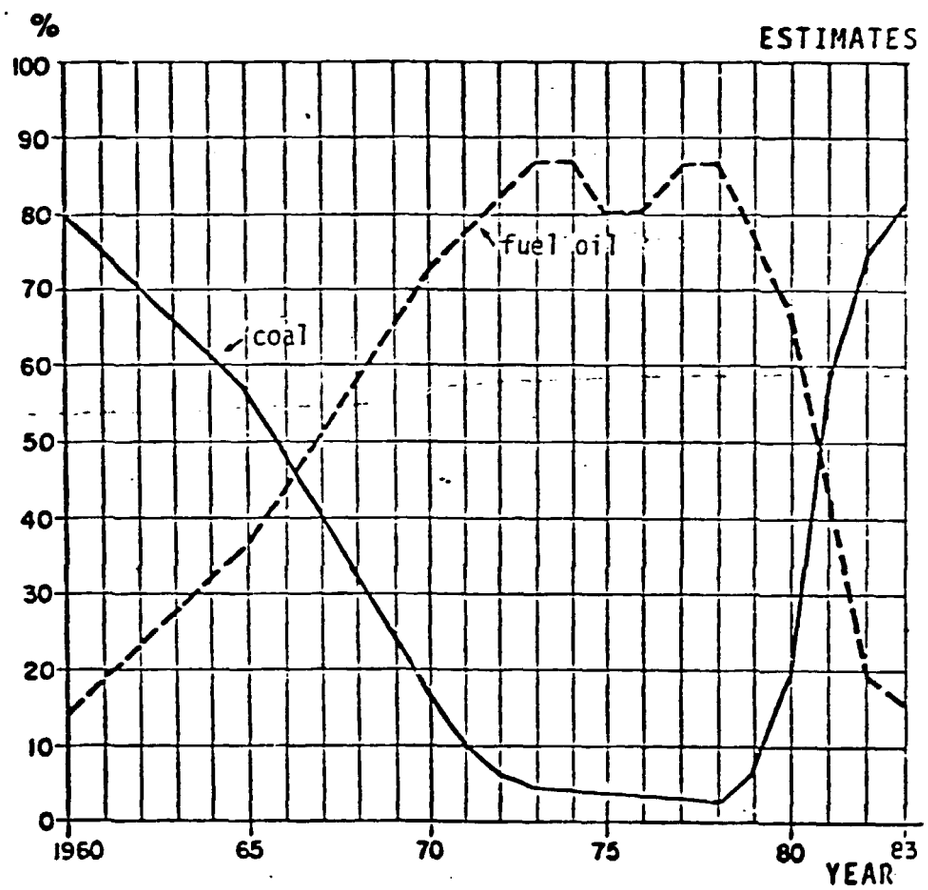


BRAZIL - IMPORTS AND EXPORTS OF CEMENT

1971-1982



EVOLUTION OF THE RELATIVE PERCENTAGE OF
THE ENERGY SOURCE USED IN CEMENT PLANTS
1960 - 1983



SOURCE: Loforge Consultoria e Estudos - Perspectivas da Indústria Cimenteira na Presente Década, MIC/CDI, CNICC, STI, ABCP, Jan. 1982, p. 17.

ALUMINUM

Building industry is the largest demanding sector of the domestic aluminum market, and has used in the last two years about 23% of the total production. This participation will probably be kept, despite the decrease in the building industry's activities.

Aluminum is employed in building in a multitude of ways; window and door frames, partitions, roofing and structural elements. The material is mainly used as extruded profiles (about 70%), destined to frames; laminated aluminum, although with a smaller share, is being more and more used in roofing and ceiling systems.

Even so, compared to developed countries, the consumption of this material in Brazil can be considered low. While in Europe there is a utilization of about 20 kg per capita per year and in the United States this number reaches 30 kg, in Brazil we have 2,5 kg per capita per year.

Brazil presents extremely favorable conditions for the production of primary aluminum, due to the very high bauxite reserves and the abundance of electrical energy, of extreme importance in aluminum production.

In market terms, the beginning of aluminum production dates from the fifties, when two companies, one of them foreign owned, started operation. Until the sixties, those two companies shared the market. In 1972 another foreign company established itself in Brazil and today the total production capacity is about 278 thousand tons per year. A new plant already in construction and the ampliation of one the already existing operations will raise this figure to 400 thousand tons per year in 1985.

