These indicators of shifts during the past ten years may indicate certain strategic characteristics of the region, and can be summarized below:

(a) The region of Gran Puntarenas, which is essentially urban, has expanded relatively its urban population.

(b) Whether such increase in urban population was due to migration from the rural area within the region or from other regions is not known. In terms of absolute change, the decrease in rural population was (S =) -14,005 and increase in urban population was (S =) 5,587.
At least, therefore, a considerable number of rural population of the region must have moved to the cities.

(c) Although the number of farms has decreased, this number was not as large as the population decrease.
Whether this indicates, together with a lesser decrease in farm area, an increase in the size of the remaining farms is not ascertainable.

Unfortunately, no reliable data on income by occupation for this region were available. Instead, a rough conjecture may be made on the basis of national figures. In 1973 per caput G.D.P. for the economically active population was 17,362 colons, and that of agriculture was 9,205 colons, which was the lowest among all other economic sectors. It could have been, therefore, that the rural population in the region was fortunate enough to change its activities to other more remunerative activities. (See Table 3.12. Economically Active Population by Industry and Per Caput G.D.P.)

3.3.3 Structural Characteristics of Agricultural Production in the Region

The relative position of the region's agriculture has declined as compared to the national agriculture over the last 10 years. Economic and structural characteristics of agriculture in the region in terms of production and some other aspects are now to be examined. It is hoped that this analysis will lead to a strategy for future development of the region.

Nearly all kinds of crops and livestock which are produced in the country are also produced in this region. These crops and livestock produced in the region have also undergone changes over the period and have adopted themselves to changes in economic and social conditions. Both some changes over time in climate and other changes of both policy and natural character have also influenced the shift of production characteristics in this region.

Table 3.13 Population, 1963

Pacifico Central

	Total	Urban	Rural
Costa Rica	1,336,274	460,543	875,731
San Jose	487,658	269,900	217,758
Turrubares	5,496	105	5,391
Alajuela	240,672	44,065	196,607
San Mateo	3,388	403	2,285
Orotina	7,093	1,749	5,344
Puntarenas	156,508	34,038	122,470
Central	55,592	19,582	36,010
Montes de Oro	6,616	1,122	5,494
Esparta	9,175	2,860	6,315
Parrita	6,877	-	6,877
Aguirre	13,065	1,858	11,207
Total of the Region	107,302	27,679	79,623
% over C.R.	8.0	6.0	9.1

Population, 1973

Pacifico Central

	Total	Urban	Rural	Total Surface Km^2	Used Land Area Km^2
Costa Rica	1,871,780	760,079	1,111,701	50,900	31,225
San Jose	695,163	428,041	267,122		
Turrubares	4,709	212	4,497	413	222
Alajuela	326,032	80,973	245,059		
San Mateo	2,969	489	2,480	135	126
Orotina	8,479	3,170	5,309	130	427
Puntarenas	218,208	45,557	172,651		
Central	65,562	26,331	39,231	2,146	1,677
Montes de Oro	6,979	1,673	5,306	177	238
Esparta	12,095	4,699	7,396	277	163
Parrita	11,901	1,365	10,536	969	785
Aguirre	14,473	2,155	12,318		
Total of the Region	127,167	40,094	87,073	4,197	3,638
% over C.R.	6.8	5.3	7.8	8.2	11.7
S	-23,136	5,587	-14,005		
Y	-0.22	0.20	-0.18		
Increase in 1973 over 1963 compound annual-rate of Increase	1.40	1.65	1.27		
	-3.4%/year				

Table 3.14 Economically Active Population by Industry and Per Caput G.D.P.

	Total	Agriculture, Hunting Forestry, Fishing	Mining, Quarrying	Manufacturing Industry	Electricity, Gas, Waters	Const-ruction	Commerce, Restaurants, Hotels	Transport Warehousing etc.	Financing	Private and Public Commmunal Service	Others
		1	2	3	4	5	6	7	8	9	0
Costa Rica	585,313	213,226	1,557	39,099	5,531	39,078	67,675	24,964	13,673	118,973	30,719
GDP (million ¢)	10,162.4	1,962.9	1,903.3		160.3	507.1	2,054.5	435.6	508.5	1,692.5	626.5
Per caput GDP (¢)	17,362.3	9,205.7	46,814.7		28,982.1	12,976.6	30,358.3	17,449.1	37,190.1	14,225.9	20,394.5
San Jose	229,045	39,951	394	15,501	2,605	17,050	36,737	10,016	9,148	63,421	10,624
Turrubares	1,339	1,096	1	11	-	28	34	12	-	104	53
Alajuela	96,987	47,812	133	9,482	601	5,507	8,248	3,491	955	15,358	5,400
San Mateo	908	563	7	31	11	50	54	29	2	120	41
Orotina	2,157	841	-	130	9	109	257	283	27	365	136
Puntarenas	64,791	38,458	266	3,711	254	2,807	5,213	2,583	802	7,383	3,314
Central	20,212	8,160	138	2,024	112	1,166	2,358	1,659	568	2,957	1,070
Montes de Oro	1,882	1,085	21	193	6	94	128	57	10	252	36
Esparta	3,477	1,257	45	482	13	254	444	156	32	592	202
Parrita											
Aguirre	4,193	2,738	-	164	26	184	256	91	25	519	190
Total of Pacifico Central Region	34,168	15,740	212	3,035	177	1,885	3,531	2,287	664	4,909	1,728
% over C.R.	5.8	7.4	13.6	4.3	3.2	4.8	5.2	9.2	4.9	4.1	5.6

Table 3.15 Relative Shift for the Region 2, by Commodity 1963 to 1973

	Number of Farms	Total Area Harvested	Total Production	Costa Rican Production 1973/1963	Annual Labor Requirement man/ha
Rice	-0.26	0.29	2.86	2.60	0.0304
Maize	-0.24	-0.29	-0.21	1.80	0.1357
Beans	-0.19	-0.12	-0.31	0.69	0.1214
Potatoes	1.24	4.05	-0.48	1.24	
Bananas	-0.15	-1.09	-0.02	0.02	0.7357
Plantains	-0.26	-0.51	-0.004	0.006	
Pineapple	-0.07	0.50	0.12	0.19	
Oranges	-0.13	-0.81	-0.05	0.23	
Coffee	-0.58	-0.30	-0.63	1.90	0.5536
Cacao	-0.42	-0.53	-0.29	0.29	
Sugarcane	-0.24	-0.27	-0.68	1.91	
Cattle	-0.16	-0.08	-0.11	0.72	
Hogs	-0.14		-0.29	1.48	
Tractors	-0.15		0.19	1.22	

Table 3.15 indicates essential characteristics of agricultural production in the region.

More detailed analyses will be made by commodity for smaller districts and possible directions for public policy may be identified. (See series of Table 3.17)

According to OFIPLAN, the Pacifico Central Region is considered fit for cultivation of such products which require relatively less labor per hectare. Such products are the following:

Table 3.16 Products Fit to Pacifico Central

	Annual Labor Requirement per Hectare	Fit to Pacifico Central Region: o	Relative Shift 63-73
Coffee	0.5536	x	-0.63
Rice	0.0304	o	+2.86
Beans	0.1214	o	-0.31
Maize	0.1357	o	-0.21
Sorghum	0.2714	o	
Bananas	0.7357	x	-0.02*
Plantain	0.4464	x	
Oil Palm	0.2429	o	-0.004
Coconuts	0.1536	x	
Cacao	0.1750	x	-0.29
Others	0.8293	x	

* The southern part of the Pacifico Central Region was once one of the principal producers of bananas in the country, but due to problems of disease, cultivation was shifted to oil palm.

It is indeed appropriate for OFIPLAN to indicate such products whose relative shift is either positive or with a very small negative value.

It should also be noticed that introduction of tractors indicated a positive shift with a value of +0.19, which indicates mechanization of agriculture has relatively advanced in this region.

The above consideration of the region indicates that this region, which is directly adjacent to the Caldera port, will have to develop an agricultural system that requires relatively less labor input.

Strategically, therefore, labor saving technology must be introduced for the agricultural activities in the region more than in any other region in the country.

Examination by product may be made in the same way for the major commodities such as rice, maize, beans, etc. The results are

presented in a series of subdivisions of the following table. In this table, a subdivision to the Canton level is adopted to identify the Region. As to rice, Pacifico Central produced in 1973 about 34 percent of the entire country's production and had about 25 percent of its land devoted to rice production. On-farm consumption in the region is only 10 percent, indicating a relatively high level of commercialization of this product.

For maize, only 9 percent is produced in this region. Similar observations can be made for other crops as well, however, a sizable contribution to the nation's production is made only by the following products: cattle which produced about 17 percent of the country's total and pigs, 12 percent of the total.

Table 3.17 Number of Farms, Area, Production and Productivity of Agricultural Commodities. 1973 as Compared to 1963

Rice 1973	Number of Farms	Area Harvested (hectare)	Total Production (kg)	Consumption in Finca (kg)
Costa Rica	15,278	65,458.4	104,009,751	4,981,975
San Jose	1,875	2,803.9	2,569,408	565,415
Turrubares	229	346.1	433,496	70,542
Alajuela	2,478	5,137.3	6,586,752	840,103
San Mateo	69	83.2	124,993	22,555
Orotina	38	249.8	406,435	11,054
Puntarenas	5,683	30,605.1	61,906,561	1,893,379
Central	682	3,290.1	8,285,204	210,142
Montes de Oro	59	155.7	334,294	17,718
Esparta	106	172.8	222,557	34,411
Parrita	550	5,599.6	13,796,412	157,771
Aguirre	446	5,305.3	13,262,781	131,811
Pac. Cent. Total	2,179	15,199	36,866,172	518,193
% over Costa Rica	14.2	23.2	34.5	10.4
Comparison 73/63				
S	-996.1	2,756.4	19,301,341.6	
$\Delta\gamma$	-0.26	0.29	2.86	
Ratio 1973/63	0.81	1.30	2.60	

	Number of Farms	Area Harvested (hectare)	Total Production (kg)	Consumption in Finca (kg)
Maize 1973				
Costa Rica	30,012	51,888.3	52,447,134	17,511,094
San Jose	8,290	10,752.3	11,565,598	4,517,155
Turrubares	282	381.5	360,783	165,760
Alajuela	5,337	7,066.4	7,070,267	2,639,403
San Mateo	134	133.4	109,320	59,853
Orotina	50	61.6	66,771	21,437
Puntarenas	6,926	14,726.0	14,021,073	4,252,123
Central	1,294	2,527.2	2,974,292	944,009
Montes de Oro	205	183.3	171,529	104,052
Esparta	135	142.4	130,693	66,108
Parrita	452	659.9	555,816	229,452
Aguirre	375	737.9	713,491	194,215
Pac. Cent. Total	2,927	4,827.2	5,082,695	1,784,886
% over Costa Rica	9.8	9.3	9.7	10.2
Comparison 1973/63				
S	0985.1	-2,066.9	-678,649.9	
$\Delta\gamma$	-0.24	-0.29	-0.21	
Ratio 1973/63	0.97	0.99	1.80	
Beans 1973				
Costa Rica	19,149	26,680.9	11,030,639	4,563,766
San Jose	5,832	6,858.2	2,833,528	1,315,497
Turrubares	173	214.4	75,790	40,894
Alajuela	4,106	4,819.2	2,499,698	1,000,674
San Mateo	83	79.0	34,254	20,292
Orotina	23	17.9	9,382	2,616
Puntarenas	4,661	7,638.7	3,089,830	1,162,462
Central	846	1,265.4	514,869	233,748
Montes de Oro	191	268.3	109,518	52,061
Esparta	86	117.0	52,647	20,841
Parrita	277	439.8	168,514	66,912
Aguirre	227	326.9	125,313	53,360

	Number of Farms	Area Harvested (hectare)	Total Production (kg)	Consumption in Finca (kg)
Pac. Cent. Total	1,906	2,728.7	1,090,287	490,724
% over Costa Rica	9.95	0.1	9.9	10.8
Comparison 1973/1963				
S	-672.1	-1,525.8	-874,748.4	
$\Delta\gamma$	-0.19	-0.20	-0.31	
Ratio 1973/63	0.71	0.55	0.69	

Potatoes 1973

Costa Rica	981	2,000.1	20,627,734	138,530
San Jose	123	110.6	775,560	16,767
Turrubares	-	-	-	-
Alajuela	225	240.7	1,161,822	32,160
San Mateo	-	-	-	-
Orotina	-	-	-	-
Puntarenas	23	9.9	35,696	7,130
Central	12	3.6	16,284	4,830
Montes de Oro	11	6.3	19,412	2,300
Esparta	-	-	-	-
Parrita	-	-	-	-
Aguirre	-	-	-	-
Pac. Cent. Total	23	9.9	35,696	7,130
% over Costa Rica	2.3	0.05	0.17	5.1
Comparison 1973/63				
S	11.2	7.7	-22,725	
$\Delta\gamma$	1.24	4.405	-0.48	
Ratio 1973/63	1.31	1.15	1.24	

	Number of Farms	Area of Dense Planting			Total Production (kg)	Consumption in Finca (kg)
		Total Area (hectare)	In Year of Production	In Off-Year		
Bananas 1973						
Costa Rica	4,256	36,154.9	34,608.9	1,546.0	11,981,128	112,625
San Jose	700	565.9	470.2	95.7	64,749	26,259
Turrubares	7	4.0	3.2	0.8	310	125
Alajuela	835	1,066.2	854.1	212.1	127,186	21,521
San Mateo	2	5.9	5.9	0	703	50
Orotina	1	0.7	0.7	0	161	-
Puntarenas	1,229	9,778.0	9,431.1	346.8	3,841,904	34,859
Central	56	32.0	28.4	3.6	4,725	1,499
Montes de Oro	6	3.2	3.2	0	730	298
Esparta	-					
Parrita	39	19.5	17.1	2.3	4,094	863
Aguirre	108	136.6	116.5	20.1	29,087	3,310
Pac. Cent. Total	219	201.9	175.0	26.8	39,810	6,145
% over Costa Rica	5.2	0.6	0.5	1.7	0.3	5.5
Comparison 1973/63						
S	-101.6	-672.8			-410,229.2	
$\Delta\gamma$	-0.15	-1.09			-0.02	
Ratio 1973/63	0.48	1.42			0.02	
Plantains 1973						
Costa Rica	3,851	6,429.1	4,524.4	1,903.7	828,115	55,276
San Jose	255	103.3	80.9	22.3	7,771	2,540
Turrubares	10	4.6	3.9	0.7	287	170
Alajuela	876	1,478.2	1,032.1	446.0	102,905	7,491
San Mateo	1	0	0	0	3	3
Orotina	7	3.5	1.9	1.5	270	22
Puntarenas	1,717	3,048.7	2,266.9	781.7	530,794	36,432
Central	159	355.3	303.1	52.2	58,067	2,954
Montes de Oro	9	2.8	2.3	0.4	952	138
Esparta	5	2.5	2.4	0.1	725	23
Parrita	120	70.9	56.1	14.8	12,008	1,835
Aguirre	60	72.3	61.6	11.2	15,870	1,175
Pac. Cent. Total	371	511.9	431.3	80.9	88,182	6,320
% over Costa Rica	9.6	8.0	9.5	4.2	10.6	11.4
Comparison 1973/63						
S	-303.9	-696.1			-150,796.5	
$\Delta\gamma$	-0.26	-0.51			-0.004	
Ratio 1973/63	0.58	0.88			0.006	

	Number of Farms	Total Area of Dense Planting (hectare)	Total Production (kg)	Consumption in Finca (kg)
Guinea Plantains only 1973				
Costa Rica	2,596	3,507.1	292,460	48,864
San Jose	289	155.7	10,698	4,343
Turrubares	18	9.1	702	164
Alajuela	483	1,252.2	109,910	6,015
San Mateo	23	21.3	1,730	446
Orotina	8	4.9	398	234
Puntarenas	1,170	1,367.6	125,355	27,335
Central	230	232.7	21,350	6,083
Montes de Oro	70	54.6	5,513	2,099
Esparta	28	23.1	2,908	298
Parrita	72	42.5	3,354	956
Aguirre	29	32.4	3,792	688
Pac. Cent. Total	478	420.6	39,747	10,968
% over Costa Rica	18.4	12.0	13.6	22.4

	Number of Farms	Area of Dense Planting			Number of Diffrent Plants	Total Production (in units)	Consumption in Finca (kg)
		Total Area (hectare)	In Year of Production	In Off-Year			
Pineapple 1973							
Costa Rica	1,654	738.0	534.7	203.2	597,776	5,310,245	74,878
San Jose	272	53.7	40.3	13.4	29,484	396,550	13,746
Turrubares	8	0	0	0	396	325	325
Alajuela	490	384.2	242.9	141.3	483,216	3,214,395	28,061
San Mateo	8	4.4	1.6	2.8	628	25,540	250
Orotina	7	0.2	0.1	0.1	229	1,435	425
Puntarenas	554	250.5	226.6	23.9	62,816	1,481,860	23,863
Central	32	1.0	0.8	0.2	1,682	13,653	1,468
Montes de Oro	15	0.2	0.1	0.1	867	1,207	607
Esparta	17	1.5	1.4	0.1	6,136	13,373	1,144
Parrita	63	7.6	3.1	4.5	5,780	26,194	2,566
Aguirre	24	4.4	1.6	2.8	6,490	16,633	1,208
Pac. Cent. Total	174	19.3	8.7	10.6	22,208	96,360	7,993
% over Costa Rica	10.5	2.6	1.6	5.2	3.7	1.9	10.7
Comparison 1973/63							
S	-41.2	-44.7				-164,547.2	
Δγ	-0.07	0.50				0.12	
Ratio 1973/63	0.37	0.72				0.19	

	Number of Farms	Total Area of Dense Planting (hectare)	Number of Different Plants	Total Production (in 100 units)	Consumption in Finca (in 100 units)
Orange 1973					
Costa Rica	14,260	408.9	244,030	508,334	82,898
San Jose	3,550	100.5	89,920	173,355	19,617
Turrubares	72	0.6	770	2,307	568
Alajuela	3,493	110.7	51,608	139,946	21,547
San Mateo	139	2.6	1,227	4,646	826
Orotina	145	9.1	1,170	8,845	831
Puntarenas	3,028	88.1	40,445	72,165	15,919
Central	649	9.3	6,395	20,651	5,395
Montes de Oro	146	2.2	1,344	2,060	846
Esparta	183	13.5	2,501	6,218	1,219
Parrita	275	2.0	2,175	4,170	1,106
Aguirre	91	3.1	1,468	953	249
Pac. Cent. Total	1,700	42.4	17,050	49,850	11,040
% over Costa Rica	11.9	10.4	7.0	9.8	13.3
Comparison 1973/63					
S	-389.2	-106.1		-14,720.9	
Δγ	-0.13	-0.81		-0.05	
Ratio 1973/63	0.67	1.13		0.23	

	Number of Farms	Total Area of Dense Planting (hectare)	Total Production (kg)	Consumption in Finca (kg)
Coffee 1973				
Costa Rica	32,353	83,406.8	369,205,120	502,639
San Jose	12,991	26,110.4	94,022,131	252,406
Turrubares	35	71.8	36,202	1,388
Alajuela	8,996	25,302.7	125,576,406	102,131
San Mateo	58	55.1	230,944	1,437
Orotina	8	3.0	12,452	188
Puntarenas	2,347	5,539.2	22,978,538	49,586
Central	242	307.9	450,955	8,161
Montes de Oro	127	153.0	221,541	4,880
Esparta	26	33.3	73,316	1,050
Parrita	12	23.5	46,478	320
Aguirre	33	21.9	24,575	764
Pac. Cent. Total	541	669.5	1,096,463	18,188
% over Costa Rica	1.7	0.8	0.3	3.6
Comparison 1973/63				
S	-616.2	-278.5	-541,247.1	
$\Delta\gamma$	-0.58	-0.30	-0.63	
Ratio 1973/63	1.09	1.03	1.90	