BRAZILIAN ALUMINUM MARKET

BRAZIL
1970 - 82
(Thou.Tons)

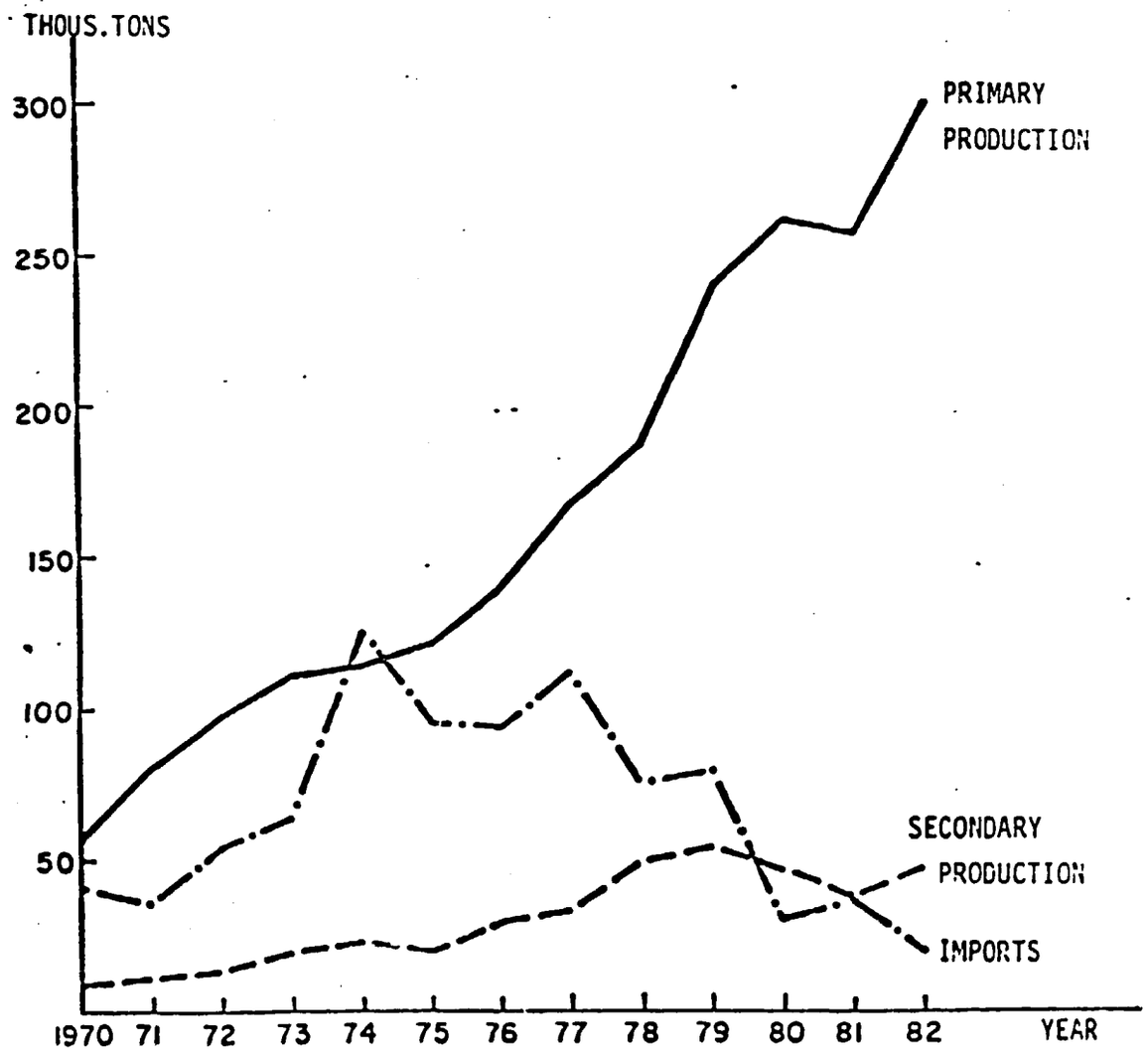
YEAR	PRIMARY PRODUCTION	SECONDARY PRODUCTION	IMPORTS	TOTAL SUPPLY
1970	56.1	8.0	40.5	104.6
1971	80.6	10.5	36.5	126.6
1972	97.7	13.0	53.3	164.0
1973	111.7	18,5	64.1	194.3
1974	113.6	22.4	125.8	261.8
1975	121.4	20.6	94.4	236.4
1976	138.9	28.0	93.5	260.4
1977	167.2	33.5	112.1	312.8
1978	186.4	49.2	75.2	310.8
1979	238.1	53.8	79.1	371.0
1980	260.6	46.1	30.3	337.0
1981	256.3	37.3	36.9	330.5
1982	299.0	47.2	18.8	365.0

SOURCES: ABAL, Anuário Estatístico (1981) e Relatório Anual do CDI (1982).

BRAZILIAN ALUMINUM MARKET

BRAZIL

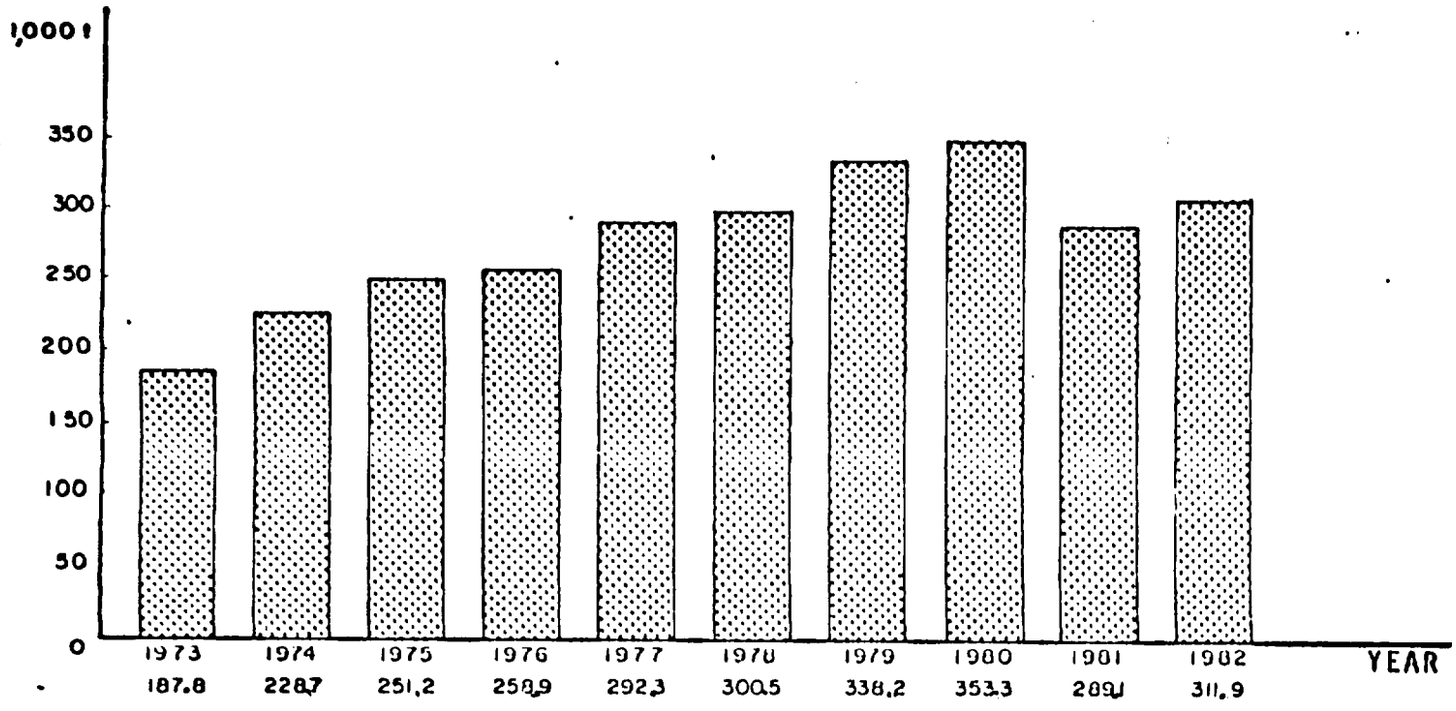
1970 — 1982



SOURCE: ABAL, ANUÁRIO ESTATÍSTICO (1981) E RELATÓRIO ANUAL DO CDI (1982)

EVOLUTION OF DOMESTIC DEMAND - TOTAL ALUMINUM MARKET

BRASIL
1973-1982



SOURCE: ABAL - Associação Brasileira de Alumínio.

- CERAMIC GLAZED TILES -

This material is widely used in houses, (kitchens, bathrooms, laundry areas) and also in swimming pools, restaurants, hospitals, always in locations which demand high standards of cleanliness, since it is extremely resistant to water and cleaning materials.

The tiles are the result of the industrial processing of a mix which main components are common clay, kaolin and feldspar.

They can come in a variety of colors and can also be printed.

The main characteristics of this industry in Brazil (mainly medium size and large companies) are its strong dependence on the building industry and the considerable concentration of supply and demand.

The eighteen Brazilian factories, belonging to twelve groups, have a total production capacity of about eighty and a half million square meters a year.

Supply is mainly concentrated in the South (47.8%) and Southeast (28.6%). One third of the total output is concentrated in the State of Santa Catarina.

On the demand side, more than two thirds lie in the states of São Paulo and Rio de Janeiro. It is also worth mentioning that almost half of the total supply is in the hands of only three companies, indicating a high financial concentration in this sector.