	Number of Farms	Area of Dense Planting			Total Production (kg)	Consumption in Finca (kg)
		Total Area (hectare)	In Year of Production	In Off-Year		
Cocoa 1973						
Costa Rica	2,856	20,305.0	18,887.5	1,417.4	4,535,877	-
San Jose	6	24.8	23.8	1.0	12,696	-
Turrubares	-	-	-	-	-	-
Alajuela	507	2,353.6	2,172.3	181.3	597,206	-
San Mateo	-	-	-	-	-	-
Orotina	-	-	-	-	-	-
Puntarenas	355	429.5	324.4	105.0	117,530	-
Central	-	-	-	-	-	-
Montes de Oro	-	-	-	-	-	-
Esparta	-	-	-	-	-	-
Farrita	1	1.0	1.0	0	460	-
Aguirre	9	7.4	5.1	2.3	1,748	-
Pac. Cent. Total	10	8.4	6.1	2.3	2,208	
% over Costa Rica	0.4	0.04	0.03	0.17	0.05	
Comparison 1973/63						
S	-22.5	-1,489.8			-222,237.5	
Δγ	-0.42	-0.53			-0.29	
Ratio 1973/63	0.60	0.54			0.29	

	Number of Farms	Area of Dense Planting			Total Production (in ton)	Consumption in Finca (in ton)
		Total Area (hectare)	In Year of Production	In Off-Year		
Sugarcane 1973						
Costa Rica	9,484	38,762.9	33,877.9	4,884.9	2,246,111	7,650
San Jose	3,075	2,940.9	2,668.7	272.1	83,661	4,317
Turrubares	53	78.5	77.1	1.4	2,493	91
Alajuela	3,520	17,605.7	15,368.0	2,237.6	1,065,230	1,285
San Mateo	29	29.4	28.4	1.0	1,048	26
Orotina	7	7.8	7.4	0.3	521	-
Puntarenas	752	3,524.1	3,225.7	298.3	221,416	818
Central	160	1,947.1	1,935.6	11.5	154,284	242
Montes de Oro	43	178.7	174.5	4.2	7,084	43
Esparta	23	309.0	302.6	6.4	20,165	19
Parrita	77	610.1	461.3	148.7	26,526	80
Aguirre	37	35.4	27.5	7.8	1,093	31
Pac. Cent. Total	429	3,196	3,014.4	181.3	213,214	532
% over Costa Rica	4.5	8.2	8.9	3.7	9.5	7.0
Caomprison 1973/63						
S	-299.3	-1,008.3			-117,624.6	
Δγ	-0.24	-0.27			-0.68	
Ration 1973/63	0.58	1.11			1.91	

	Number of Farms	Number of Cattle	oxen
Cattle 1973			
Costa Rica	43,699	1,693,912	22,403
San Jose	10,036	156,676	5,694
Turrubares	413	17,055	170
Alajuela	10,043	372,497	4,350
San Mateo	226	12,369	129
Orotina	219	29,627	188
Puntarenas	7,739	343,199	3,014
Central	1,944	156,152	1,281
Montes de Oro	358	17,048	175
Esparta	351	16,461	231
Parrita	495	20,773	116
Aguirre	476	19,648	110
Pac. Cent. Total	4,482	289,133	2,400
% over Costa Rica	10.3	17.1	10.7
Comparison 1973/63			
S	-728.9	-14,680.3	-419.2
$\Delta\gamma$	-0.16	-0.08	-0.11
Ratio 1973/63	1.18	1.61	0.72

	Number of Farms	Number of Hogs
Hog 1973		
Ganado Porcino 1973		
Costa Rica	36,565	215,792
San Jose	7,332	31,182
Turrubares	366	1,633
Alajuela	6,828	41,418
San Mateo	213	903
Orotina	279	1,065
Puntarenas	8,845	55,140
Central	2,296	14,240
Montes de Oro	414	1,565
Esparta	315	2,098
Parrita	607	3,093
Aguirre	501	2,734
Pac. Cent. Total	4,991	27,331
% over Costa Rica	13.6	12.7
Comparison 1973/63		
S	-616.1	-6,632.2
$\Delta\gamma$	-0.14	-0.29
Ratio 1973/63	1.26	1.48

Agricultural Machinery 1973

	Tractors	
	Number of Farms	Quantity
Costa Rica	3,764	5,432
San Jose	195	239
Turrubares	4	4
Alajuela	1,470	1,858
San Mateo	3	3
Orotina	26	43
Puntarenas	516	1,036
Central	164	269
Montes de Oro	12	20
Esparta	15	17
Parrita	78	170
Aguirre	72	174
Pac. Cent. Total	374	700
% over Costa Rica	9.9	12.9
Comparison 1973/63	-54.6	95.1
S	-54.6	95.1
$\Delta\gamma$	-0.15	0.19
Ratio 1973/63	1.15	1.22

3.4 Strategies for Agro-Based Regional Development

3.4.1 Strategic Image of the Roles and Functions of Agriculture for Regional Development in the Pacifico Central

The development of agriculture as an industry in the region has relatively been retarded as compared to that in other regions of the country as has already been analyzed for the past decade in the previous sections of this chapter.

Consequently, the region may not have great opportunity to develop traditional agriculture in general, unless a strong government policy in that direction is adopted and necessary measures at both public and private levels are taken.

However, the region has a set of characteristics some of which constitute locational advantages. The region is indeed located between two urban centers, namely San Jose and its surrounding cities located on the Meseta Central on the eastern side, and Puntarenas on its west. The distance between the two cities is less than 100 km; transportation facilities have brought these two urban centers within a communication distance of one and a half hours. The two urban areas are well connected by a rather well developed traffic and communication system including roads, railways and air routes. Such geographical advantages of this region provide agriculture in this region with urban-oriented characteristics. This concept might appear somewhat unconventional, but should imply the following functions. First: The region includes the Pacific coast which has been known for some periods as a traditional domestic as well as foreign recreational and resort area. Agriculture should function to improve the environmental and ecological charactor so as to maintain its natural characteristic as a recreational and resort area that attracts domestic as well as foreign tourists. In many cases in economic development, environmental up-keep and improvement has become difficult particularly through industrialization. Beautiful sites and nature are sacrificed to such an extent that ecological as well as esthetic balances of the involved areas are lost and their restoration becomes either difficult or involves prohibitive costs.

There may be new social and human values which in the future must be realized and agriculture should play a considerable role in maintaining and creating them, together with enhancing those traditional values including the measurable one of increasing the G.D.P. Considering the heavy concentration of the population in San Jose and its surrounding cities, where more than half of the population of the country resides, the open area leading to the Pacific coast must logically provide the room or the space for such a concentrated population of an essentially urban character.

Two things should be chosen for agriculture to play such strategic roles. One is to augment vegetation throughout the year and the other is to conserve and utilize water. These two are very much related and essential for enhancing economic activities and for protecting the environment from deterioration.

As to augmenting the vegetation, policies for the area should be made with a conscious effort to cover the land with vegetation year round, particularly with perennial plants including afforestation to reduce soil erosion. Actual sites and respective scales of such afforestation should be investigated further, but, in general, farms should be encouraged to plant and grow trees of suitable variety. The results of experiments on growing trees, being presently conducted at the CATIE in Turrialba, should be utilized in this regard. Water resource utilization should be systematically explored for agriculture as well as for other activities. Second: Fuller utilization of the rural labor force should be planned in order to provide opportunities to improve the income level of the rural populace. This could be done in two ways, one is to diversify agricultural activities and the other is to create more employment opportunities in any other activities for rural population.

Diversification of this region's agriculture, at first sight, may appear not to be so feasible because of the economic reasons which have made agriculture in this region specialize more and more in the cultivation of a few selected commodities as indentified in earlier sections.

However, more detailed studies of labor utilization on farms through farm-management or farm-household type of surveys would be able to identify more effective labor utilization plans.

The other way of utilizing rural labor is to introduce non-agricultural activities into the region. Although no empirical surveys have been made, it appears that during the dry season, which stretches nearly through half of the year, labor seems to have a lesser opportunity of gainful employment on farms for traditional agricultural activities.

As it will be recommended in the respective parts of the report, the introduction of various industrial activities in the region would thus provide additional opportunities for employment in non-agricultural activites.

Such activities like fishing and marine culture require a new entrepreneurial technology, but, as far as the type of required labor is concerned, there will be many common elements with agriculture.

The same can be said for tourism which should have greater potential in future.

3.4.2 Tactics Recommended for the Development of the Region.

1) Integrated activities consisting of agriculture, manufacturing industry and recreation and tourism should be promoted in the region. From this point of view, industrial activities to be introduced in the region should be so made as to fulfill standard requirements for environmental protection which contribute to the sound development of the region. For this purpose it is strongly recommended to introduce planned development by providing an adequate set of incentives.

The "Ley de Fomento a la Industria Rural" which is under consideration for promulgation in this country should be one of the useful tools in implementing such an objective. Consequently, it seems recommendable to designate an appropriate zone in this region (Pacifico Central) as "Zonas de Desarrollo Rural" following the designation already made of such zones in Limon Province.

The contents of the designated zone should include "Parques Industriales Rurales." The location, size and type of activities of the "parques" should be carefully planned, as considered and recommended in this report, in order to achieve priority objectives of the country in a coherent way for short-, medium- and long-term perspective. However, in view of the impact expected from such designations, closer coordination between the Ministry of Agriculture and related institutions, including Consejo Nacional de Producción, Instituto de Tierras y Colonización and Sistemas Bancario Nacional, in particular, would be indeed preferable. Participation in planning from academic circles, particularly from the economic and agricultural departments of the University of Costa Rica, would be highly recommendable.

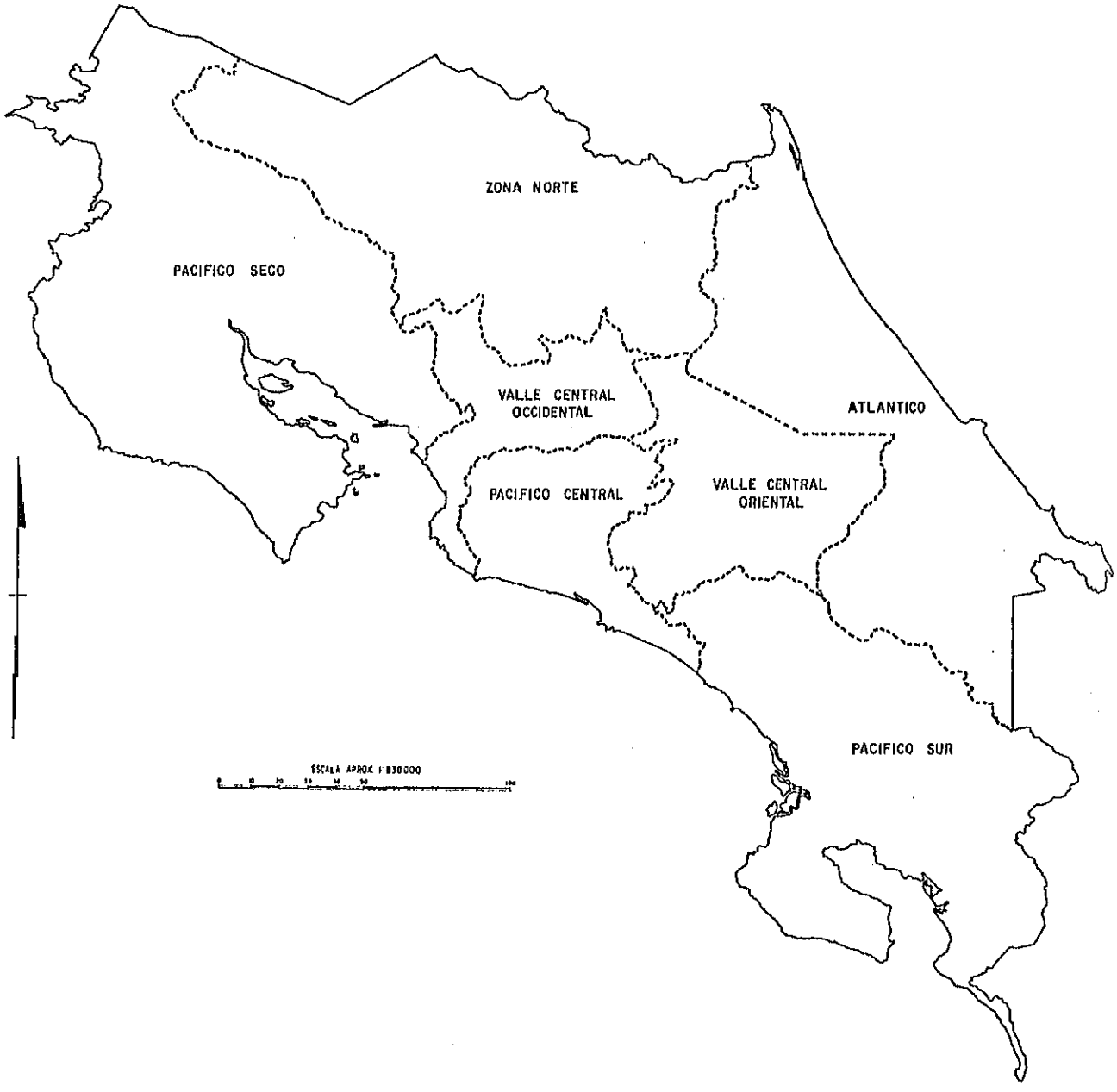
The type of regionalization adopted by OFIPLAN and identified as the hinterland of Gran Puntarenas in this report straddles several agricultural regions defined and adopted by the Ministry of Agriculture and used for tabulation of the 1973 Census of Agriculture. There must be some reasons in defining the respective regions for various purposes. Maintaining a closly coordinated definition of the region is strongly recommended for a harmonized policy for the development of the region.

Any regional developmental schemes involving some concrete projects naturally require studies of various fields which are closely connected. It, therefore, may be recommendable to commence a concrete feasibility study on implementing an industrial estate in Gran Puntarenas. Such study should not be limited to mere physical and financial aspects as often has been the case in the past. Particularly, as past history indicates, new industrial investments tend to be attracted naturally to the Meseta Central, where the labor force may be more easily available and the major domestic market is located. However, after about two decades, the entire population will be nearly doubled as well as per caput income. What will be demanded by the population and how best such demands may be met require studies of an economic and sociological nature of the region.

Paticularly, urban-oriented rural life style, including both production activities of persons engaged in both agriculture and other activities and the creation and maintenance of a rural-recreational environment, should be made compatible. Designating the Parque Industrial Rural should make it possible to realize these aims.

Figure 3.6

Agricultural Regions of Costa Rica



Source: Censos Nacionales de 1973
Agropecuario, Regiones Agricolas

2) Diversification of activities on farms should be systematically promoted in view of the urban oriented agricultural area of the region. It is indeed difficult to make a concrete recommendation here. On the one hand, according to the Ministry of Agriculture's investigation, in the three agricultural regions partly included in the Pacific Central Region, the following crops are identified as having potential land use in the future. These are coffee, cacao, rice, sorghum, cotton and sugarcane. For each crop potential areas of further cultivation have been noted previously.

These commodities are relatively suited to the region since their land productivity is already higher in this region than among other regions of the country.

For permanent crops, production of coffee per hectare is highest in Valle Central Occidental, producing 5,281.5 kg per hectare against 4,426.5 kg per hectare for the national average. The average productivity and other information on other crops, including permanent crops, are presented in Table 3.18.

In almost all data made available officially, farm activities are treated as producing main crops or livestock. There are, however, doubts whether all farms located in the region should also be specialized in producing one or a few crops.

Any comparable advantages in production of a certain crop or livestock should be taken in full scale. At the same time, there seems to be potential for other farms to diversify their production and introduce urban-oriented crops and livestock having higher value.

For example, fresh vegetables of higher quality should be developed and produced.

Improvement of the quality of tropical and other traditional fruits may also be remunerative in the future.

Research presently being undertaken on the management of small farms by the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) at Turrialba would be useful in formulating policy on urban-oriented diversification of activities on farms in this region. As far as the scope of the present research is concerned, a few main crops, including the rotation of yuca, frijol, maiz and camote are considered. It is indeed recommended to introduce the cultivation of fresh vegetables and fruits in an integrated fashion in the scope of the investigation by the said institution.

The grading of vegetables, packaging and marketing should also be improved. Indeed, it is very important to prepare for increased population in the Meseta Central, to have a well equipped distribution system of food, in particular, fresh perishable products.

Table 3.18

Area, Production and Productivity of Crops in Three Agricultural Regions in Costa Rica

	Permanent Crops (area)	Rice Area (ha)	Rice Production (kg)	Rice (kg/ha)	Maize Area (ha)	Maize Production (kg)	Maize (kg/ha)	Beans Area (ha)	Beans Production (kg)	Beans (kg/ha)	Sorgo Area (ha)	Sorgo Production (kg)	Sorgo (kg/ha)
Pacifico Seco	11,473.3	29,048.6	39,045,683	1,344.2	14,765.2	14,371,604	973.3	8,225.5	2,951,738	358.9	1,900.2	4,424,280	2,328.3
Valle Central Occidental	44,708.6	930.5	2,463,853	2,647.9	2,673.5	2,931,754	1,096.6	1,553.0	776,538	500.0	121.1	305,440	2,522.2
Pacifico Central	25,717.8	12,602.6	28,814,639	2,286.4	6,226.7	6,301,000	1,111.9	4,058.5	1,539,284	379.3	974.7	1,833,514	1,881.1

	Bananas			Coffee			Cacao			Sugarcane		
	Area (ha)	Production (kg)	(kg/ha)	Area (ha)	Production (kg)	(kg/ha)	Area (ha)	Production (kg)	(kg/ha)	Area (ha)	Production (kg)	(kg/ha)
Pacifico Seco	144.7	15,864	109.6	2,598.9	4,922,639	1,894.1	6.0	488	76.6	7,058.2	491,808	69.7
Valle Central Occidental	73.9	9,767	132.1	31,272.6	165,167,094	5,281.5	-	-	-	12,574.7	793,164	63.8
Pacifico Central	227.6	38,995	171.3	12,966	46,417,374	3,579.9	9.1	2,208	242.6	2,088.7	65,753	31.8

	Gineo Cuarado			Plantains			Yuca		
	Area (ha)	Production (kg)	(kg/ha)	Area (ha)	Production (kg)	(kg/ha)	Area (ha)	Production (kg)	(ha/kg)
Pacifico Seco	722.6	57,901	80.1	473.6	65,477	138.2	91.7	450,294	4,910.5
Valle Central Occidental	128.0	9,121	72.3	75.3	4,769	63.3	111.5	1,028,031	9,220.0
Pacifico Central	172.0	12,259	70.9	171.2	29,718	173.5	63.8	333,592	5,228.7

Table 3.19 Cost of Production for Rice

		Pacifico Seco	Pacifico Sur
Area (ha)		29,048.6	17,134.5
Production (kg)		39,045,638	26,786,832
Yield (kg/ha)		1,344.2	1,563.3
			Per ha Cost of Production
Cost of Production Colons per ha	1975	3,352.70	3,575.70
"	1976	4,013.15	4,200.05
Cost of Labor Colons	1975	1,341.00 (40%)	1,536.00 (43%)
"	1976	1,811.05 (45.1%)	1,989.95 (47.2%)
Cost per kg	1975	2.49 Colons	2.28 Colons
Cost per kg	1976	2.98	2.68
Labor cost per kg	1975	0.997 Colons	0.98 Colons
Labor cost per kg	1976	1.347	1.273
Average Producer's Price (Colon/kg)	1974	1.977	
"	1975	3.087	

Source: Gorge Wildamberoggio, Informe sobre Costos de Producción de Una Hectaria de Arroz Mediante Sistema Mecanizado, Unidad de Investigaciones Económicas y de Mercado C.N.P. Enero de 1977

3) In spite of the need for diversified urban-oriented agriculture in this region, there may still remain the need for rationalizing the production of traditional agricultural products. One such product is rice which has been a characteristic product of the region. As seen in Table 3.18, average productivity of rice is very high in two main agricultural regions. Among them, however, Pacifico Seco and Pacifico Central produce the majority of rice in the country.

As has already been seen, rice is one of the basic grains of the country. The government has adopted policies to achieve self-sufficiency on this product. This objective has now been achieved, but it has created a difficulty in the National Production Council which administers grains, because of accumulating operational deficits.