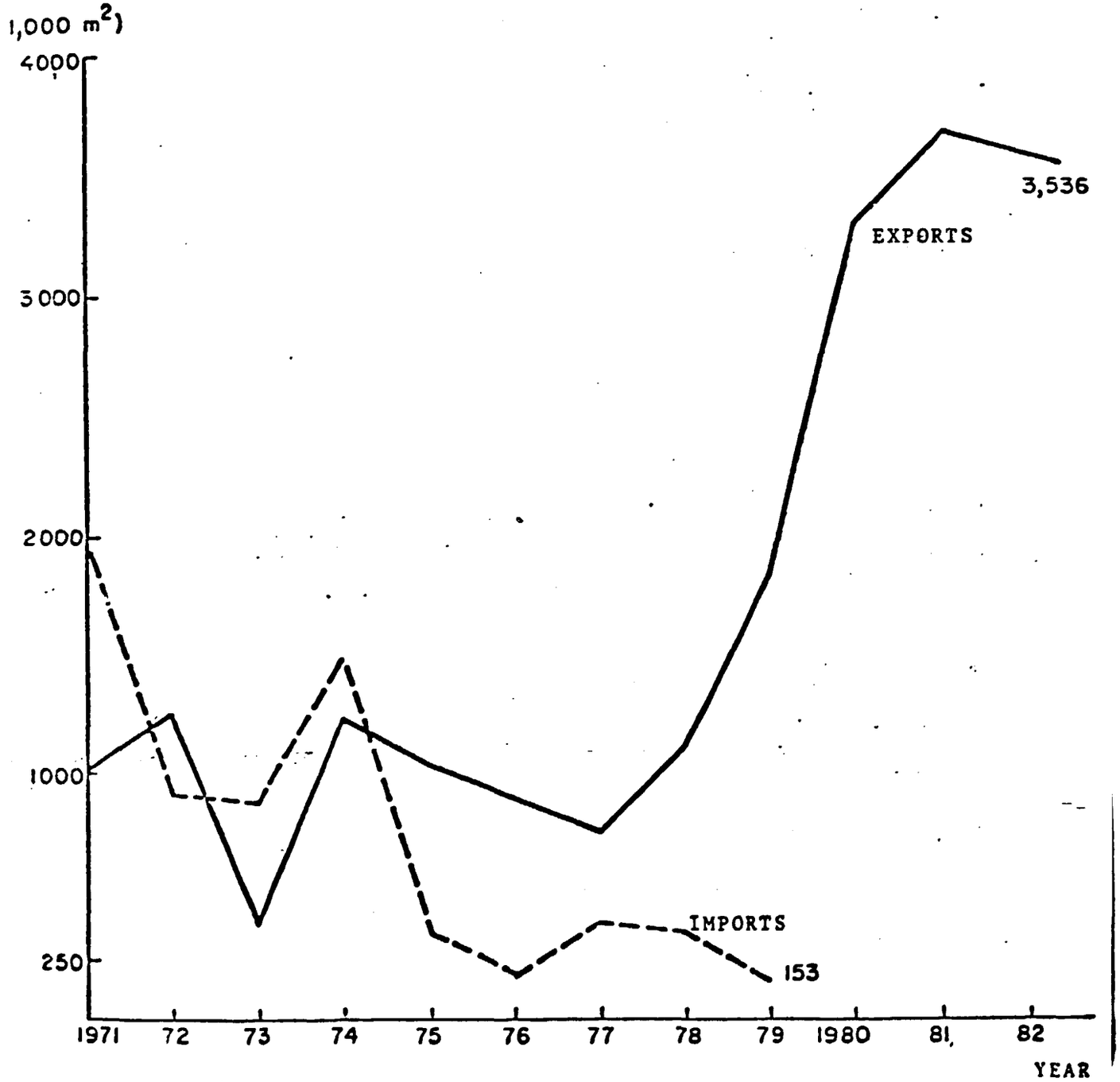
Production figures show that the sector experienced until 1977 high growth indexes, having more than doubled its total output capacity as compared to the beginning of the decade. From 1977 on there was a steep decrease, and in 1982 total output figures fell down 13.5% as related to 1981. Due to the smaller demand, excess production capacity lies now around 35%.

Imports of this material, already insignificant in 1975, were practically zero in 1979. Exports, on the other side, due both to the expansion of the sector and the retraction of the domestic market show a rising tendency, representing, in 1982, about 6% of the total. The exported volume however, is not enough to compensate for the difficulties faced in the internal market. Efforts to increase exports have not succeeded mainly because of economic recession affecting the main importing countries (Argentina, for instance) and competition of traditional exporting countries, such as Italy. There are also technical drawbacks (tiles' dimensions, for instance) and esthetical resistance to colors and print patterns in the U.S. and Canada, potential importing countries.

IMPORTS AND EXPORTS OF GLAZED TILES

BRAZIL

1971 - 1982



BRAZILIAN MARKET OF GLAZED TILES

BRAZIL

1971 - 1982

(1,000 m^2)

YEAR	PRODUCTION	YEARLY GROWTH RATE %	IMPORTS	EXPORTS	APPARENT CONSUMPTION
1971	24 442	-	1 986	1 040	25 734
1972	30 437	22.8	909	1 289	30 057
1973	35 147	15.5	891	408	35 630
1974	38 540	9.7	1 506	1 243	38 803
1975	43 271	12.3	365	1 045	42 591
1976	48 053	11.1	191	914	47 330
1977	55 076	14.6	382	775	54 683
1978	60 230	9.4	365	1 120	59 475
1979	63 844	6.0	153	1 855	62 142
1980	68 816	7.8	-	(1) 3 276	65 450
1981	70 770	2,8	-	3 648	60 610
1982	61 500	(13.1)	-	3 536	57 594

SOURCE : Associação Nacional dos Fabricantes de Azulejos - ANFA.

- PLANE GLASS -

Building industry is responsible for the demand of 60% of the total production of smooth glasses; the 40% left are destined to the automotive industry.

This demand concentration in only two sectors makes the glass industry extremely vulnerable to demand oscilations in those sectors. This situation is demonstrated by the sales decrease in the domestic market of about 20% in 1981, due mainly to the simultaneous activity decrease in the building and automotive companies.

Plane glass is made in Brazil by only four companies, all in São Paulo and with a total production capacity of 1540 tons/day. The three most important organizations are foreign owned.

In the production of plane glass more than thirty components are used, among which feldspar, aluminum, iron and soda ash. Part of the soda ash is still imported from East Europe but a new factory being built in the Northeast will be able to replace these imports.

SECTORS AND PRODUCTION CAPACITY GLASS INDUSTRY

BRAZIL - 1982

SECTOR	COMPANY	FACTORY LOCALIZATION	CAPACITY Tons/Day	NUMBER of EMPLOYEES	ECONOMIC GROUP
BOTTLES AND RECIPIENTS	Cisper	RJ, SP, RS	1 500	3 300	Owens-Illinois
	Santa Marina	SP, RS	550	(1) 5 800	Saint-Gobain
	CIV	PE, CE, BA	520	1 200	Irmmand
	Wheaton	SP	350	2 500	Wheaton
	Nadir Figueiredo	SP, MG	260	2 200	Nadir Figueiredo
	Inovisa	PE	230	425	Rocha e Pitu
	Anchieta	SP	(e) 40	200	Ricardi
PLANE GLASS	CEBRACE	SP	650	500	Saint-Gobain
	Santa Marina	SP	470	...	Saint-Gobain
	Providro	SP	300	(e) 600	Pilkingtons
	UBV	SP	120	...	F. Simões
GLASS FOR LAMPS	General Elétric	RJ, PE	80	1 000	General Elétric
	GTE-Sylvania	SP	40	200	GTE-Sylvania
	Philips	SP	30	(e) 500	Philips
	Sadokin	PE	15	(e) 100	Osram
GLASS FOR CINESCOPES	IBRAPE	SP	125	(e) 700	Philips
	Vidros Corning	SP	100	(2) 800	Corning Glass/ Works
TABLE GLASS	Santa Marina	SP	110	...	Saint-Gobain
	Brasividro	RJ	55	1 200	Nadir Figueiredo
GLASS FIBER	Santa Marina	SP	60	...	Saint-Gobain
	OCFIBRAS	SP	40	500	Owens Corning
	EUCATEX	SP	...	...	EUCATEX
GLASS FOR DRUGS	Vitro Farma	RJ	40	(e) 1 000	Jenaer Glaswerk/ Schott
OPTICAL GLASS	Vidros Corning	SP	4	...	Corning Glass/ Works
GLASS FOR INSULATORS	Electro Vidro	RJ	70	(e) 500	Saint-Gobain
GLASS FOR THERMAL BOTTLES	M. Agostini	RJ	16	600	M. Agostini

- STEEL -

Brazil ranks 12th among world steel producers, due to the high growth indexes of the last decade. As a whole, Brazilian siderurgy grew, in the seventies, 180%, raising the production of raw steel from 4925 thousand tons in 1969 to 13891 thousand tons in 1979. More recently, however this sector is facing a sharp decrease in its growth, and in 1981 and 1982, negative figures, following, therefore Brazilian economical recession.

In general, Brazil is self-sufficient in laminated steel production, although in some periods it had to import high quantities of the material to meet domestic demand.

Due to the strong decrease in the internal market, this sector has been pursuing an agressive exporting policy, with the result that in 1982 the total of exports of laminated steel represented 19.3% of the total output. However even this good performance did not compensate for the fall in domestic demand and considering that the total production capacity of the sector is 20 milion tons/year, one can estimate excess production capacity as nearly 35%.

The building sector uses steel as one of its main intermediate materials and is surely the main consumer, with 28.4% of the total. This figure will probably remain the same until 1985 at least.

Even if the building industry is the main buyer of steel in Brazil, this participation is, in worldly terms, very low. In Japan, for instance, more than 50% of the total steel produced is destined to the building industry. This small share is explained by the fact that in Brazil reinforced concrete predominates in building technology as compared to steel construction.