Among the main reasons for the deficits, one can calculate the price relationship between the prices paid to farmers and the consumer prices. According to the law under which the practice of marketing rice operates, rice-producing farmers can sell all the rice they produce to the Council at the stipulated price. The Council then processes it and distributes it to consumers.

Determination of price levels of rice and efficiency in processing and distributing will affect the financial position of the Council.

The average price per kg of rice paid to producers in 1975 was 3.087 colons according to preliminary data of the Banco Central de Costa Rica. Compared to this price, the cost of production was 2.98 colons and 2.68 colons per kg, respectively, for Pacifico Seco and Pacifico Sur.

Assuming these figures are reliable, rice producing farmers seem to get enough profit, ranging from 24 to 35 percent of the cost of production for respective regions.

It is natural that the production of rice has increased so much. Consequently the National Production Council suffered from a squeeze between purchases and sales of the rice.

In order to contribute to the further success of production of basic grains, particularly rice, in this region, the following measures will be recommended:

(a) Surveys on the cost of production of rice should be carried out on a continuing basis. For this purpose, the cooperation of farms producing rice needs to be secured. A design of sample farms producing rice should be worked out to cover various types of farms for different sizes and locations. The form and content of the survey should be worked out possibly by utilizing some standard forms made available, for example, by the FAO and others. The method adopted in Japan for many years and used for the very same purpose of controlling the

price of rice may also be helpful. Important aspects in carrying out the survey would be such that the results can be usable for the policy making of the government. Thus such aspects as the distribution of the cost of production over different types of farm and sizes of farm should also be obtained as well as ascertaining the degree to which farmers respond to certain levels of producer prices.

Cooperation from academic circles, such as the University of Costa Rica, should also be obtained on a countinuing basis for the entire stages of the survey, including the design of the survey and analyses of the results .

(b) Producer prices of rice in Costa Rica are among the highest in the world; such a level is only surpassed by that of Japan & Korea and has been at a much higher level than any other rice-producing countries. (FAO Statistics)

Table 3.20 Producer Prices of Rice in U.S. cents/kg

	1969	1970	1971
Costa Rica	24.9	28.2	28.5
Guatemala	12.6	14.7	12.6

Whether the producer price is adequate for policies on the self-supply of food in Costa Rica may be an urgent subject for investigation. It is particularly relevant in view of the difficulties and the deficits of the Consejo Nacional de Producción.

For comparison, consumer prices of milled rice in the world in 1971 had been around 13 U.S. cents per kg.

(c) Production and processing efficiency should also be evaluated carefully. As it has already been pointed out earlier, the yield of rice in Costa Rica is comparatively low and had been around 1.6 ton per ha (1974), while the average yield for North and Central America was 3.8 ton per ha. One of the reasons for this relatively low yield may be attributable to the cultivation of upland rice. Water control and provision of irrigation may be able to convert the presently used varieties into those of higher yield.

Transportation and processing of paddy could also be improved; factors of converting paddy to milled rice may be improved by adopting somewhat improved technology and equipment. Improvement of efficiency in this field would help to ameliorate the financial difficulties of the Consejo Nacional de Produccion.

4) Exploitation and cultivation of marine resources

The Pacific coast appears to be endowed with a variety of marine resources ready for exploitation and cultivation. In particular, shrimp cultivation may prove a promising line of activity in Nicoya Bay. Other marine cultivation such as oysters, mussels, eel etc. should also be explored.

Exploitation of other ocean fish, such as tuna and deep sea shrimp, need to be investigated with respect to their potential resource endowment. The possibility of commercially exploiting them should be examined.

In the process of developing marine culture, the present mangrove trees should never be destroyed in any case for ecological reasons.

5) Reforestation and exploitation of forestry resources

Tropical forests in this country are endowed with a variety of traditional species of trees. In the past, it appears as though some competition existed between foresty resources and developing pastures and ranches. It now seems important to make more positive efforts in preserving trees for maintaining an ecological balance, in particular for the purpose of preserving water during the dry season.

Positive effort in the direction of planned reforestation and forest management would be required for continuing the timber supply and for preserving ecological balance.

In this effort some exotic species such as Pinos Caribes and Eucaliptus might profitably be included in addition to traditional species.

6) Consideration of new lines of agriculture

Endowed with a tropical climate having varieties of moisture, rainfall and temperature according to locality and evaluation, the country seems to fit to almost all kinds of agricultural production. It should therefore indeed be worthwhile to investigate some new line of activities for the future. Such may include mulberry trees for silk production and grapes for wine production.

CHAPTER IV

LIVESTOCK DEVELOPMENT

CHAPTER IV

LIVESTOCK DEVELOPMENT

4.1 Dairy Cattle and Dairy Farming

The main purpose of dairy cattle and farming is to produce and supply milk for national consumption. In many countries, especially in economically advanced countries, dairy cattle also supply beef in addition to milk.

4.1.1 Areas of Dairy Farming and Their Natural Environments

Because the major dairy cattle breed in Costa Rica is Holstein-Friesian, a type of northern continental cattle originating in Friesian, Holland, dairy farming in Costa Rica has naturally developed in several suburbs of towns and cities on the plateau or tableland. Here the altitude is between 1,200 and 2,000 meters and the air temperature is comparatively cooler than that of the lowland. It is suitable therefore to Holstein's physiological conditions for lactation. Not only do Holstein-Friesian but almost all other improved breeds of dairy cattle in European and North American countries are a type of northern continental cattle, all of which require rather cool environments. In light of the above, the existent locations of dairy farming in Costa Rica can be said to be "reasonable," because of the temperature, moisture, and radius consumption markets. Raw milk can remain fresh only for an extremely short time, only a few hours if it is over 25 degrees Celsius. Therefore, dairy farming should be located near consumption markets such as cities or towns. This researcher did not find particularly any problems concerning the location of dairy farming in Cost Rica.

4.1.2 Technical Problems in Dairy Farming

In this section I will deal with (1) breeds of dairy cattle and their performance, (2) breeding and genetic improvement, (3) dairy feeds and feeding, (4) sanitation and others.

(1) Breeds of Dairy Cattle and Their Performances

The results of the data and information that I gathered directly at dairy farms in Costa Rica concerning lactation per cow in the regions of Zarcero, Quesada, San Jose and Cartago, indicate the average of annual milk production per milking cow is between 2,500 and 3,000 kg. This level cannot be said to be "good."

In general, the average milk production per milking cow is over 6,000 kg in the U.S.A. and more than 4,500 kg in Japan; particularly on intensive or professional dairy farms in both the U.S.A. and Japan, averages are almost 7,000 to 8,000 kg for Holstein-Friesian herds, and are not necessarily exceptional.

We have sometimes noticed Jersey cows on Costa Rica dairy farms. A Jersey is somewhat smaller than Holstein-Friesian. Its genetic performance of lactation vis-a-vis volume is also somewhat lower than that of Holstein-Friesian, but milk-fat content for Jerseys is in general 4 percent or more compared with 3.4 percent for Holstein-Friesian. One of the advantages in raising Jerseys is that they can be fed only coarse roughage and yet passably produce milk. Jerseys are most suitable for pasture grazing, because they have a stronger constitution and stronger bone structure than Holstein-Friesian.

Holstein-Friesian, on the other hand, belongs to the American-Canadian breed line and needs to be fed high quality feed or higher energy feed composed of good quality hay mixed with grains like ground corn, milo, oats, etc. to maintain a high level of lactation of more than 5,000 kg annually.

Holsteins are reportedly not conducive for grazing on pastures of mountainsides or hillsides because their weak legs cannot support a fast enough pace for grazing sufficiently to produce milk. Below are listed breeds of dairy cattle suitable to Costa Rica:

(a) HOLSTEIN-FRIESIAN:
Rather suitable for intensive dairy farming in suburbs of cities or towns and having a high production of milk per head.

(b) JERSEY:
Rather suitable for producing milk on low cost grazing, but having a lower milk yield than that of Holstein.

(c) BROWN SWISS:
It seems that part of the dairy men in Costa Rica and specialists working for the Tropical Agricultural Research and Training Center of Turrialbo are interested in the performance of Brown Swiss, a most popular cattle breed in Switzerland (and North America), and in its introduction into Costa Rica.

Brown Swiss is one of the dual purpose breeds - milk and beef production - which has been improved to be raised on Alpine pastures having an altitude of 1,000 to 2,000 meters. It is big boned, can

walk and climb fast on sharp slopes of mountainous pastures while grazing and can retain good lactation and state of health. However, its average milk production is not higher than that of a Jersey and its carcass weight is only about 55 percent of live weight, a little lower than that of other breeds.

Nevertheless, Brown Swiss is one breed of cattle which is trialworthy in Costa Rica.

(d) ZEBU or INDIAN CATTLE:

Among various strains of Zebu there are some dairy strains improved especially as dairy cattle in India. Their annual milk performance is about 4,000 to 5,000 kg or more under severe tropical conditions. I have seen some Zebu farms in Costa Rica, but all are used for beef production. It might be worthy to study further dairy Zebu for developing dairy farming in tropical lowland regions of Costa Rica.

(e) SIMMENTAL:

Simmental is a Swiss dairy breed, belonging to the same variety of Alpine cattle as Brown Swiss, and suitable for dairy farming on the tableland in Costa Rica. This breed is also a dual purpose breed - adequately producing both milk and beef - but its genetic performance of lactation is better improved at the rate of 70 percent in lactation and 30 percent of beef production. Simmental is thought to a good contributor to improve conventional dairy cattle performance in Costa Rica in the future. Both Costa Rica dairy specialists and I were in agreement on the above.

(2) Breeding and Genetic Improvement of Dairy Cattle

The first, central and most effective method in improving the performance of dairy cattle in Costa Rica is to adopt a system of artificial insemination. The technic and practice of artificial insemination in dairy cattle have presently been simplified and systematized. It is comparatively easy and adoptable in any country, including Costa Rica.

However, a few veterinarians or livestock breeding specialists need to be sent at first to one of the artificial insemination centers in the U.S.A. to study at least for several months the technics and organization of breeding systems. The U.S.A. has been mentioned as a place of studying abroad not only because it is a country most advanced in artificial insemination of dairy cattle but also because it is the biggest and best supplier of semen (frozen) from dairy bulls which have proved ability for best heredity of improved genetic character and performances.

In dairy cattle breeding, cross-breeding between different breeds should never be practiced, but "pure-breeding" should be the rule; "up-grading" should be used only in improving conventional dairy cattle. The grade-breeding is a way of inserting into conventional

livestock blood lines of livestock having an excellent genetic character of improved breed bulls.

Concerning a method of improving Costa Rican conventional cattle, I would like to comment below on a practice of grade-breeding.

A: conventional stock; female

B: desirable breed; bull or male

A cow - X - B bull
↓
daughters - X - B bull
↓
daughter - X - B bull
↓
continued future mating with a bull of breed B only, generation by generation, without using a bull of another breed, e.g., C or D.

"B" here is a bull of a breed which dairymen in Costa Rica have to decide and choose from various foreign breeds, for example, Holstein-Friesian of the American-Canadian type, Simmental, Brown Swiss and so on.

(3) Dairy Feeds and Feeding

The Conventional feeds and feeding in dairy farms of Costa Rica have various defects and strong points fortes.

(a) Defects:

In feeding dairy cattle, especially milking cows, we found a common habit on every dairy farm, that is, all dairy farmers in Costa Rica usually have a tendency to feed their dairy cattle on feeds that is considerably deficient in nutrients required to produce milk at the level of the cows' capacity. In other words, the total energy content of these feeds is always deficient, especially in feed for milking cows.

The nutritive deficiency in feed for milking cows seems to be due to the sort of conventional feed used, most of which are composed of "roughage" (feeds high in fiber but low in digestive nutrients). If dairy farmers would feed their milk cows feeds containing required nutrient amounts at a reasonable level, their cows would produce more milk, at least 50 percent more, or more than 4,000 kg annual milk yield.

Unfortunately, dairy farmers can hardly use high energy feeds or grains like corn, milo, oats etc. in feeding their dairy cattle because of the shortage of grain and its comparatively high price. However, some grain is needed in feeding their milking cows for better milk production yields per cow. Nevertheless, the total energy amount of Costa Rica dairy feeds for "milking cows" should be raised significantly.

(b) Strong Points

In every region of Costa Rica, the dairy farmers can easily acquire sufficient roughage from their own farms and neighborhood, for example grass, baggasse, sugar cane tops etc. These varieties are in available in Costa Rica at cheap prices and most suitable for feedstuff of dairy cattle.

In utilizing the roughage mentioned above for dairy feed, there seems to be room for improving the formulation of these feeds nutritively. For example, adding some portion of molasses to the roughage at dairy feed is an important and beneficial way to increase the nutritive value of the feed for better lactation.

(4) Sanitation in Dairy Production

Major diseases occuring in Costa Rica dairy herds are as follows;
i) Brucelosis
ii) Mastitis
iii) Anthrax
iv) Tuberculosis
v) Others caused by parasitic infections

Without having specialized in veterinary sciences, this writer was unable to write any positive comments concerning the above diseases. However, all diseases listed above are not so dangerous to dairy farming in Costa Rica only, but very common problems among cattle farmers in any country, they should be controlled by standards of veteriany sanitation set by the national government.

I would like to add also that severe restrictions and careful inspection are desirable when importing any breeding stock from foreign countries, not only including South America but Europe as well, because most of the countries in these regions are traditionally well known as areas contaminated with "Foot and mouth disease," the most dangerous animal disease.

4.2 Beef Cattle Production

Beef is one of the most important agricultural products in Costa Rica, and not only has it occupied a large part of the exports but also has been a most important food domestically. The number of slaughtered cattle in this country reaches more than 340,000 head annually.

4.2.1 Areas of Beef Cattle Farming and Their Natural Condition

Cattle raising or beef cattle farming in Costa Rica is located in the areas of Peninsula de Nicoya including Puntarenas, Guanacaste, and other areas along the Pacific coast.

(1) Peninsula de Nicoya and Puntarenas:

Peninsula de Nicoya has been one of the areas of cattle farming in Costa Rica. The region has grazing pastures capable of raising many cattle until recent years. However, recent weather conditions have been severe in the tropics and have tended to harshen the dry season from November to April, turning the land and vegitation gradually into drought ridden desert so that the pastures have lower capacity for animal grazing during the half year of the dry season.

The rainy season is from May to October. Daily showers make the land verdant and stimulate the growth of vegitation so that it can support livestock grazing for a half of a year until the next dry season.

The grassland of the peninsula cannot supply sufficient forage or grass for all grazing cattle for all year round because of the six month dry season. This is the most troublesome question of cattle farming in Peninsula de Nicoya. Consequently, there is recently movement among farmers and beef producers in this area of the peninsula to develop for cattle farming new pastures or grasslands at Alajuela, where weather conditions are better suitable for grass cultivation grass and cattle raising. This would mean moving their cattle from regions in Peninsula de Nicoya and Puntarenas to the grassland of Alajuela, because drought in the lowlands of the west and semi-parched land have increasing year by year. The annual amount of rainfall in the Peninsula and Puntarenas is said to be 1,100 millimeters, most of which naturally appears in the wet season only.

(2) Guanacaste

Livestock production around Guanacaste has a lengthy history of development in the area of Valle de Tempisque and its surroundings. Unfortunately, however, for many years livestock producers in Guanacaste have suffered from poor vegitation of their grasslands because of the severe drought during the dry season along Costa Rica's Pacific coast. As in the case of Peninsula de Nicoya and Puntarenas, many farmers and cattlemen are planning to move their cattle to some region of Alajuela and cultivate new grasslands or pastures for their beef production.

At the same time, there is a movement to establish an irrigation system from Lake Arenal to the fields of Guanacaste. If the irrigation can be accomplished successfully, the farming situation should improve. But because details of the irrigation project have not been published yet, I can hardly comment on the possibility of developing livestock farming in Guanacaste.

(3) Quesada of Alajuela

As mentioned above, cattle farming in the western part of Costa Rica has recently been depressed by annual droughts of six months.

Cattlemen are going to move their cattle to some regions near Ciudad Quesada of Alajuela, where they have plenty of water available from streams and rainfalls to supply their farms or grasslands.

Furtunately we visited a region where wild forests were being cleared and land was being cultivated for opening new grassland and pastures. The area surrounding Ciudad Quesada is expected to become a better land for cattle raising, not only for beef production but dairy production as well, because various feedstuffs like sugar cane tops, cassava, baggasse, molasses, and even corn and maize are available in addition to plenty of water for cultivating grass or forage in grasslands.

4.2.2 Breeds of Beef Cattle

In beef cattle farming in economically advanced countries, at present, all cattle are divided into two sorts, one is commercial stock which should be slaughtered after fattening and the other is breeding stock. However, in Costa Rica, we could hardly find any difference between commercial stock and breeding stock, except for bulls.

Most cattle for beef production in this country seemed to be conventional or native cattle whose blood line has been drawn from various breeds and strains, for example, Brahman or Zebu with some mixture of European breeds of cattle. According to a specialist at Pacifico Seco Regional Office of the MAG Liberia, they intend to improve the breed lines of conventional cattle by crossing them with Charolais, a French breed of cattle with large bone structure used for beef production, for grade-breeding.

Charolais today is one of the most well known breeds of beef cattle in many countries because of many benefits due to its genetic character, its body being larger than that of other breeds of cattle and its faster growth rate with higher yielding carcasses. At the same time, however, such merits of Charolais' performances have frequently brought unexpected problems in many cases of cross-breeding. Most problems are genetic and have occurred in relationship to problems of giving birth and miscarriages.

Concerning the cases of abortion, many veterinaries have concluded that the growth of an embryo which is of half-Charolais is slightly faster and larger so that the non-Charolais mother has great difficulty allowing the embryo to reach the time of delivery because of her comparatively smaller womb. Vetinaries have also insisted that miscarriages in cross-breeding between Charolais bulls and other breeds of cows are attributable to their unmatching blood-types. Nevertheless, Charolais is very attractive animal, but they have not spread as a common beef producing animal in all countries. Why? It may be a genetic question of cross-breeding.

I would like to insist that Aberdeen Angus, Scottich breed of beef cattle, should be introduced to the newly opened pastures on the highlands near Quesada where there is always heavy fog or moist clouds hanging over farmlands of 1,500 to 2,000 meters altitude sea. Aberdeen Angus is a cattle yielding more than a 60 percent carcass on average, matching well the foggy highlands of Scotland where only rough forage can be grown under such severe natural conditions. There are some results from Aberdeen Angus in Japan, obtained at a national experimental farm.

(1) Beef Cattle Improvement

It seems that Costa Rica is going to develop a new strain or breed of cattle called "criollo" from some triple-crossing of three different breeds. However, the results of developing a new strain always take many years and much money.

I would like to insist that conventional cattle can be improved efficiently and rapidly by upgrading the breeding system, through of a particular breed, specifically a desirable European breed, in particular herds of conventional cattle.

After several generations in grading, we will necessarily be able to select some individuals having desirable characteristics and genetic performances, which can be used as basic breeding stocks in developing a new strain or breed. Through grading (see 4.1.2 (2)), Japanese have obtained valuable facts on developing new breeds, e.g., Japanese Black Cattle (Kuroge Wagyu) and Japanese Red Cattle (Akage Wagyu).

(2) Sanitation in Raising Beef Cattle

I have already mentioned some principal problems connected with bovine diseases (see 4.1.2 (4)). The same may be described as that mentioned in section 4.1.2 (4) on dairy cattle sanitation.

One thing in particular which I would like to consider is the parasite or parasitic diseases in cattle grazing. If parasite control in Costa Rica would be carried on more effectively and more intensively, leather industries in this country would be surely more developed and would increase the production and export of leather.

4.2.3 Feeds and Feeding of Beef Cattle

The most important thing which I wish to insist here is that, as described in section 4.1.2 (3) of this paper, cattle in this country, regardless whether they are dairy or beef cattle, lack proper feeding because of various deficient nutritive conditions. This seemed to be caused by the poor vegitation conditions in grasslands or pastures, especially during the dry season.

This is not difficult to supplement. Costa Rica cattlemen and farmers have various kinds of available feedstuffs in plenty, for example, sugar cane tops, baggasse, molasses, etc., most of which have not ever been utilized in cattle feeding nor in feed industries.