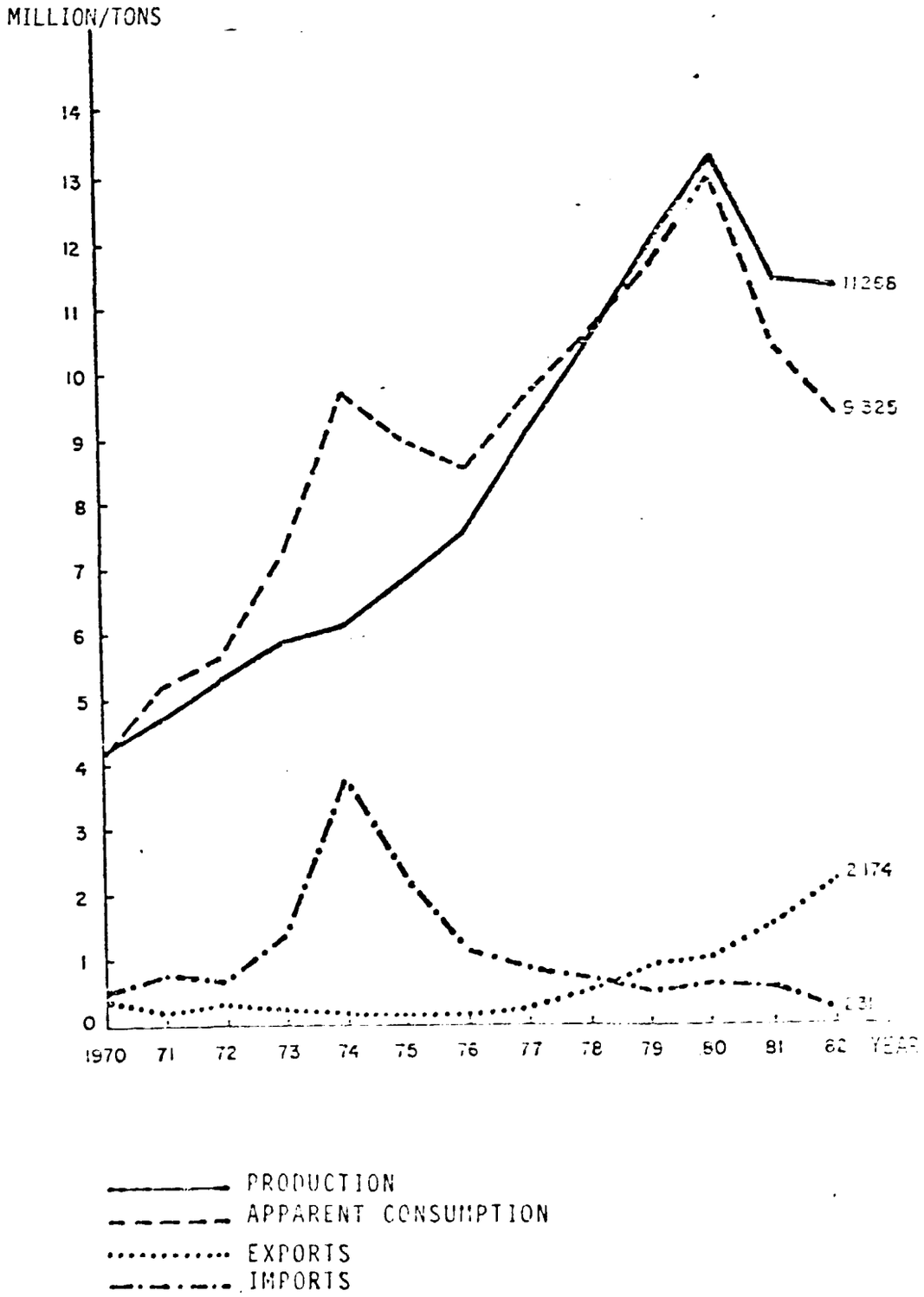
Makers of laminated steel comprise 32 companies, with predominance of the private sector, either domestic or foreign.

BRAZILIAN STEEL MARKET
1970 - 1982
(TH.TONS)

YEAR	RAW STEEL PRODUCTION		LAMINATED STEEL		APPARENT CONSUMPTION OF LAMINATED STEEL		LAMINATED STEEL EXPORTS		LAMINATED STEEL IMPORTS	
	QTY.	INDEX	QTY.	INDEX	QTY.	INDEX	QTY.	INDEX	QTY.	INDEX
1970	5 390	109,4	4 150	106,3	4 108	107,5	382	176,8	496	151,2
1971	6 011	122,0	4 725	121,0	5 171	135,3	172	79,6	789	240,5
1972	6 518	132,3	5 333	136,5	5 670	148,4	347	160,6	684	208,5
1973	7 149	145,1	5 988	153,3	7 171	187,7	258	119,4	1 441	439,3
1974	7 507	152,4	6 101	156,2	9 786	256,1	143	66,2	3 795	1 157,0
1975	8 308	168,7	6 795	174,0	8 989	235,3	125	57,9	2 319	707,0
1976	9 169	186,2	7 541	193,1	8 487	222,1	141	65,3	1 086	331,1
1977	11 164	226,7	8 998	230,4	9 648	252,5	222	102,3	872	265,8
1978	12 106	245,8	10 405	266,4	10 570	276,6	538	249,1	703	214,3
1979	13 891	282,0	11 917	305,1	11 577	302,1	866	400,1	526	160,4
1980	15 338	311,4	13 306	340,7	12 922	338,2	1 006	465,7	622	189,6
1981	13 230	268,6	11 345	290,5	10 428	272,9	1 498	693,5	581	177,1
1982	12 996	263,8	11 268	288,6	9 325	244,0	2 174	1 006,5	231	70,4

BRAZILIAN MARKET OF LAMINATED STEEL

1970 - 1982



- WOOD -

Wood industry is intimately related to building industry, and more particularly with housing. This market uses mainly three kinds of wood: pine, comprising nearly half of the supply; "pinus" (reforesting wood) with about 20%; and other woods (Canela, Cambará) with 30%.

Brazil has extensive areas covered by forests. A survey made in 1973 shows that almost all of the dense ones are in the North and Center-West, with respectively 82.5% and 9.3% of the total. However, although most of the resources are in those regions the wood industry is almost totally concentrated in the South and Southeast, near to the main domestic markets. In 1979 both regions produced 98.4% of the total output of industrialized wood. Brazilian wood production reached its peak in 1973, following the economic boom. The number of saw mills grew from 14812 in 1970 to 17907 in 1975. In the year 1973 production of (wood in logs) reached 36.6 million m^3 to fall, in 1979, to 31.5 million m^3.

Exports of wood also reached their peak in 1973: 899 thousand tons in 1971, 1,124 thousand tons in 1973, falling drastically in the next two years. After this period though, exports showed a strong tendency to recovery and in 1980 the figures were 871,961 thousand tons.

The market structure: in 1980 15.058 firms shared the market, being 145 of large size, 994 medium and small size and 13.919 very small, representing therefore 92.4% of the total number of producers. This of course characterizes an extreme dispersion of this industry's productive structure.

The presence of either large companies and foreign owned firms is not significant: In 1979, 93.3% of the companies in the market were Brazilian and private-owned. It must also be stressed that this industrial sector has the lowest productivity and the smallest average wages in all industry.

RESEARCH ACTIVITIES

Main Institutions

There are in Brazil several important research institutions dealing with building materials, some of them very old, since this area is traditionally the first one to be approached.

Most of these organizations were created formerly as laboratories belonging to universities and afterwards became independent from tham as the demand for their services made it necessary a larger degree of autonomy, both administrative and technical.

All of them depend on large part for their existence on selling services and obtaining research grants from private and governmental enterprises, with a small percentage of funds being allocated as subsidy for overhead, documentation, and for funding projects not immediately interesting to clients but which are recognized as important for the field.

Cooperation among the institutions has been until recently, not very intense, due, among several factors, to geographical separation, regional biases and competition for the same federal funds. Recently however the Brazilian Association of Industrial Research Institutions was created, aiming to minimize these differences and at the same time to help establishing a common technical competence. Brazil is also beginning to set up a Certification of Conformity system for industrial products and it is of course evident the necessity of a national network of laboratories to the success of this system.

On Going Programmes

The main line of research programmes has been, as a rule, looking for cheaper materials and building techniques, as well as the use of local materials and labor. This line however has several drawbacks in that industry in general does not take an interest in it, since from their point of view, very few of them allow for industrial economies of scale. This is the case for instance, of studies dealing with the use of rice husk ash and lime as a pozzolamic cement; soil cement in masonry applications as bricks, blocks and also as monolithic walls; plasters made with gypsum resulting from the production of phosporic acid.

On a more industrial basis, several research projects dealing with replacement of asbestos in asbestos-cement products are under way, including technologies for manufacturing alkali resistant glass fibers.

In the same basis, reforestation woods, particularly "Pinus spp" are currently being used experimentally in the construction of low cost houses in the South of Brazil.

RESEARCH ACTIVITIES IN LATIN AMERICA

With the exception of Mexico, Brazil and Argentina, which have established important building and construction industries of their own, Latin American countries depend very much on imports of building materials and technologies. This dependence leads also to a weak position in terms of research in the field, since innovation comes normally in the same way.

There are however some remarkable activities, mainly related to the use of indigenous materials and taking into account local conditions of climate and labor qualification.

Worth mentioning is the Andean Pact project PADT-REFORT, in Peru, which concerns the introduction of tropical wood as a building material; included in this project are personnel training lab equipment, editing of publications in timber engeneering.

Undoubtedly one of the main problems which affect research in this field in Latin America is the almost complete lack of information about what each organization is doing.

The establishment of an effective information system for researchers in Latin America must therefore be considered as a primary goal in what regards policies for the advancement of in knowledge in the building materials' field.

Due regard to local conditions of climate, manpower and raw materials must be paid in every research project; it is widely known that many costly mistakes could be avoided, specially in low cost housing, if these factors had been respected.