In fact, regarding ruminant feeds and roughages for beef and milk production, Japan has been importing tons of baggas, sugar cane top, and molasses from the Philippines and other tropical areas of the Far East every year, in addition to importing hay or grass from the U.S.A., Australia and Africa, because these are extremely suitable feeds for ruminant consumption and efficient in supplementing the shortage of cattle feed in Japan.

I would encourage the use of molasses mixed with sugar cane top or baggas in feeding beef cattle after they are 16 months old and before they are marketed. Adding molasses to the ruminant feed increases its energy content and results in better daily gain (DG) during the fattening period.

In regard to livestock feed and feed resources, Costa Rica has many nutrious and valuable resources that are abundant. I consider the establishment of effective technics and facilities for utilizing feed resources in cattle feeding to be a most important factor for developing livestock industries in Costa Rica, at present.

Also, it is important that Costa Rican beef production should be modernized into a more intensive farming operation. I advise the following:

(a) Developing and Improving Grassland

There is need for creating new grassland for cattle grazing in regions where streams or water are available and reasonable amount of rain-fall exists, in addition to irrigation projects, which was planned to improve drought striken grasslands. In other words, better and more productive vegetation of grasslands and more intensive rotation of pasture are desirable. An economic target for improving grassland is to approach a productive level such that either more than 4,000 tons of fresh grass per 10 a (are) by grazing three times annually or grazing one head of cattle per 1 - 1.5 ha per year.

(b) Calving and Rearing

Calving or delivery and the rearing of calves are recommended to be undertaken with the conventional type of grazing on improved intensive grassland.

(c) Fattening and Finishing

About three months before marketing, beef cattle, which are expected to be marketed and slaughtered, should be kept in a feedlot or a paddock and be fed high energy feed composed of various feed stuffs,

baggas, sugar cane top, molasses, whole-crop corn silage (containing foliage with grain), and some sort of feed grain if available, without grass or hay. Feeding cattle on the high energy feed will certainly improve the quality of beef carcass and up-grade its market ranking in the trade or export business. If feed grains are not available, adding molasses to the feed for beef cattle in feedlots is economically effective to supplement the energy.

The so called "feedlot" is composed of many feedlots or paddocks, each of which accommodates about fifty to one hundred cattle, and has a building for processing feed. The cattle in feedlots can exercise or move only slightly until marketing day; their restricted movement is helpful for better daily gain and beef carcass quality.

The location of the feedlot is primarily desired to be located between grazing pastures and regions which supply the feed. In the U.S.A., most commercial feedlots, that feed out almost one hundred thousand head of cattle per year, are located in areas with low rainfall or on poor land which is unsuitable to crop production. This is because the huge amount of animal excreta or waste can easily be disposed in these areas without causing any trouble of public pollution. In Costa Rica, I believe, the intensive operation of feedlots could economically utilize baggas, sugar cane top, molasses, and other agricultural by-products, in making animal products - with added-value - like beef and milk.

4.3 Suggestions

Regarding the future development of livestock industries in Costa Rica, this reporter would like to suggest the following.

4.3.1 Sheep Farming

In Costa Rica there is need to challenge the difficulties of animal production in droughty regions along the Pacific coast of the country, regardless of whether the irrigation project is completed or not.

Sheep farming is generally a popular and successful form of animal production in any drought ridden areas or deserts throughout the world. In Costa Rica, sheep farming should be set up for the purpose of producing both mutton and lamb skin, rather than wool whose demand is centralized mostly in the Australian market.

Before undertaking the project of sheep farming, some specialists of Costa Rican animal industries should visit Australia to select and purchase sheep of breeds suitable to the Costa Rican droughty regions and also to learn the technics of raising this animal. Recently Australians have improved successfully some Scottish breeds of sheep and developed a few tropical strains that can be raised in droughty or desert areas and that have dual purposes of lamb meat and lamb skin or wool.

This reporter believes that sheep farming in Costa Rica will surely become a hopeful phase of animal industry in place of existing cattle farming in drought ridden Peninsula de Nicoya and Puntarenas.

4.3.2 Artificial Breeding

Concerning artificial insemination in animals, I have already suggested some things about studying abroad in 4.1.2 (2) of this paper. In addition to that, the reporter would like to insist that it is desirable to send some animal breeding specialists or veterinarians to the National Institute of Animal Industries of Japan, Chiba Prefecture, for studying technics and practices of not only artificial insemination but also egg-transfer or fertilized egg transplantation in ruminant animals. The Japanese studies on egg-transfer have been regarded as the most advanced in the world.

The egg-transfer is the best way of effectively utilizing hereditable characters or genetic performances of excellent female animals of cattle and sheep. It is becoming a popular technic of animal breeding in Australia, the U.S.A., and Canada, where they are able to reproduce three to six times many more calves, which received hereditary traits that showed high economic performance from excellent breeding female-stock or mothers, through host mothers, who are only used for the purpose of transplanting some fertilized eggs from the above excellent female-stock and of producing a calf or calves, if there are twins.

4.3.3 Improvement of Grassland or Pasture

With regard to the operation of improving grassland, it is desirable to employ from the U.S.A. or Japan some scientists or specialists of creating and managing intensive grassland in Costa Rica. I would recommend Dr. Shigeharu Yoshida, professor emeritus at Tohoku University, Sendai, Japan, as one of the technical advisors on developing and managing the intensive grassland.

4.3.4 Feedlot Farming

At present, the conventional pattern of cattle farming in Costa Rica faces no one difficulty in particular except the problem of drought in the grassland in the western part of the country. Beef is one of Cost Rica's main export products which has been contributing to the national economy. Various and principal endeavor should be made, therefore, in the future production of beef. In this connection, I would like to advise the following.

(a) First, a few Costa Rican specialists of cattle farming or beef production should be sent to the U.S.A. to learn the various phases of the modern operation of intensive cattle

farming, including the so-called feedlot and also the U.S. Standard of beef-carcass grading or classification which was devised a couple of years ago by the U.S.D.A.

(b) It is desirable to contact and engage Dr. William H. Hale, professor of Arizone State University, Tucson, Arizona, and specialist of feed and the feeding of beef cattle, if intensive beef cattle farming or feedlot operations are needed to be established in Costa Rica in the near future.

CHAPTER V

AGRO-INDUSTRY AND OTHER MANUFACTURING INDUSTRY

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5.1 Role of Agro-Industry in Costa Rica

In spite of the generally high productivity of agriculture and cattle raising, the agro-(processing)-industry has not yet fully developed in this country. The agro-industry will fulfil mainly three roles in augmenting industrialization of the country.

(a) The first role is one of increasing value-added to agricultural products and thereby augmenting the income of farmers.

(b) The second role is expands and diversifies future exports of Costa Rica. At the same time, it is useful in substituting domestic goods for imported commodities. The foreign trade statistics indicate that a considerable amount of such goods as processed foods, edible oils etc. are imported every year. This has been one of the reasons why there has been an imbalance in Costa Rican international trade accounts, thereby causing a deficit. This indicates that there is some room for improvement. By the development of the agro-industry, these trade imbalances may hopefully be rectified.

(c) The last role served by the agro-industry is one of acting as a preliminary stage for developing a higher stage of industrialization. The agro-industry can stimulate the development of other allied industries and finally all kinds of modernized industries by training farmers and other laborers, including skilled workmen, while improving the infrastructure of rural areas. It also contributes to accumulation of technology and funds for advanced industry.

5.2 Summary of Agro- and Agro-Allied Industry in Costa Rica

Continuing the discussion on industries suitable to this area, I would like to summarize agro- or agro-allied industry in Costa Rica. It would be useful to identify which industries could be soundly developed in this planning area.

(a) Main Agro-Industries:

Cereals:

Paddy rice	.....	rice processing food
straw	.....	paper, board, feed
bran	.....	edible oil, soap material, feed
husk	.....	carbon, fuel
Corn	.....	starch, oil, gluten, feed corn processing, foods
Sorghum	.....	feed

Sugar, starch:

Sugar cane sugar	.....	sugar processing
molasses	.....	feed, fermentation products
baggasse	.....	board, paper, feed
Cassava	.....	food processing, starch, feed, fermentation products

Fiber:

Cotton fiber	.....	spinning and weaving
seed	.....	edible oil, feed
Mulberry	.....	silk
Sizal	.....	bag, rope, brush
Abaca	.....	rope, paper, cloth

Oil seed:

Soybean	.....	processed food, edible oil, feed
Coco palm kernel	.....	copra, edible oil, feed, processed food, carbon
husk	.....	rope, mat, cushion
flower	.....	liquor
Oil palm	.....	edible and industrial oil, feed
Peanut	.....	processed food, edible oil, feed

Sesame	.....	edible oil, feed
Caster	.....	industrial oil, fertilizer

Vegetables:

Vegetables	.....	canning, sauce, ketchup, juice

Fruits:

Banana, orange, mango, papaya, pineapple, etc.	.....	canning, bottling, dried fruits, powdered fruits, jam, marmalade, liquor

Special crops:

Coffee	.....	coffee processing
Cacao	.....	cacao processing, chocolate making
Citronella etc.	.....	essential oils

Animal husbandry:

Cattle, milk	.....	milk processing, butter, cheese, fermented milk
Cattle, swine meat	.....	refrigerated meat, canning, smoking, drying, tallow, lard
hide	.....	tanning
waste (bone, blood etc.)	.....	gelatin, feed
Fowl	.....	meat processing, egg processing, feed

Marine products:

Fish	.....	refrigerating, canning, salting, drying, smoking, fish meal, edible and industrial oil
Lobster, prawn, shrimp	.....	canning, refrigerating
Shell	.....	canning

Forestry:

Wood	.....	furniture, veneer, plywood, tipboard, charcoal curing

Others:

Beekeeping	.....	honey, beeswax
Wild animal and bird	....	stuffed products, tanning
Cane	.....	cane works

(b) Main Agro-Allied Industries

Fertilizer and Soil Improver

Most synthetic fertilizers, such as ammonium sulfate required in Costa Rica, are now supplied by a factory located near Puntarenas Port. There is some demand for urea fertilizer. But unless the market for this kind of fertilizer is suddenly enlarged, there will be no possibility to establish another synthetic fertilizer factory. Lime is, however, a very important soil improver as a nuetraizing agent of acidic soil in this country.

Agricultural Machines and Tools

Supply of good agricultural machines and tools is indispensable for good and efficient farming. Furthermore, it is important to maintain these machines and tools by continual repair.

Insecticides and Pesticides

It would improve considerably the economy to examine the insecticide and pesticide distribution systems, including economies of scale in importing larger bulk and packaging for domestic distribution.

Seed Center

There should be further improvement in existing certified seed centers and establishment of new centers, stressing the distribution of certified varieties of seeds together with the appropriate extention services.

Facilities for Cleaning, Drying, Storage and Milling of Farm Products

These facilities are essential for raising productivity in agriculture and it allied industries.

Fishing Boat Construction

A small fishing boat industry has not yet developed sufficiently to cope with expected needs. Cultivation of this industry is an urgent requirement for the further development of fishing.

Fishing Nets and Tools

For the same reasons mentioned above, these industries must also be considered.

All Sorts of Containers for Agro-Based Products

Gunny (jute) sacks, metal cans, glass or plastic bottles, plastic bags and other containers are indispensable for the sound and efficient processing and distribution of agro-based products.

Facilities for Ice Making and Refrigeration

For processing and distribution of fresh agro-based materials and products, these facilities are indispensable especially in a warm climate like the planning area.

5.3 Agro- and Agro-Allied Industries in the Planning Area

5.3.1 Structure of Planning Area

At the present stage, it seems that agro- and agro-allied industries in the planning area have not sufficiently developed. Difficulties of developing these industries are attributed to the following causes:

(a) There is a scarcity of raw materials in local production, except for marine products caught in nearby seas. Therefore, the main source of supply should be sought from other regions as well.

(b) The hot climate in this area is rather inadequate to process and preserve fresh agro-products in good condition. Therefore, the types of industries chosen should be such that the temperature itself does not bear a major influence on these goods.

(c) There would be shortages in the present high quality labor force; people living on the highlands might refuse to move or commute to work on the lowlands, thus delaying development.

(d) This area itself would not be cosidered capable to provide a sufficient consumer population for the final products. Therefore, the main market should be sought elsewhere.

(e) There has been no satisfactory infrastructure for developing industry. The lack of an adequate port, good transportation system, suitable residential area etc. make this area less advanced.

New planning to improve the infrastructure of this area is being undertaken now. Some of these defects will be diminished gradually through these new plans.

In the near future this area will become strategically important for the economy of this country. This area, moreover, should be located at the intersecting point of two cross lines connecting, on the one hand, the capital at San Jose with Costa Rica's largest foreign trade port on the Pacific coast and, on the other, the northern and southern rural areas of Puntarenas. It is also well-situated for transshipment via the Pan American Highway, or production of manufactured goods to be sold in the Central American Common Market. The flow chart of raw material and products is illustrated in Figure 5.1.

5.3.2 Selection of Suitable Industries

Some of the above mentioned agro- or agro-allied industries will be suitably adopted in this flow sheet. On the other hand, the development of the hinterland of Caldera and Puntarenas ports should probably parallel the development of tourism and industry. In order to encourage a clean and cheerful environment for tourists and to cultivate sound industries, the establishment of an industrial park should be recommended. Then, considering these conditions, the industries adopted in this area would be classified into the following three groups.

(a) Marine Product Processing Industries

Although the sea along the Gulf of Nicoya and the Pacific coast are supposed to be rich in marine resources such as fish, prawn and shrimp, at present these species of marine life are not fully exploited. The development of fishing is presently being plan with the aid of the IDB and other foreign countries. The above mentioned species are high profit resources for marine product processing. As marine product processing is closely related to the function of a fishing port, these processing factories could be located on the outskirts of a fishing port in Puntarenas as part of an industrial park.

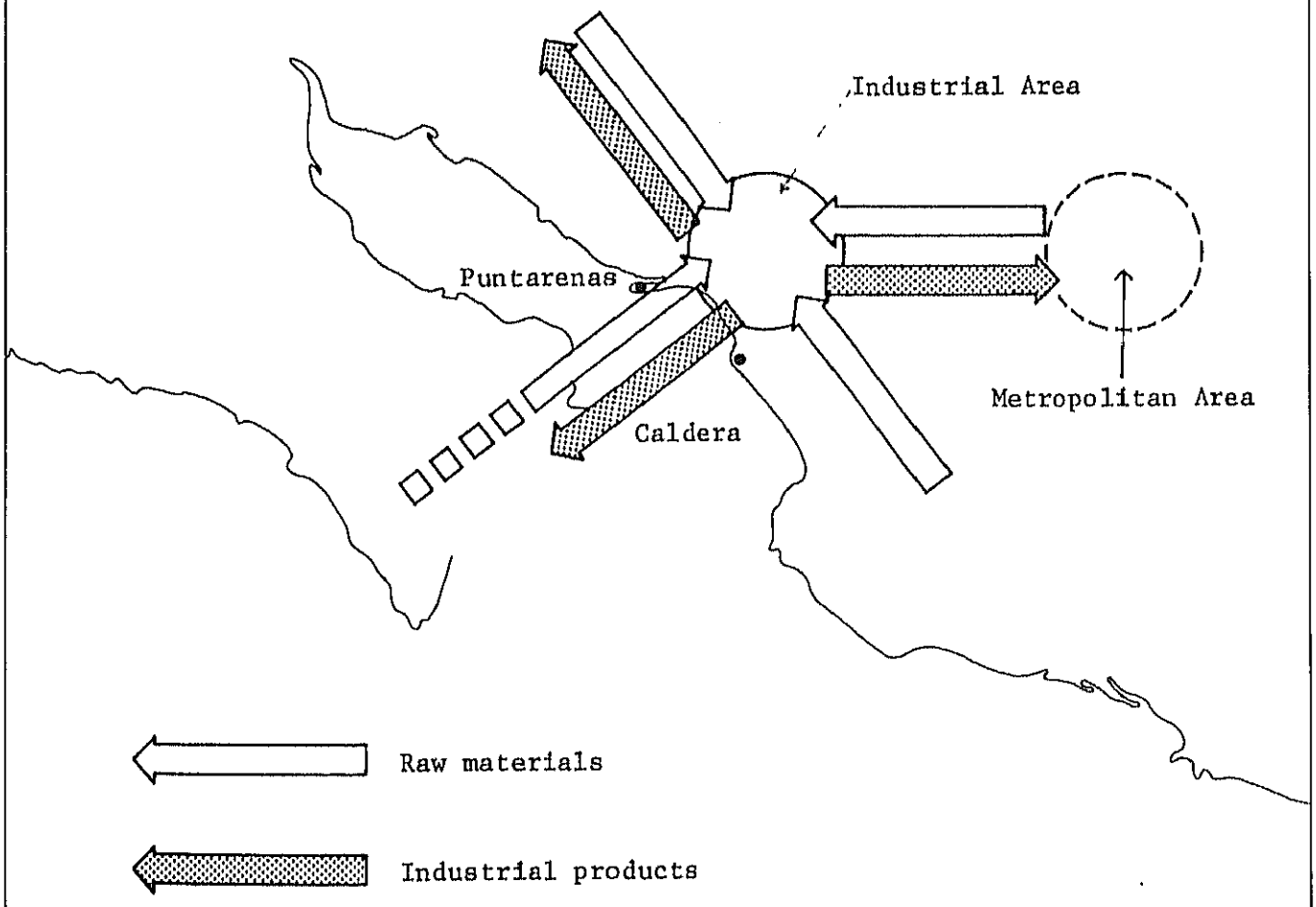
In the area of Puntarenas port there are now several marine product processing factories, including those which refrigerate or can marine products. It may be advisable that most of these factories could be moved to a newly established industrial park, in view of the fact that the existing plants are too antiquated and the present site is too narrow to avoid polluting the sea water from the drainage of these factories.

In the past, effluents from marine product processing factories were a principal source of environmental pollution also in Japan. But in present modern factories, this problem has been almost resolved.

In tuna canning, for example, not only the meat but all parts of the fish are reasonably and perfectly utilized as by-products so that wastes are minimized. This system is summarized as follows:

1) Fish heads, bones, fins and tails are boiled under pressure, dried and pulverized in order to make feed ingredients.

Figure 5.1 Flows of Raw Materials and Products



2) The viscera and blood are decomposed by an enzymeaction process and dried to become feed ingredients.

3) The residual syrup in the boiling kettle is concentrated, and used as an ingredient of condiment sauces in the food-processing industry.

4) Then, the minimized waste, which remains mainly in the wash water that was used in the process, is treated by biological oxidation method to become innocuous water and then is discharged.

5) The malodor caused by the putrefied fish ingredients is minimized effectively by constantly treating the fish while in a fresh state.

(b) Animal Husbandry and Farm Product Processing Industries

As animal husbandry is a main agricultural industry in this country, processing its products could be a most promising agro-industry. There are several slaughter houses on the transportation routes connected to this area. Both the products and by-products from these slaughter houses should be efficiently processes. The main port for these products could be exported from the port at Caldera to foreign countries.

On the other hand, farm products produced in northern and southern Puntarenas could also be a important raw materials for the agro-industry.

These factories could most appropriately be taken in inland industrial estates which are located in several places in the hinterland of Caldera and Puntarenas Ports.

(c) Other Processing Industries

Except for the agro- or agro-allied industries as mentioned above, some light or duty industries, whose operations are closely connected with the function of the new port at Caldera, could be developed in the near future, keeping pace with the strengthening of infrastructure in this area. An industrial park consisting of these industries should be located on the seaside near the new port. The factories included in this park are, for example, as follows:

plywood manufacturing
plastic processing
ship building (small scale)
machine repairing
machine assembling

For developing tourism, it is essential that attractive and good quality souvenirs be made.

At present, this industry seems very underdeveloped. Although this industry should be classified as a type of cottage industry, it should be encouraged nevertheless.

5.3.3 Strategy for Development of Agro- or Agro-Allied Industries

The success of agro- or agro-allied industries basically depends on whether agricultural products are supplied with high productivity, i.e. with low cost, in large quantity having good and uniform quality, constant supply and so on. These factors are indispensable for sound development of any kind of these industries.

The recent failure, for example, of factories making feed from cassava is attributed to the lack of basic strategy from the aspect of cost of cultivating.

The exploitation of foreign markets for agro- or agro-allied processing products would encourage more difficult problems. Continuous study of foreign markets vis-a-vis life styles, trends, law, hygienic regulations regarding food in recipient countries, competition with similar products from other exporting countries etc. must be undertaken. There should be a strictly followed strategy for united efforts of both government and people.

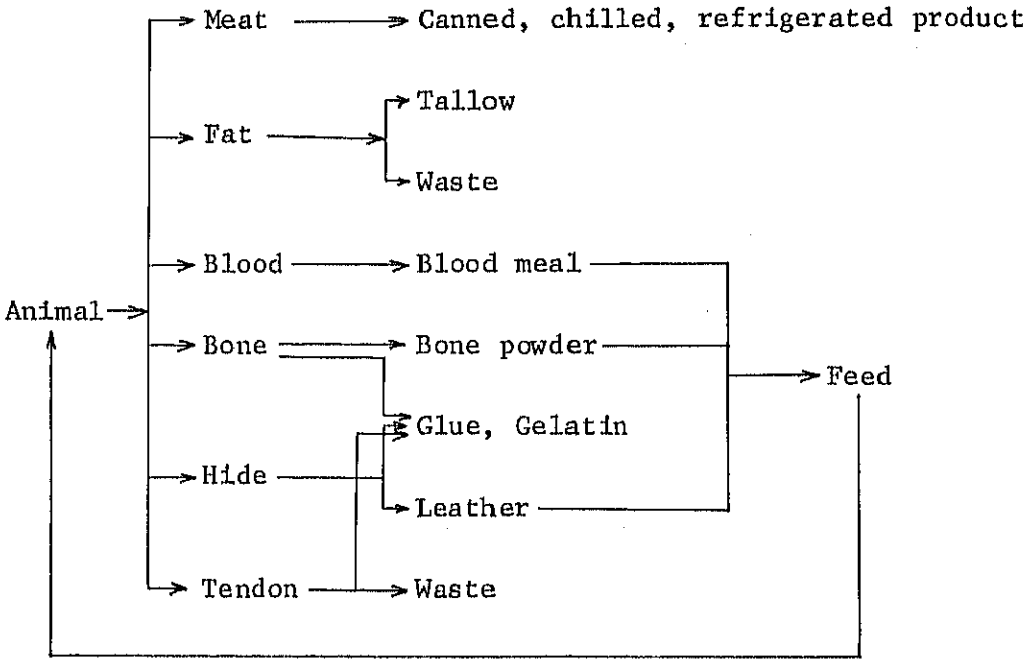
In general, the development of agro-industry may be divided into three categories.

The first category concerns the agro-industry in which raw materials are already sufficient both in quantity and in quality. The animal-processing industry in Costa Rica is in this category. Efforts should be taken to fully utilize these materials and the value-added factor of its products. This is illustrated in figure 5.2. Development of industry in this category could be undertaken immediately and most easily and, moreover, is strategically very important.

The second category concerns the agro-industry in which raw materials presently exist and are utilized, but whose quantity is insufficient to expand the industry beyond the present level. Most marine-product processing industries are in this category. To expand these processing industries, increased production of material in the fishery industry is essential.

The last category concerns raw materials which as of yet do not exist in present stage of development, but the future exploitation of these materials is expected to be potentially feasible in and approximate to this region. Production of pineapple for canning might be one case in point. From an agricultural standpoint a feasibility study should be undertaken to investigate these potential industries.

Figure 5.2 Perfect Utilization of Animal Products



5.4 Candidate of Agro-Based or Agro-Allied Industry in This Area

Taking into consideration all the conditions mentioned above, the following kinds of agro- or agro-allied industries are chosen as candidates suitable for introducing in this area. A feasibility study should follow this report, aided by experts in and out of this country.

5.4.1 Description of Main Factory

(a) Marine Products Processing Factories

(1) Refrigerated Shrimp Factory

There appears to be great potential for catching and culturing prawn and shrimp in and out of Nicoya Gulf. According to MAG sources, however, the catching of shrimp in this Gulf is not possible above the present level of catch, but in other areas the potential is supposedly large.

These products then should be refrigerated for export and domestic distribution. Their main foreign markets are the U.S. and Japan. There are one large-scale farming pond nearby and several refrigerating factories in Puntarenas Cape, indicating much room for future expansion of this industry.

(2) Sardine Canning Factory

According to MAG sources, however, biological conditions may inhibit an increase in sardine fishing in the long-run. In recent years, however, other areas along the Pacific coast of Costa Rica, besides the Nicoya Gulf, have become increasingly important as sardine fishing grounds. (See Figure 5.3)

Presently one sardine canning factory is operating in Puntarenas Cape. By strengthening the fishing fleet, however, establishment of one of more factories of this kind might be appropriate and possible. These products should be also exported to foreign countries.

(3) Tuna Canning Factory

This is one of Costa Rica's most promising processing industries of marine products. MAG's fishing department considers 30,000 tons of tuna to be a realistic figure for potential capture in Costa Rican waters. This figure is even well above the 2,000-odd tons caught at present by Costa Rican tuna boats.

There is only one tuna canning factory in Puntarenas Cape. This industry should be encouraged by strengthening the fishing fleet. The U.S. may be a good foreign market of canned tuna, but some agreement about the frame of export quantities must be determined between both governments. (See Figure 5.4)

(4) Fish Meal Factory

Fish meal as a component of mixed feed is also one of the most promising industries in this country. People in this country do not eat much fish in their daily diet. Such raw materials are abundantly obtainable from inedible fish caught in nearby seas and from the fish wastes of fish processing factories. As fish meal consists of rich proteins and minerals, it is a valuable and important feed ingredient. But in the case of processing miscellaneous fish, care should be taken not to inter-mix poisonous fish. Although it is a troublesome task, poisonous fish must be culled and rejected out by hand.

(b) Animal Husbandry and Processing Factories of Farm Products

(5) Canning Factory for Sliced Beef

One of the biggest agricultural products in this country is beef. So the canning of sliced or processed beef such as corned beef for export is a most promising agro-industry in this country. This factory should be connected with the existing or newly established adjacent slaughter house. Japan, however, is not a good market for canned beef, except for corned beef. Japan imports most of its beef from Australia and New Zealand in the form of chilled or refrigerated fresh beef.

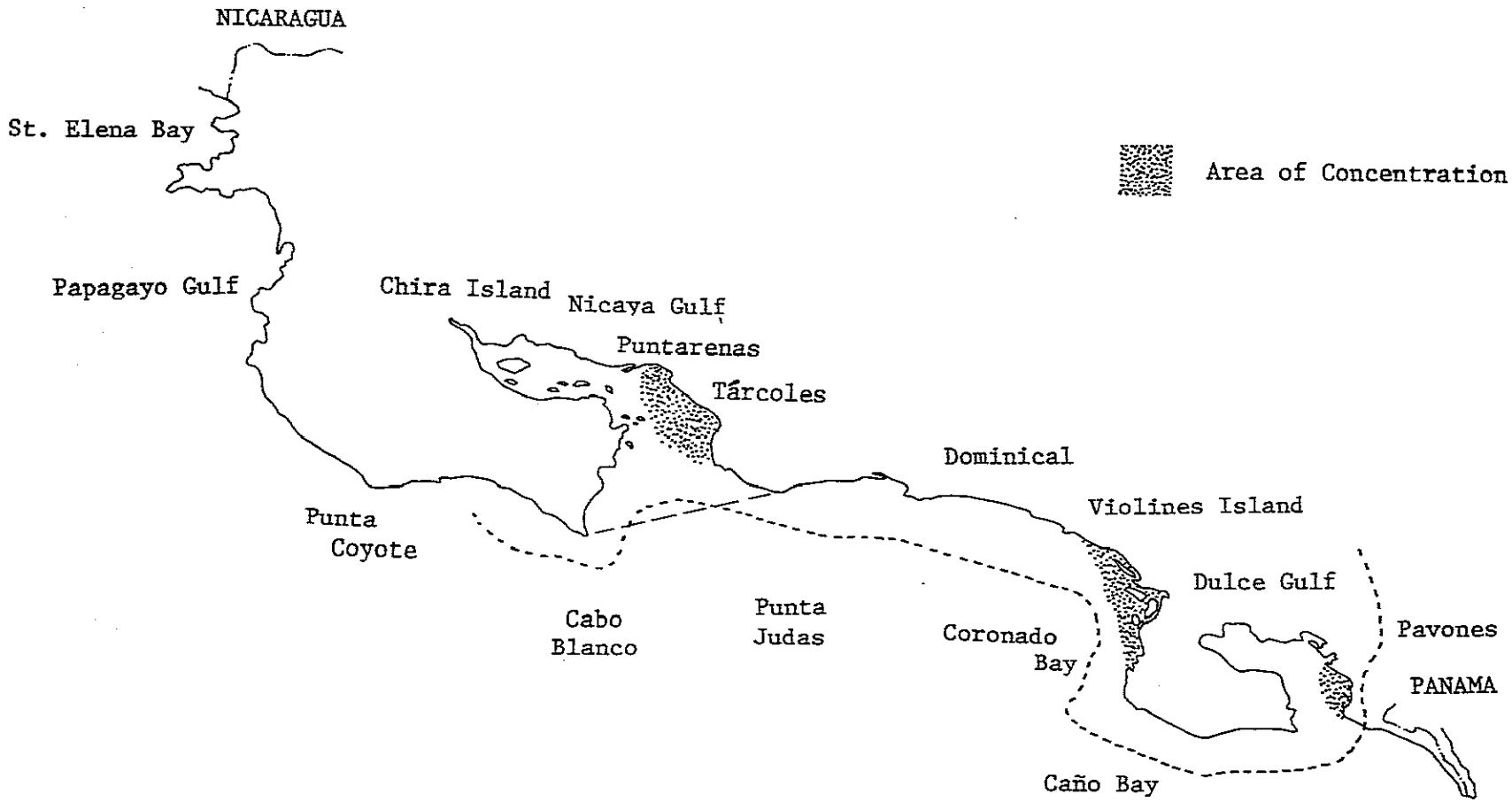
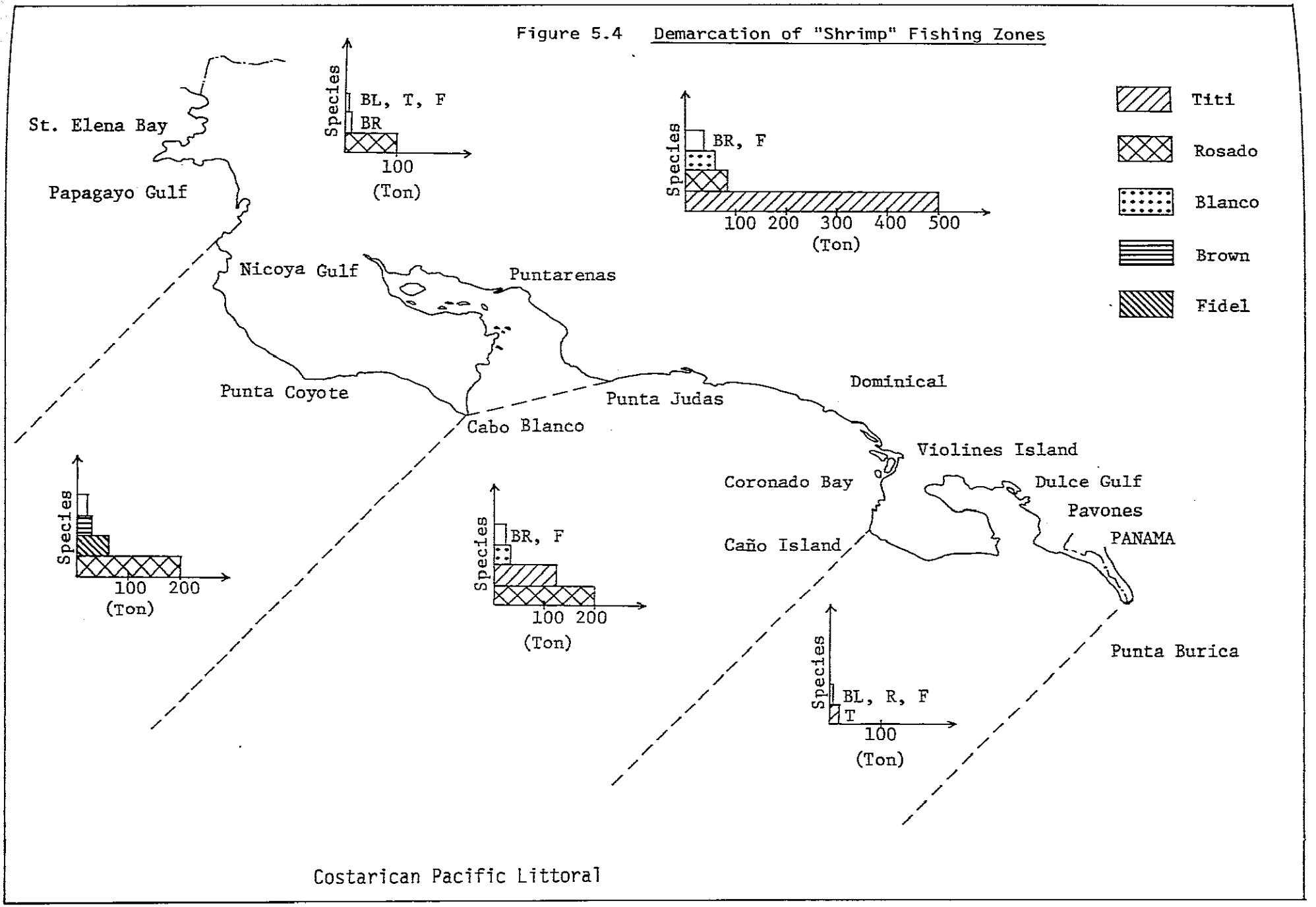


Figure 5.3 Principal Areas of Concentrated Sardine Spawning Areas and Fishing Zones

Figure 5.4 Demarcation of "Shrimp" Fishing Zones



(6) Tanning Factory

Although there is an abundance of cattle hide, the tanning industry seems to be far behind that in foreign countries. To improve tanning technics by the aid of foreign experts is an urgent problem for the development of Costa Rica's agro-industry. This factory should be connected with the slaughter house. Leather and finished products of tanning will have a big market in and out of this country. Japan is importing much semi-processed hide from other countries.

(7) Gelatine Factory

Gelatine is extracted from beef waste such as bone, bone marrow, hide, tendons etc. It has a large market throughout the world, used as a material in photographic film, food processing etc. This is, then, one of the export industries with the brightest future. This also should be connected with the slaughter house.

(8) Rendering Factory

This factory too should be connected with the slaughter house and sliced beef factory. From the waste of these factories, tallow and feed materials are obtained by rendering. Industrial grade tallow is used as material for soap making and other oil and fat processing, while refined tallow obtained from the sliced beef factory can be used as edible fat.

(9) Mixed Livestock Feed Factory

For Costa Rica animal husbandry mixed feed is an important factor. Although pasture is the main cattle feed in this country, some concentrated mixed feeds of good quality are essential for fattening cattle before slaughter, or for stimulating lactation in cows. This is also one of the most promising industries if the price of products would be adequate. The relevant raw materials obtainable in this country are as follows:

Corn, sorghum, cassave, oil cake, molasses, fish meal, bone meal, blood meal etc.

These ingredient must be combined properly. Among these ingredients, fish meal and oil cake, being rich in protein, are the most important. Mixed feed, however, can seldom be exported, because every country generally mixes its own feed.

(10) Factory for Processing Fruits and Vegetables

As mentioned above, Costa Rica is endowed with many kinds of fruits. Canning and bottling them should be considered. In this area mango, cashewnut, citrus, papaya, tamarindo and aguacate are cultivated. These fruits could be processed by canning or bottling. But it

must be remembered that in the international market, these products are less popular than those such as pineapple or oranges. On the other hand, canning or bottling of sauce, ketchup, vegetable juice etc. also should be considered.

(11) Factory for Wood Products

In Costa Rica there is an abundance of good quality wood. It will be possible to develop the wood processing industries such as furniture making for export.

Table 5.1 Principal Cultivation of Fruit Trees

(Cantons: Orotina, Esparza, San Meteo and Atenas)

Species	No. of Trees	Cultivated Hectares	Estimated Production
1. Mango	17,085	335	10.2 million unit
2. Cashew-nut	208,108	1,020	41.2 million unit
3. Citric	35,736	175	35.7 million unit
4. Papaya	67,783	60	4,744 tons
5. Tamarind	3,245	37	447 tons
6. Avocado	9,185	180	N.A.
Total		1,807	

Source: Centro Agricola Regional, Region Pacifico Centro

(c) Agro-Allied Industries

(12) Factories Constructing Fishing Boats

As mentioned above these facilities should be enlarged to strengthen fishing capacity. Now a plan to establish a boat building factory is being prepared. But considering the scale of fishing in the future, these facilities should be considered preponderant.

(13) Ice Factories

In the near future, in order to keep pace with the rapid increase of amount of fish caught, the demand for ice used in fish storage will be greatly increased. It is advisable to establish one or more model factories having high operating efficiency.

(14) Insecticides and Pesticides Factories

There are a presently several factories producing insecticides and pesticides. But for new crops, especially rice, it seems there is still room to establish another factory. This factory should also be strategically located for marketing to other Central American countries. This factory should be subdivided into production, mixing and packaging bulk chemicals.

(15) Lime Factory

While lime is, as mentioned above, an essential chemical for improving acidic soil which is inadequate for vegetable cultivation, establishment of this factory should be considered. But as the cost of this kind of product largely depends on transportation costs, it must be determined which is more economical to transport either as heavy compact raw material or as light but bulky final product.

5.4.2 Approximate Unit Scale of Each Factory

The list is shown in Table 5.2.

These items show approximately the smallest factory scale in the initial development stage. Keeping pace with the development of industry, therefore, these units should be multiple or be enlarged to a larger scale.

Table 5.2 Approximate Unit Scale of Each Factory

Classification	Site (m^2)	No. of Employee	Remarks
1. Refrigerated shrimp factory	3,000	50	material 600 t/year
2. Sardine canning factory	5,000	300	material 2,000 t/year
3. Tuna canning factory	5,000	150	material 3,000 t/year
4. Fish meal factory	4,000	30	product 10,000 t/year
5. Canning of sliced beef factory	5,000	150	material 4,000 t/year
6. Tanning factory	3,000	100	
7. Gelatine factory	2,500	50	
8. Rendering factory	3,000	50	
9. Combined feed factory	3,000	150	product 2,000 t/year
10. Factory of processed fruits and vegetables	5,000	250	material 4,000 t/year
11. Factory of wood products	3,000	50	
12. Fishing boat building factory	5,000	50	boat 24/year
13. Ice factory	3,000	30	product 100 t/day
14. Insecticides and pesticides factory	3,000	150	
15. Lime factory	3,000	50	product 100,000 t/year

CHAPTER VI

INDUSTRIAL PARK

CHAPTER VI

INDUSTRIAL PARK

6.1 Present Conditions of Industrial Locations

6.1.1 Nation-Wide View of the Situation.

Conditions of regional distribution: In short, the most prominent characteristic of a nation-wide pattern of industrial locations is the concentration of major factories within the metropolitan area of San Jose. Major factories in other areas are very few in number; small- and medium-sized factories are so widely scattered that a concentrated pattern of these factories in other local areas can hardly be found. Thus, the concentration in metropolitan areas is extremely heavy.

In Table 6.1 and 6.2, the number of factories by province according to the 1964 Industrial Census can be seen. In Table 6.2, factories employing more than 50 persons were counted and classified by the employment size. This is to understand their development trends. These tables were arranged especially for this research.

These tables indicate the about 80 percent of the nation's factories are concentrated in Meseta Central which includes the metropolitan area of San Jose and its surroundings. Furthermore, 90 percent of the major factories are located here. Figure 6.1 is a country map of industrial locations broken down by cantons and number of factories. Looking both at the pattern of spatial distribution of Figure 6.1 and of the pattern of topography and urban location of Figure 6.2, the tendency towards concentration of factories in the Meseta Central is glaring. This concentration is especially noticeable in San Jose and its surroundings, cantons. From a macro-perspective there is a clear pattern of centripetal development.