LATIN AMERICAN ORGANIZATIONS ACTIVE IN BUILDING MATERIALS RESEARCH

ARGENTINA

- Dirección Nacional de Investigación y Desarrollo Tecnologico , Habitacional y Urbano.
  Secretaria de Estado de Desarrollo, Urbano y Vivienda
  Defensa 120, Piso 3º, Oficina nº 3841, Buenos Aires, Capital Federal.

- Instituto del Cemento Portland Argentino
  Calle San Martin 1137, Buenos Aires

- Instituto Nacional de Tecnologia Industrial - INTI
  Leandro N. Alem, 1067 . 5º-7º
  1001 - Buenos Aires

- Programa Nacional de Tecnologia de La Vivienda - PNTV
  Córdoba 831 - 6º
  1054 - Buenos Aires

- Universidad de Buenos Aires, Faculdad de Ingenieria
  Casilla de Correo 4564, Buenos Aires

- Universidad Nacional del Nordeste - Faculdad de Ingeniería
  Avenida Las Heras 727, 3500 Resistencia (Chaco)

BRASIL

- Centro de Pesquisas e Desenvolvimento - CEPED
  Km 0 - Rodovia Bahia 535 - Centro Industrial
  48.240 - Camaçari - BA.

- Centro Tecnológico de Minas Gerais - CETEC
  Av. José Cândido da Silveira, 2000
  30.000 - Belo Horizonte - MG.

- Confederação Nacional da Indústria - Departamento de Edificação Civil - [illegible]
  Rua Mariz de Barros, 13 - 3º andar
  Rio de Janeiro - 20270

- Fundação Instituto de Tecnologia do Estado de Pernambuco - ITEPE
  Av. Conde de Boa Vista, 426 - Recife
  Caixa Postal 756 - Telex (081) 2291 - Fone 231.10.48

- Fundação Núcleo de Tecnologia Industrial - NUTEC
  Rua Monsenhor Otavio de Castro, 21
  60.000 - Fortaleza - CE.

- Instituto Nacional de Tecnologia - INT
  Av. Venezuela, 82 - 4º andar - Rio de Janeiro
  Cais do Porto - CEP: 20081
  Caixa Postal 21019 - fone (021) 243.80.70 - 243.14.28

- Instituto de Pesquisas Tecnológicas do Estado de São Paulo - IPT
  Divisão de Edificações - DEd
  Cidade Universitária - Caixa Postal 7141 - CEP: 01000

CHILE

- Habitat Ltda
  2 Norte 851
  Viña del Mar , Chile

- Instituto de Investigaciones y Ensayos de Materiales - IDIEM
  Universidad de Chile - Santiago
  Chile - Casilla 1420

- Servicio Latinoamericano y Antártico de Vivienda y Urbanismo - SELAVIP
  Casilla 871, Santiago - Chile

COLOMBIA

- Instituto Colombiano de Productores de Cemento - ICPC
  PO Box 52816 - Medellín
  Carrera 6a No 26 - 85 piso 7º
  Bogota

CUBA

- Centro Tecnico de la Construcción y los Materiales
  Apartado 6180
  La Habana

ECUADOR

- Instituto de Investigaciones Tecnologicas (IIT)
  Escuela Nacional Politecnica
  PO Box 27 - 59
  Quito - Equador

GUATEMALA

- Centro de Investigaciones de Ingeniería
  Universidad de San Carlos
  Cindad Universitaria, Zona 12
  Guatemala

MÉXICO

- Universidad Autónoma Metropolitana Azcapotzalco, Departamento de Materiales, División de Ciencias Básicas e Ingeniería - UAM Azcapotzalco
  Ave San Pablo s/nº, Apdo Postal 16 - 306, Mexico 16, DF.

PARAGUAI

- Instituto Paraguayo del Cemento
  Humaitã, 357 - 5º piso
  Casilla 384
  Asuncion - Paraguay

URUGUAI

- Camara de la Construcción del Uruguai
  Colonia, 1460
  Montevideo - Uruguay

- Instituto Técnico de Desarrolo Integrado - INTEC
  Minas, 1577
  Montevideo - Uruguay

VENEZUELA

- Asociacion Venezolana de Productores de Cementos
  Av. San Juan Bosco - Ed. Panavem - 4º piso - Alcamira
  Apartado 6495
  Caracas 106 - Venezuela

- Fundaconstrucción
  3ra Av con 6ta Transversal, Qta Panorama, Urb Los Palos Grandes,
  Apartado Postal nº 51641, Caracas 105

- Instituto Nacional de la Vivienda - INAVI
  Centro de Investigación
  Edificio Cruz Verde - Esquina Cruz Verde
  Caracas 101

- Universidad Central de Venezuela
  Instituto de Materiales y Modelos Estructurales - IMME
  Apartado 50361 - Sabana Grande 105, Caracas.