Table 6.1 Number of Factories and Employees by Province (1964)

Province	Number of Factories		Number of Employees	
1. San Jose	2,492	(42.9%)	19,355	(58.2%)
2. Alajuela	1,088	(42.9%)	4,826	(14,5%)
3. Cartago	698	(12.0%0	3,169	(9.5%)
4. Heredia	381	(6.0%)	1,946	(5.8%)
1 to 4	4,659	(80.2%)	29,296	(88.0%)
5. Puntarenas	481	(8.3%)	1,876	(5.7%)
6. Guanacaste	477	(8.2%)	1,187	(3.6%)
7. Limon	191	(3.3%)	895	(2.7%)
5 to 7	1,149	(18.8%)	3,958	(12,0%)
COSTA RICA	5,808	(100%)	33,254	(100%)

Source: Tercero Censo de Industrias Manufacturenas, 1964

Table 6.2

(1) Number of Factories (Employing more than 50 Persons) and Employees by Province (1964)

Province	50-59 Persons	60-69 Persons	70 or more Persons	Total (50 +)
1. San Jose	13	12	39	64 (73%)
2. Alajuela	2	0	6	8 = 79 (90%)
3. Cartago	1	1	3	5
4. Heredia	1	0	1	2
5. Puntarenas	1	0	4	5
6. Guanacaste	1	1	0	2 = 8 (10%)
7. Limon	0	0	2	2
COSTA RICA	19	14	55	88 (100%)

Source: Industrial Census (original data sheets)

(2) Number of Employees and Factories (1964)

Total Employees	50-59 Persons	60-69 Persons	70 or more Persons	Total (50 +)
33,254	1,050	909	7,330	9,289
(100%)	(3)	(3)	(22)	(28)

Source: Industrial Census, 1964 (Cuadro 52)

(3) Factories with More than 50 Employees by Region

Area	No. of Factories	Employees
° Cantons in Meseta Central	127 in M.A.	18,720
° Northern Part of Puntarenas Province	65 in its surroundings 5 in Putarenas	10,463 893
Total	197	30,077

Source: Industrial Census, 1975

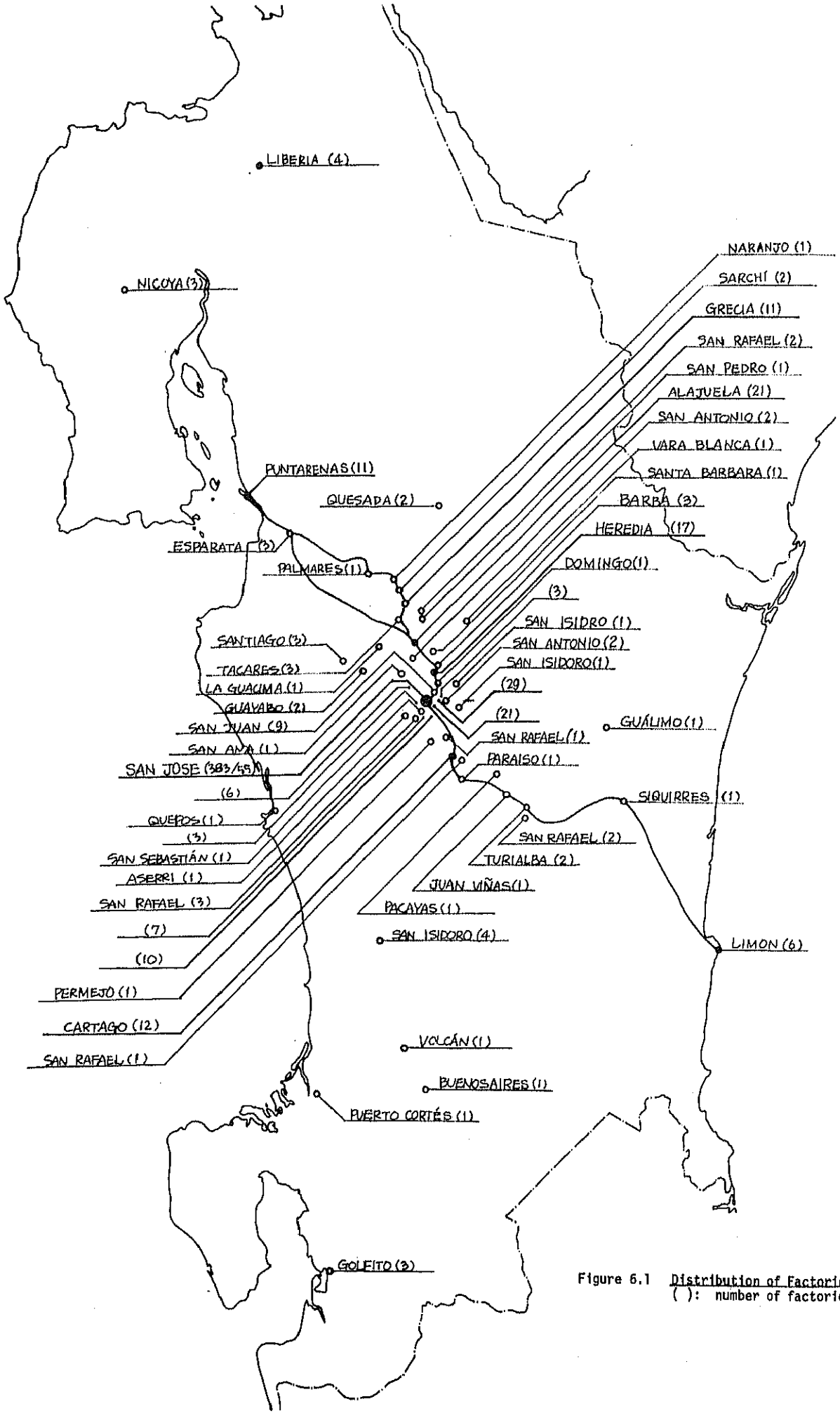


Figure 6.1 Distribution of Factories
( ): number of factories

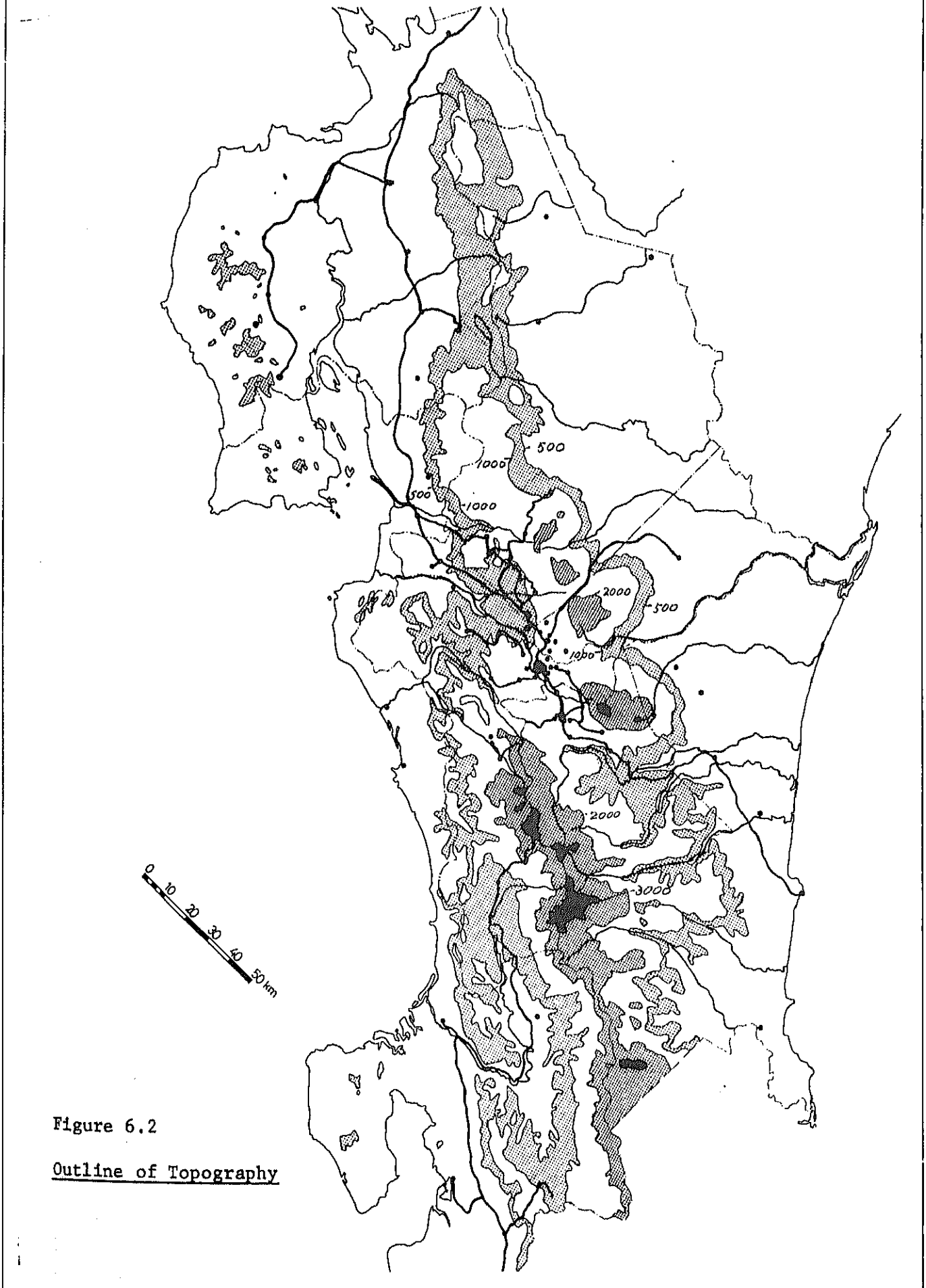


Figure 6.2

Outline of Topography

6.1.2 Long-Term Changes

At present, the 1964 census, made about 10 years ago, is the only available basic data on factories. The changes in each region from 1964 to now, however, are of central interest.

Facts concerning the above points are discussed in brief both section 6.2.1 which concerns San Jose metropolitan area and in section 6.2.2 concerning Puntarenas. The fact that the number of factories has doubled and employees tripled an average annual rate of increase of nearly 12 percent cannot be missed.

Recent statistical data could not be obtained even from the 1975 Industrial Census, which has already been completed but not yet been processed. Recent tendencies of manufacturing industries' to concentrate in specific locations is difficult to grasp. However, thanks to the cooperation of the Bureau of Statistics, factories larger than a certain size (over 50 employees) have been listed, this has helped to estimate certain trends.

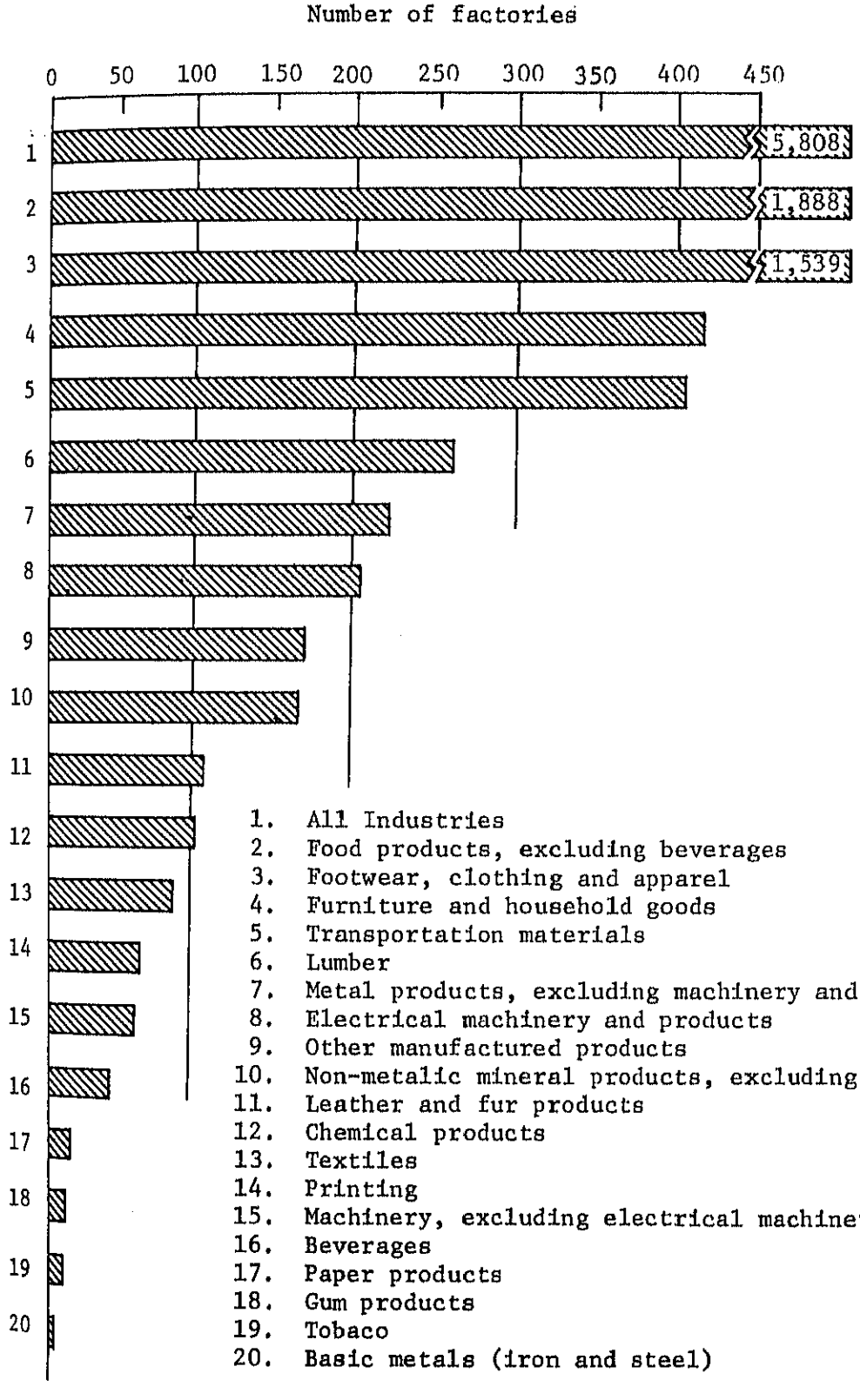
6.1.3 Characteristics of Industrial Types

Concerning manufacturing industries, Figure 6.3 illustrates the number of industries classified by industrial composition according to data from obtained through the 1964 census. The majority of the most factories (3,400) are comprised of two industries - in approximate figures - food (1,900) and footwear, clothing and apparel (1,500). This number approximates nearly 60 percent of all factories (5,800). But in both of these industries, small-sized workshops or household industries lacking non-household employees have been included. Fifty percent of the food industry and 80 percent of the apparel industry consists of these small-scale factories. Factories having less than 20 employees comprise 90 percent of both industries. It should be taken into consideration that other types of industries also are household or small-scale enterprises.

The structure of the manufacturing industry is pyramid-shaped - the smaller the size of enterprise the more their number and the larger the enterprise the less their number. This is the general characteristic of existing industries (See Figure 6.3). But it should be noted that the distribution of the numbers of employees has a slightly different feature. (Table 6.3)

The total number of factories (classified by the factory's size) and employees (classified by the type of industry). According to this table, manufacturing industries can be classified into two types: that is, many small-scale manufacturing enterprises employing only a few employees per firm but the majority of employees nation-wide and a few factories employing many employees. In a field where large factories which are few in number are dominant, some industries must tend to utilize a mass production method. This can be assumed even in the current development of Costa Rican industry.

Figure 6.3 Total Number of Factories According to Classification of Industry (1964)



1. All Industries
2. Food products, excluding beverages
3. Footwear, clothing and apparel
4. Furniture and household goods
5. Transportation materials
6. Lumber
7. Metal products, excluding machinery and transport equipment
8. Electrical machinery and products
9. Other manufactured products
10. Non-metalic mineral products, excluding petroleum and carbon
11. Leather and fur products
12. Chemical products
13. Textiles
14. Printing
15. Machinery, excluding electrical machinery
16. Beverages
17. Paper products
18. Gum products
19. Tobaco
20. Basic metals (iron and steel)

Table 6.3 Number of Factories and Employees by Size and Classification

Size of Enterprise Based on Employment	Total Industries and Employees			Food			Foot Wear		
	No. of Enterprise	Personnel		No. of Enterprise	Personnel		No. of Enterprise	Personnel	
Total	5,808	33,254	(100%)	1,888	12,282	(100%)	1,539	4,487	(100%)
0	3,370	5,903	(18)	998	2,401	(20)	1,162	1,466	(33)
1 - 4	1,387	4,702	(14)	426	1,565	(13)	287	892	(20)
5 - 9	509	3,963	(12)	266	2,111	(17)	39	298	(7)
10 - 19	281	4,064	(12)	111	1,566	(13)	24	349	(8)
20 - 29	94	2,288	(7)	37	931	(8)	6	141	(3)
30 - 39	53	1,841	(6)	14	483	(4)	6	220	(5)
40 - 49	26	1,204	(4)	15	694	(6)	1	58	(1)
50 - 59	19	1,050	(3)	5	265	(2)	5	275	(6)
60 - 69	14	909	(3)	1	66	(1)	4	261	(6)
70 -	55	7,330	(22)	15	2,200	(18)	5	526	(12)

	Furniture			Transportation Materials			Electrical Production machinery		
Total	417	1,616	(100%)	407	1,506	(100%)	205	481	(100%)
0	235	348	(22)	210	339	(22)	146	178	(37)
1 - 4	131	430	(27)	138	435	(28)	50	160	(33)
5 - 9	25	189	(12)	34	255	(16)	4	33	(7)
10 - 19	17	271	(17)	16	224	(14)	3	53	(11)
20 - 29	3	78	(5)	4	92	(6)	1	21	(4)
30 - 39	1	31	(2)	2	69	(4)	1	36	(7)
40 - 49	2	97	(6)	2	85	(5)	-	-	-
50 - 59	2	110	(7)	-	-	-	-	-	-
60 - 69	1	62	(4)	1	61	(4)	-	-	-
70 -	-	-	-	-	-	-	-	-	-

(con't)

Number of Factories and Employees by Size and Classification

Size of Enterprise Based on Employmenet	Textile			Printing			Beverages		
	No. of Enterprise	Personnel		No. of Enterprise	Personnel		No. of Enterprise	Personnel	
Total	89	2,280	(100%)	67	1,452	(100%)	47	883	(100%)
0	53	162	(7)	10	19	(1)	1	1	(0)
1 - 4	4	11	(0)	16	59	(4)	22	89	(10)
5 - 9	4	35	(2)	19	155	(11)	11	90	(10)
10 - 19	3	47	(2)	7	113	(8)	6	79	(9)
20 - 29	3	72	(3)	2	53	(4)	2	49	(6)
30 - 39	7	234	(10)	4	144	(10)	-	-	-
40 - 49	1	41	(2)	1	46	(3)	-	-	-
50 - 59	1	59	(3)	-	-	-	-	-	-
60 - 69	2	127	(6)	2	133	(9)	2	133	(15)
70 -	11	1,492	(65)	6	730	(50)	3	442	(50)

	Machinery			Paper Products			Indian Rubber (Gum)			Tabacco		
Total	64	516	(100%)	19	430	(100%)	16	279	(100%)	15	260	(100%)
0	19	30	(6)	2	7	(2)	6	13	(5)	11	28	(11)
1 - 4	17	46	(9)	2	10	(2)	3	12	(4)	1	5	(2)
5 - 9	11	81	(16)	6	56	(13)	2	11	(4)	1	7	(3)
10 - 19	7	96	(19)	4	55	(13)	4	64	(23)			
20 - 29	7	161	(31)	1	21	(5)	-	-	-	1	21	(8)
30 - 39	3	102	(20)	1	30	(7)	-	-	-			
40 - 49	-	-	-	1	43	(10)	-	-	-			
50 - 59	-	-	-	-	-	-	-	-	-			
60 - 69	-	-	-	-	-	-	-	-	-			
70 -	-	-	-	2	208	(48)	1	179	(64)	1	199	(77)

(con't)

Number of Factories and Employees by Size and Classification

Size of Enterprise Based on Employement	Lumber			Chemical Products			Non-Metalic Mineral Products		
	No. of Enterprise	Personnel		No. of Enterprise	Personnel		No. of Enterpirse	Personnel	
Total	261	1,793	(100%)	103	1,500	(100%)	167	1,303	(100%)
0	105	200	(11)	20	31	(2)	82	204	(16)
1 - 4	88	293	(16)	35	124	(8)	48	176	(14)
5 - 9	25	187	(10)	17	131	(9)	11	77	(6)
10 - 19	29	440	(25)	13	186	(12)	9	131	(10)
20 - 29	5	119	(7)	7	165	(11)	10	248	(19)
30 - 39	5	186	(10)	3	99	(7)	3	100	(8)
40 - 49	1	44	(2)	-	-	-	1	49	(4)
50 - 59	1	62	(3)	1	58	(4)	2	108	(8)
60 - 69	-	-	-	1	66	(4)	-	-	-
70	2	262	(15)	6	640	(43)	1	210	(16)

	Metalic Products			Other Mmufactured Goods			Leather			Basic Metals (Iron & Steel)		
Total	223	1,011	(100%)	171	542	(100%)	107	470	(100%)	3	9	(100%)
0	139	221	(22)	117	165	(26)	54	90	(19)			
1 - 4	54	159	(16)	34	125	(19)	28	102	(22)			
5 - 9	15	112	(11)	8	55	(9)	11	80	(17)			
10 - 19	8	110	(11)	7	103	(16)	13	177	(38)			
20 - 29	2	43	(4)	2	51	(8)	1	22	(5)			
30 - 39	2	77	(8)	1	30	(5)	-	-	-			
40 - 49	1	47	(5)	-	-	-	-	-	-			
50 - 59	-	-	-	2	113	(18)	-	-	-			
60 - 69	-	-	-	-	-	-	-	-	-			
70	2	242	(24)	-	-	-	-	-	-			

(a) Typical examples of industries where small-scale factories are overwhelming in number;

i) Food excluding beverage;
ii) Clothing and
iii) Furniture.

However there are a few large-scale food enterprises and medium-scale furniture enterprises.

(a') Industries with a comparatively large number of small-scale factories employing many persons, comparable to those industries listed in (a) above, but still lacking development on a large-scale;

i) Transportation materials
ii) Electric appliances.

(b) Industries controlled by fairly large-scale factories;

i) Textiles
ii) Printing
iii) Beverages
iv) Machinery
v) Paper products
vi) Rubber products
vii) Tobacco.

(c) Industries other than the above and those (including medium scale factories) having both large- and small-scale factories:

i) Lumbering and wood products (excluding furniture)
ii) Chemical products and materials
iii) Cement products and non-metalic mineral products
iv) Metalic goods and manufactured products
v) Miscellaneous products
vi) Leather and fur products.

(d) Other industries which are very rare;

Basic metals

Industries such as those in (c), including medium-scale factories, may be further subdivided even though they belong to the same industrial classification into those which manufacture slightly different types of products and into those that mutually supplement each other's production by having different stages of production while belonging to the same production group for the same product. Furthermore, products may be divided by their difference in quality into those produced either by fairly large-scale factories principally or by small-scale enterprises. Even the same products may be qualitatively different. In this case, the former mentioned factories appear to be a mass-production type and the latter type manufacturing order-made products. But, poor quality products do not always come from small-scale factories. This fact is an important one that is related to target industries future development planning of industrial parks. General research on each industry should follow and be based on detailed research that is expected to be undertaken.

Generally, the location of industry using mass production is determined by the size of the market areas and the labor supply. But factories manufacturing order-made or various products in small amounts must depend on the quality of labor and technological ability. This should be noted.

6.1.4 Some Subjects to Be Considered

On promoting regional development programs involving industrialization the following should be taken into account:

1) Concentration of many factories in Meseta Central is a problem that has already been discussed. Considering the actual location and diversification of the factories' type and size, we can better understand that trends of determining their location are closely related to the following specific features of the district:

(a) Concentration of population in the metropolitan region of San Jose caused by migratory movements of the population.

(b) Growth of area built-up around San Jose and its satellite cities.

(c) Intensification of urban functions helped by the establishment of infrastructure and urban facilities.

As seen in this metropolitan region, industrialization and urbanization - two features connected to the transformation of the urban character - are inseparately related to each other and are mutually both the cause and result of dynamic change. It is important to admit that industrial district is concentrated but the problem of evaluating it still remains.

Concentrated industrial districts serve a complementary functional role. With many allied industries as being a place to promote new industries which are needed. This is found within wherever there are new industries and new industrial locations (as mentioned in (b)).

Given the context of the realities mentioned above of (a) and (c), industrial manufacturers are born through the needs of a new manufacturing sector and innovations of the existing industry.

2) One condition to make an industrial park development program feasible on the periphery of a metropolitan area is to establish in a district which provides incentives for its industrialization, an industrial location policy which decides the kind of the production field of manufacturing to promote or to control. Whatever direction this leads will motivate regional development.

Establishing an united industrial location policy by inducing readjusting and guiding the location of industries, vis-à-vis the already concentrated districts of established industries, becomes the key to successful industrial park development in rural areas and to promotion of regional development. Peripheral areas, if left along, would have many more new industries, but are dependent on location policies of metropolitan areas.

All industries may not be restricted equally. It is obvious that what should be restricted or induced should be decided according to a detailed study.

3) Many major industrial locations can be found in the capital city, in built up areas surrounding it and its fringe areas (mentioned later in 6.1.2). It is important to bear in mind that this area must accomodate the functions of the capital at San Jose and other urban functions. Industrial relocation would be very difficult and costly if it would be done later, when the manufacturing functions of industry become restricted by industrial scale, of products and manufacturing (e.g., when manufacturing activity contaminates the urban environment).

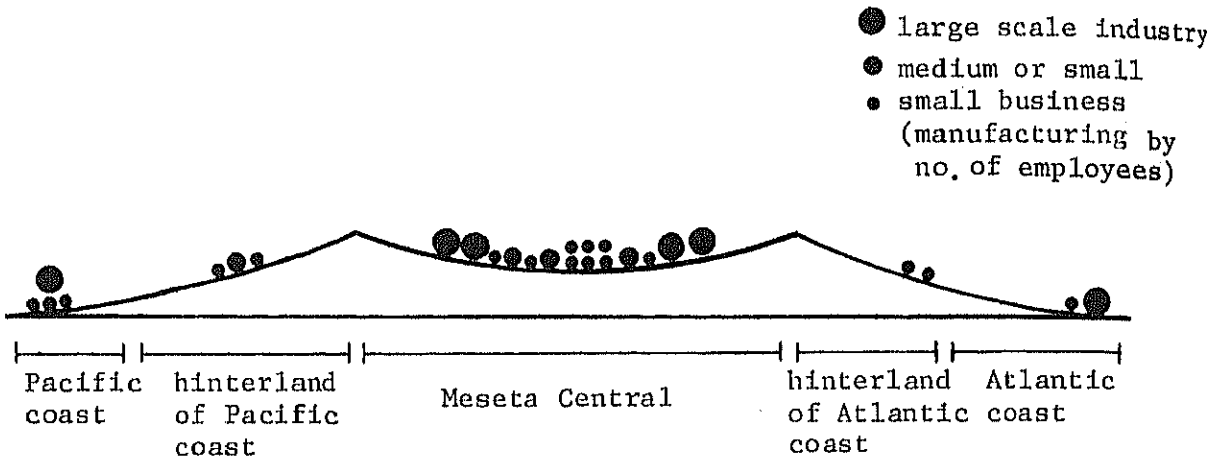
4) In relation to the above mentioned 2), it is necessary to forcefully restrict land use, especially in conurbated areas which already envelop a continuous chain of built-up areas, if the environment of the capital city and its surroundings are to be well preserved.

The meaning of regional development can be understood if it is thought of as a measure of accomplishing a desirable form and capacity of a city.

5) A general pattern can be illustrated by drawing the conditions for industrial location in a most macroscopic diagram.

A continuously extending urban agglomeration is gradually being built through concentrating various urban functions in San Jose metropolitan area. It would be very difficult to synthesize and objectively evaluate the merits and demerits of the extreme concentration of manufacturing industries in this area.

It has been pointed out that this industrial concentration and the phenomenon of urbanization have advanced to too high an altitude in Meseta Central. Furthermore, it has also been pointed out that traffic jams, contaminated environment, increased land prices etc. have affected the functions of the city. Despite these warnings, consideration should be given to the facts that neither are industrial locations severely restricted or has industry relocated in peripheral zones of urban.



6.2 Problems and Present Situation of Specific Locations

- The metropolitan Area of San Jose, Its Surroundings and Puntarenas -

6.2.1 The Metropolitan Area and Surroundings

As previously mentioned, according to the Industrial Census of 1964, 80 percent of all factories in the nation and 88 percent of employees can be found in the metropolitan area of San Jose, where there is an extreme industrial concentration. This tendency toward industrial agglomeration is assumed to have continued up to now.

Compilation and analysis of the recent 1976 Industrial Census is close to completion. As an interim census was not undertaken, several items from the 1975 census data forms were picked especially for this research. Only factories with more than 50 employees were chosen because the calculation have not been totalized, data analysis on these industries is not clear, but the industrial classification of the major factories, total number of employees and areas where the industries are located (i.e., canton and district) has been identified. The census field is all of the Cantons in Meseta Central plus the northern part of Puntarenas Province. (Due to the circumstances, the target field has to be limited).

In this research the number of factories was about 200 and the number of employees about 30,000. (See Table 6.2 (3)). Comparing these numbers (excluding Limon, Guanacaste) with those of all of Costa Rica in the 1964 census, factories have increased 2.2 times and employees 3.1 times. The average annual growth rate of employees in ten years has been about 12 percent. This rate of increase should be watched because the actual rate of rising.

From the existing data on distribution by location, which we will note later, the industrial distribution map drawn up by the Instituto Nacional de Vivienda y Urbanismo (INVU) should be highly assessed as a valuable asset. But when examining the problem of industrial location, the extension of the industrial location seems to cover more area than the residential sprawl.. Industrial relocation should very rapidly occur, because it is clear from this research that the metropolitan area is too narrow. It will be necessary to assure the movement and establishment of new factories in the future by supposing an area of at least a 50 km radium, centered in San Jose, as the target area of industrial location.

There is fear that the industrial sprawl appears repeatedly in the following order: first, in areas of infrastructure build-up and their surrounding areas (e.g., Heredia suburbs), then with the metropolitan region of the capital and finally around the populated areas outside this region, especially centering around highways and roadsides. Therefore, industrialization in Heredia and Alajuela should be carefully considered. Pressure of population migrating into the capital city, prevention of a rapid increase in the demand for urban facilities and promotion of rural industries will be problems to be solved. (Fig. 6.4)

6.2.2 Detailed Distribution of Industrial Location

The data indicating most clearly the industrial concentration within the metropolitan region can be found on the INVU's map of "OPAM '75." This is a kind of existing land-use map. Although neither the minimum size of industrial sites drawn up nor the size of factories listed is clear, the overall pattern is clearly indicated. By superimposing this pattern on a topographical map (1/50,000 scale) and presumably dividing up the factories by an outlined area of industrial land sites, an industrial distribution map (Fig. 6.5) was drawn.

Table 6.4 was tabulated according to industries in each canton. From this, the general composition of industries can be understood.

Major industries are food (23%), metal goods and machines (19%), textiles (14%), lumber and furniture (13%) and chemicals (12%). But they are increasingly diversifying.

The reason for the heavy concentration (53 percent of the total industries in Cost Rica) in Canton Central is that small-scale factories are included.

6.2.3 Factories in Puntarenas

A breakdown of the present factories in Puntarenas and Barranca are shown in Table 6.5, on the basis of the information obtained from the municipality office. The items prefixed with "*" are industries suitable for location on the water front in an industrial park. The figures listed in the table show the growth of the industrial sector for the decade prior to 1977. Most new factories are concentrated in the water front location.

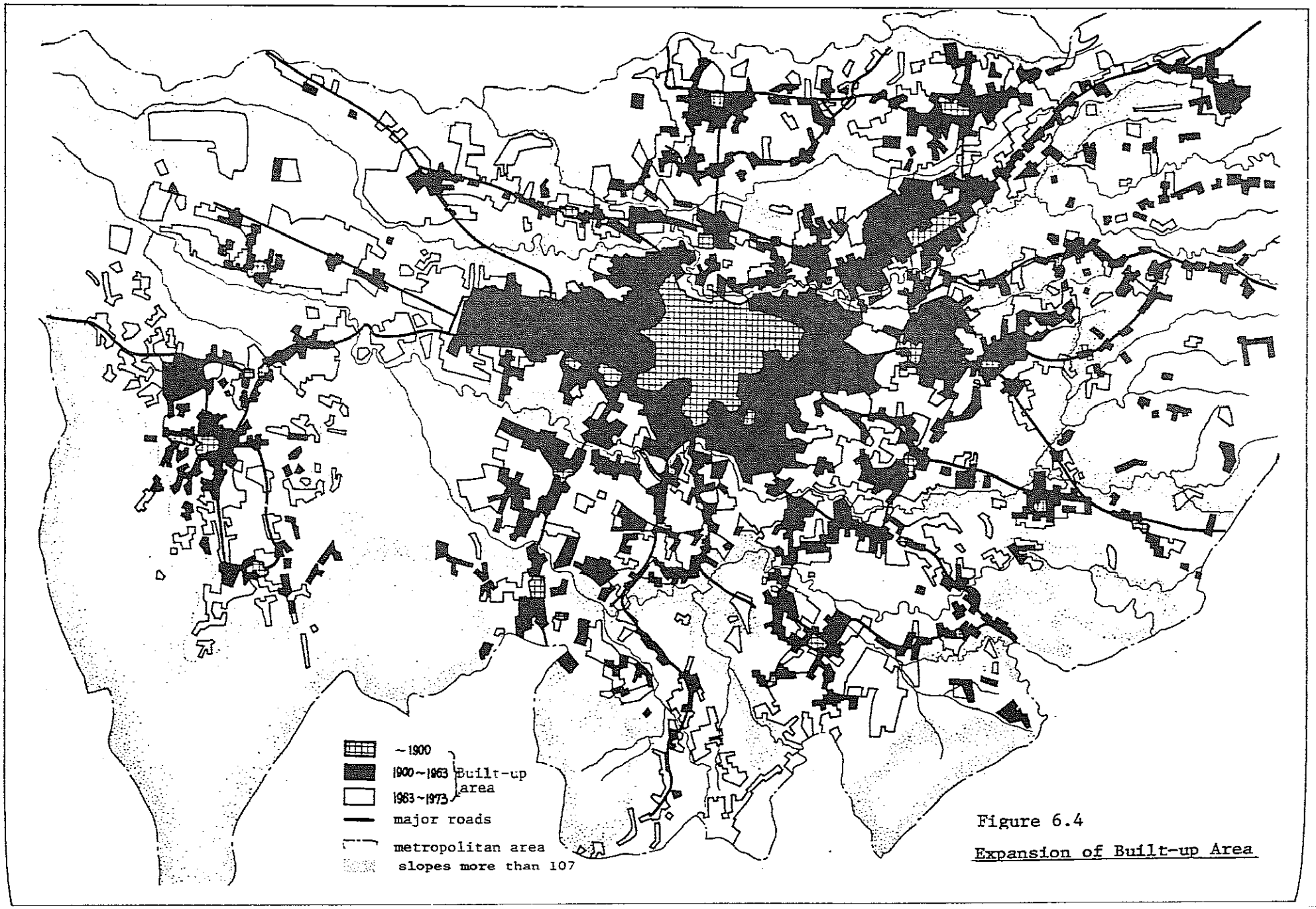


Figure 6.4

Expansion of Built-up Area

Figure 6.5
Distribution of Factories in Metropolitan Area
Source : INVU "OFAM 1975"

Table 6.4 Number of Factories in Metropolitan Area

(Unit: No. of Factories, %)

Industry / Canton	Food, Beverages, and Tobacco		Textiles		Lumber and Furniture		Paper and Printing		Chemicals, Gum Petroleum		Non-Metalic Minerals		Metals Machines		Others		Total	
Central	68	18%	64	17%	44	12%	26	7%	50	14%	15	4%	78	21%	25	7%	370 (53)	100%
Escazu	7	43	2		1	6			2	13	3	19	1	6			16 (2)	100
Desamparados	11	37	1	3	1	3			4	13	7	23	4	13	2	8	30 (4)	100
Goicoechea	23	24	10	11	16	17	3	3	7	7	8	9	20	21	7	8	94 (13)	100
Alajuelita	3	75									2	15			1	8	44 (1)	100
Coronado	8	61	1	8	1	8					2	15			1	8	13 (2)	100
Tibas	11	19	4	7	14	24			8	14	4	7	15	26	2	3	58 (8)	100
MORAVA	4	17	3	13	6	26	2	9			2	9	3	13	3	13	23 (3)	100
Montes de Oca	10	25	8	21	3	8	2	5	6	15	3	8	6	15	1	3	39 (6)	100
Curridabat	16	29	7	13	3	5	6	11	6	11	7	13	7	13	3	5	55 (8)	100
Total	161	23	100	14	89	13	39	6	83	12	52	7	134	19	44	6	702 (100)	100

Source: INVC "OPAM 1975"

Table 6.5 Existing Factories, Products & Employees in Barranca and Puntarenas

District	Factories Established prior to 1964		Factories Established betwen 1965 and 1977		Employees (1977)
a) Barranca	Carne (meat)	(225) 1954	Carne (meat)	(175) 1973	
	Granos (grains)	(251) 1952			
	Madera (lumber)	(2) 1954	Mosaicos (concrete tile)	(7) 1972	
	Arroz (rice)1/	(4) 1937	Arroa (rice)	(3) 1968	
	Pan y reposterin (bread)	(4) 1961	Diatomita (diatomite)	(16) 1966	
Sub-total		(486)		(201)	(687)
b) Puntarenas	*Abonos (fertilizer)	(377) 1963	*Enlatadora Sardinas (canned sardines)	(210) 1974	
	*Atun (tuna); sardinas (sardines)	(43s) 1951			
	*Camaron (shrimp)	(72) 1960	*Pesca (fish)	(76) 1967	
	*Camaron (shrimp)	(10) 1956	*Camaron (shrimp)	(118) 1974	
	*Hielo (ice)	(12) 1960	*Camaron (shrimp)	(66) 1967	
	*Hielo (ice)	(8) 1954	*Camaron (shrimp)	(22) 1967	
			*Hielo (ice)	(6) 1965	
	*Barcos (fishing boats)	(45) 1936	*Barcos (fishing boats)	(23) 1972	
	Barcos (fishing boats	(8) 1927	"Barcos (" ")	(8) 1973	
	*Derivados-Petroleo (petroleum by products)	(17) 1940 1975	*Barcos (" ")	(3) 1973	
			Beverages	(1) 1966	
	Cafe (coffee)	(12) 1925	Leather 2/		
Sub-total		(996)		(541)	(1,537)
Total factories and employees in a) & b) (employees)	a) + b) = 5 + 10 = 15	(1,482)	a) + b) = 4 + 11 = 15	(742)	2,224

Arranged from the "Lista de Fabricas Instaladas en Barranca y Puntarenas," (March 11, 1977).

Note: Each entry indicates one factory and its main products or somponents. (Number of employees in the most recent year xx); the year factory was installed.

1/ Originally in the center of Puntarenas in 1931, but has since removed.
2/ RECOPE, original plant started as "Union Oil" in 1940.
3/ Unidentified.

6.3 Industrial Potential of Gran Puntarenas

6.3.1 Environment as a Premise of Industrialization

When developing Puntarenas within a regional perspective, it should be related to with industrial concentration in the metropolitan area under the following considerations:

1) Judging from existing data, it is only a matter of time before some obstruction impedes the expansion of industrial locations especially in the metropolitan area and its surroundings. The combined expansion of a continuously spreading capital city and its surrounding urban areas should be thought as a conurbation areas. When planning for environmental improvement of urban life and for strengthening urban functions, some restrictions will need to be placed on industrial locations. Consolidation of the urban infrastructure should clearly delineate specific uses for which fixed areas may be used as a premise of development. Certain segments of land use in urbanizing areas should be designated for industrial use, either specific industries or industrial development, to prevent a mixture of land uses. But it will be increasingly difficult to find enough suitable land around the capital city.

2) From the perspective of production styles and proximity to market, there is a fixed priority of industrial types industries may locate near the capital. A variety of industries should be enticed to relocate from Meseta Central to an area outside the region. There will be a need to obtain some kind of location guidelines related to the structure of industry within the present metropolitan area. The area should restrict entrance except for the following industries: printing and its related industries, finishing processes of food processing (packing, bottling etc.), food collection and distribution bases, high level machinery industry, metal processing and prefabrication industry. Location restrictions should be formulated to eliminate industries that cause pollution or consume a great amount of city water. On the other hand, there is need both to induce labor intensive industry outside the metropolitan area, especially in sites conducive to industrial park development, and to induce manufacturing industries, that inflict on their locations noise, vibration and untreated industrial waste, to relocate in coastal industrial parks.

3) Considering the way in which industrial location spreads, the present size of the metropolitan area may be slightly small. A project aimed at constructing a self-contained community should be examined for the San Jose area, including part of Puntarenas Prefecture. If the industrial park development of Gran Puntarenas has the potential to be developed within range of influenced of the metropolitan region, there is no need to restrict industries to local resources and harbor-related industry.

6.3.2 Industrial Locations

Predominant conditions for situating a certain industry can be determined from the following locational factors and comparative items.

The advantages of locating in this area can be evaluated by checking the following points, depending on the industry proposed. Table 6.6 is divided into two categories: one (marked by *) suggests the relative advantage of Puntarenas in a nation-wide comparison; the other (**) requires "soft-infrastructure" or institutional incentives to attract manufacturing industries for accelerating regional development. The natural conditions could be improved through some arrangement of infrastructure.

6.3.3 Regional Conditions of Gran Puntarenas

Regional Analysis of Physical Resources (1965) may be used in evaluating the regional conditions of industrialization in the northern part of Puntarenas Province, especially from a broader perspective. Its regional advantage may be easily seen by superimposing maps which illustrate various location factors noted in the Table 6.6.

For example, based on the following four items, Puntarenas is clearly distinguished by being blessed by several factors suitable for potential development outside the metropolitan area. In Puntarenas, for example, there is a network of traffic junctions with vast plains surrounding them.

(a) Topographical features: surface configuration and land divisions ..... Figure 6.6
(b) Climate: climatic zones, rainfall ..... Figure 6.7
(c) Road traffic & distribution of cities .. Figure 6.8

6.3.4 Further Necessary Investigation

In order to promote the development of specific industrial districts in the region from the standpoint of long-term and comprehensive views, it is essential to accumulate and classify useful basic information on industrial location. The essential information can be divided mainly into two categories:

(a) Nation-wide general information, for example, where and under what local conditions new factories have been constructed recently.

(b) Detailed and specific information

The specific information in the latter entailed the following: where the land authorized by the central and/or local government for constructing industrial parks is located and how large the parks are to be; the local conditions and environment, availability of industrial water and transportation

Table 6.6 Checkpoints for Conditions of Industrial Location

A *	Market Area	1. accessibility to market area
B *	Land and Water	2. land: size and shape of site, topography, ground foundation, price and purchasing.
		3. industrial water: availability, quality, quantity, temperature, stability.
		4. drainage: flood way, plains and rivers
C	Natural Features	5. climate: temperature, rainfall, saline damage, sandblast.
		6. natural disaster: flood, earthquake, landslide.
D *	Transportation and communication	7. transportation: road, railway, channel, airport, harobr.
		8. communication: telephone, telegraph, postal service.
		9. information: governmental institution, business associations.
E **	Institutional conditions	10. taxation: incentive system.
		11. investment: bank, trust.
		12. legal restriction.
F **	Labor market and community relations	13. labor: (un) skilled, morale, supply, commuting.
		14. community relations adn environment: local government, recreation, tourism
G	Mateirals and relevant industry	15. resources and energy: quality, quantity, stability, accessibility.
		16. relevant industries: related industries, competitors, repairshops.

(*) Relative advantage of Puntarenas to the rest of the coutnry.

(**) Soft-infrastructure or institutional incentives that attract industry which accelerate regional development.

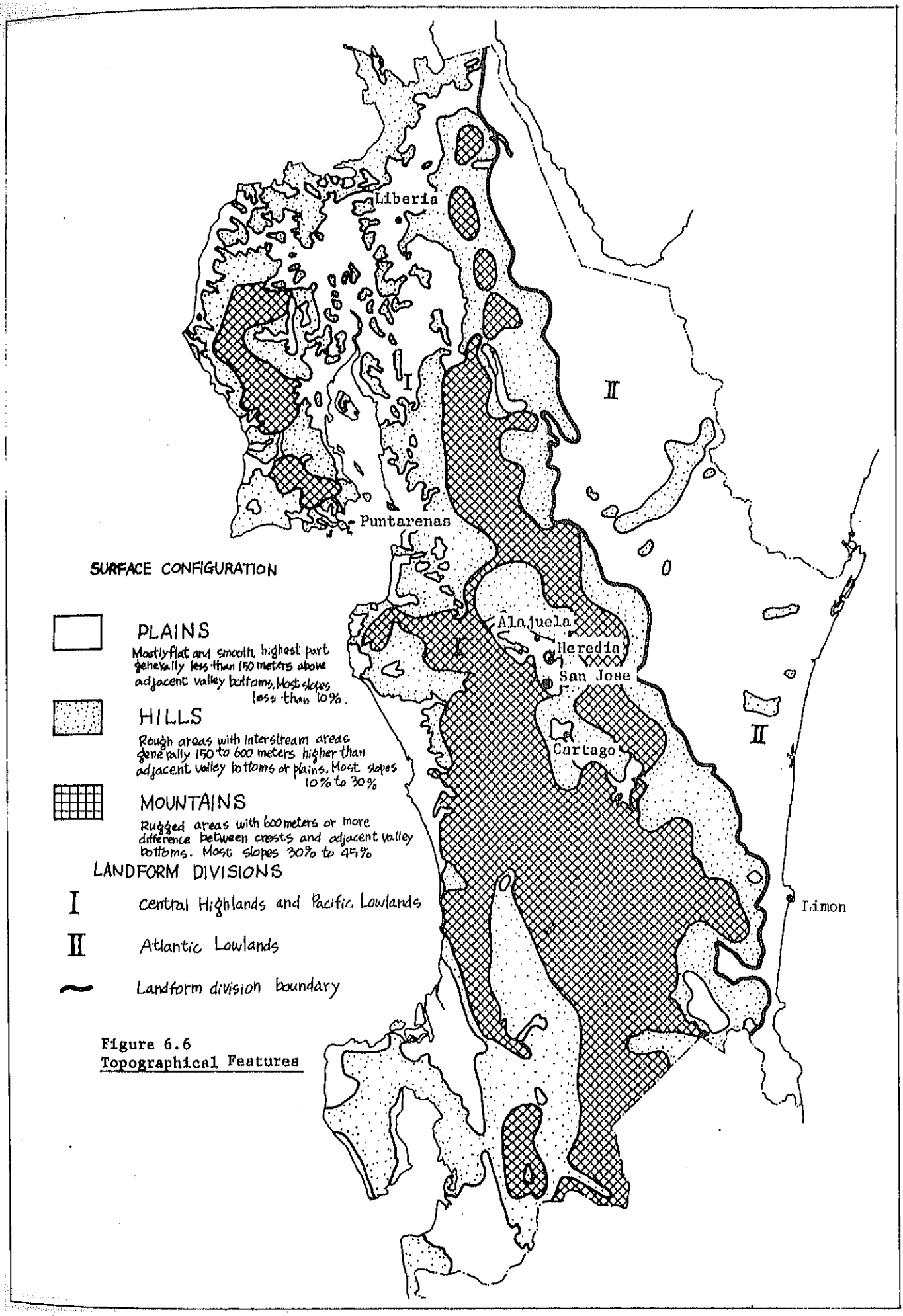


Figure 6.6
Topographical Features

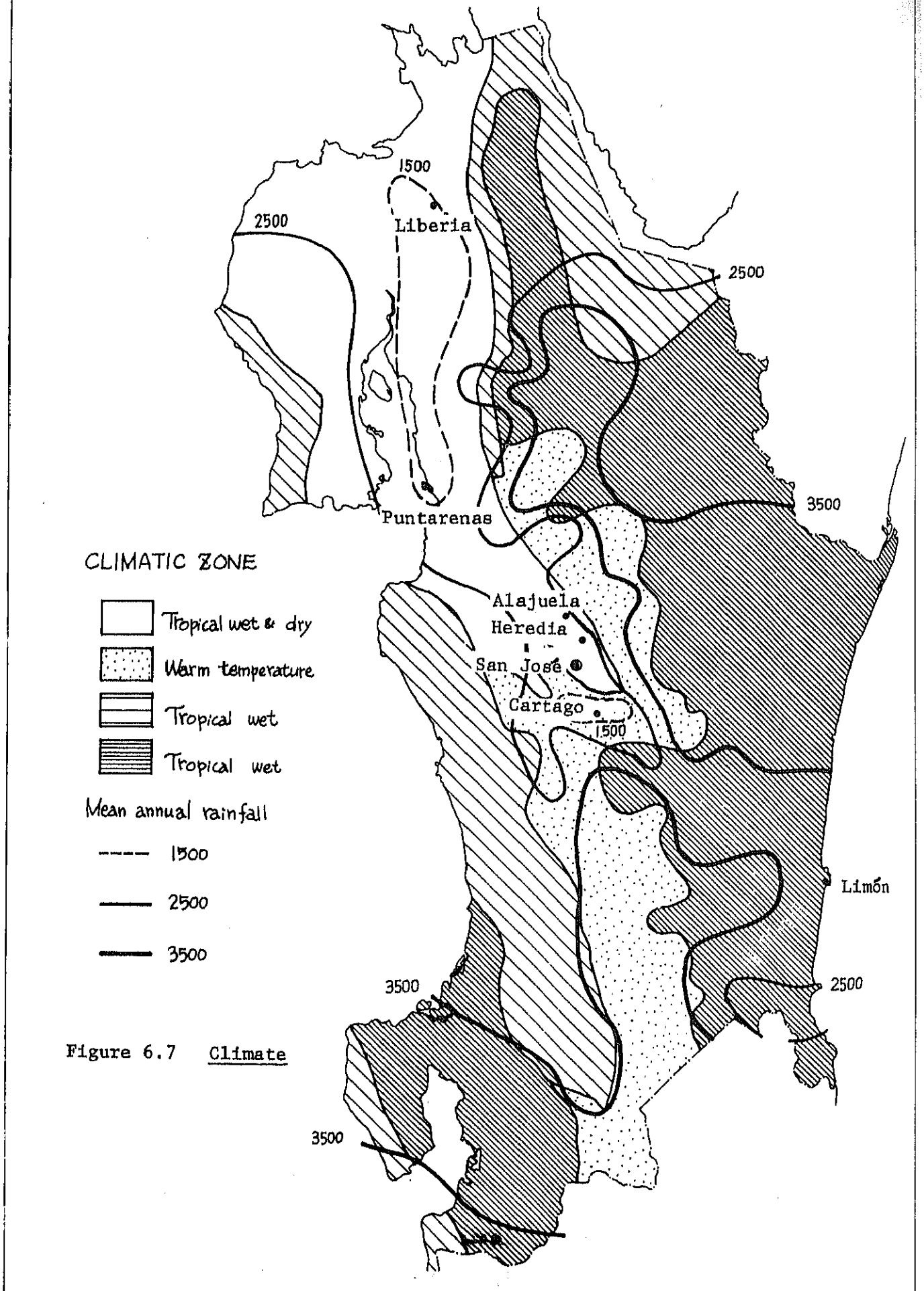


Figure 6.7 Climate

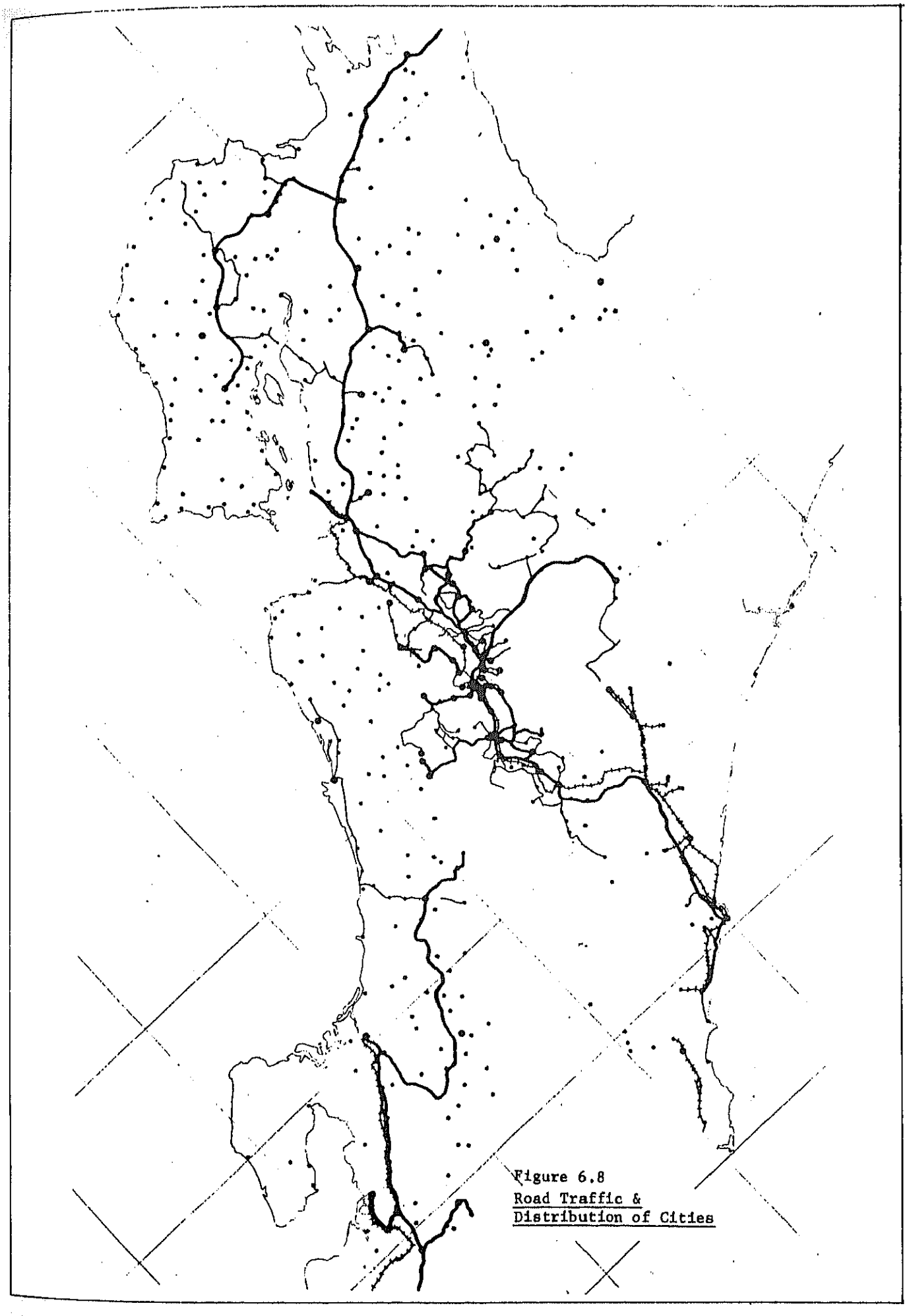


Figure 6.8
Road Traffic &
Distribution of Cities

facilities. Information should be obtained on each industrial park and then should be filed. Questionnaire items are listed below. The first half of the questionnaire is mainly related to plant location; the last part is directed to information on suitable sites for industrial parks. The Japanese industrial parks survey was performed as follows:

Research the newly constructed plants or enlargement of plants which occupy more than 1,000 m^2 as a plant site. Each prefecture conducts a survey annually and reports the results to the central government.

According to the survey conducted between 1970 and 1975, increase in plant sites amounted to 6,400 ha/year in average. It is reported that 37 percent of the increase (5 percent in recent years) occurred in industrial parks. About 4,000 to 5,000 new factories have been constructed annually. Regional trends or changes in the number of factories and production output can be observed through a national industrial census, but the census does not clarify the relation between physical factors and industrial location factors in new plant construction. Therefore, it is necessary to obtain information which shows changes by industry.

There are three kinds of surveys conducted in appropriate plant sites.

(a) In this research, information on population, industries, present and future infrastructure is gathered. General region-wide information is adjusted once a year.

(b) Various conditions on construction and characteristics of each sub-region, in which 5 to 20 suitable sites for plants are located, are summarized. The information is adjusted once every other year.

(c) Information is gathered on local conditions, transportation facilities, water systems, drainage, and environmental preservation in each plant side. This information should be available and useful for private enterprises to seek a new plant site. Moreover, this information should be made available to the general public. It should also be made available as PR information for a prefecture trying to entice industry to its industrial parks.

The 1976 Japanese survey on suitable plant sites covered 2,340 sites, about 90,000 ha. These data are filed in computer systems and are available for selecting and introducing the most suitable site in reply to a private industry's request. If the above surveys are classified effectively to plan the region-wide industrial development, it will be easy to compare comprehensively several sites which both the central and local governments authorize as suitable for plant sites.

(Basic) Items on a questionnaire regarding plant construction sites:

Note: 1) This questionnaire is conducted for the central government by the section of the local government in charge of plant construction.

2) Location of the plan is illustrated on a 1/25,000 or 1/50,000 polygraph map.

3) The research is conducted on the basis of the Industrial Location Law. The researcher is obligated to keep the research confidential, while the researched corporations must answer the questions.

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1. Plants

1) Name of company and/or plant.
2) Address of the head office.
3) Location of the construction site of the new plant (including planned construction).
4) Capital
5) Total investment in the new plant and related facilities (including expense for a site).

2. Schedule

1) When do you plan to purchase the site?
2) When will you start the construction?
3) When will you start the operation at the new plant site?

3. Plant Site and Other

1) Area of plant site.
2) Building site, number of floors.
3) Land classification.
4) Price of the land per m^2.

4. Location of the Plant and Other

1) Will you construct a new plant or expand the present plant?
2) Is the plant located in an inland area or around the seaside? (Is the site located next to port facilities?)
3) Is the plant a part of the planned industrial park or not?
4) Is the plant moved totally or only partially.
5) When the plant is moved, inform the appropriate government agencies of the old address.

5. How did you decide the location of your new plant?

1) Construction sites.
Indicate the first and second priority items of the following.

(1) Convenience in getting raw materials and parts,
(2) Transportation and distance to market for manufactured goods,
(3) Facility in securing labor.
(4) Easy access to industrial water.
(5) Accessibility to customers.
(6) Easy to get cooperation and assistance from the local government.
(7) Personal relation of the management with the area.
(8) Seaside industry.

2) Why did you the select plant site?
Indicate the first and second priority items of the following.

(1) Convenient transportation.
(2) Reasonable land price.
(3) Easy purchase of the plant site.
(4) Plant site is located in an industrial park.
(5) Easy for workers to commute.
(6) Effective to advertize the products or the plant.
(7) Offer from the local government.
(8) Personal relation of the management.
(9) Cooperation with other industries.
(10) Availability of port facilities.

6. Transportation

1) Names of raw materials and products.
Volume of sales (per month).
Means of transportation (by car, train, ship,or air).
2) Origin and destination of each raw materials and product.

7. Labor

1) Total number of employees. (Also indicate the number of employees who are hired locally.)
2) Education, age and sex of the local employees.

8. Industrial Water and Water Resources

1) Industrial water or water works.
2) Kinds of water for industrial supply.

(1) surface water (2) well water
(3) riverbed water (4) sea water
(5) recirculated water

3) How much water do you use a day?

(1) fresh water (2) sea water

9. Where is the new plant located in the area assigned by the Regional Development Law?

10. Land Use Regulations
Is the location of the new plant suitable to the plant site regulated by the City Planning Law?