Table III-2-A3 Argentine Petrochemical Product Forecast (Case C)

ID	CONTENT	UNIT	78	80	82	83	Rate %	84	85	86	87	88	89	90	91	92	93	94	95	83/78	95/85
001																					
*002	GNP dollar	BIL dollar	50.4	66.2	71.6	61.3	0.060	64.9	68.8	73.0	77.3	82.0	86.9	92.1	97.7	103.5	109.7	116.3	123.3	3.9	6.0
*003	Population	MIL	26.4	27.7	28.4	29.6	0.020	30.1	30.7	31.4	32.0	32.6	33.3	34.0	34.6	35.3	36.0	36.8	37.5	2.3	2.0
004	LDPE	thousand t	68.0	70.0	126.0	98.0														7.5	
005	HDPE	thousand t	13.0	23.0	26.0	28.0														16.5	
006	PVC	thousand t	37.0	54.0	55.0	70.0														13.6	
007	PN	thousand t	12.0	19.0	24.0	27.0														17.6	
008	G.P Total	thousand t	130.0	166.0	231.0	223.0														11.3	
009																					
010	EG	thousand t	6.0	3.0	5.0	6.0														0.0	
011	AN	thousand t	8.0	10.0	15.0	16.0														14.8	
012	S.F Total	thousand t	14.0	13.0	20.0	22.0														9.4	
013																					
014	PS	thousand t	22.0	24.0	24.0	27.0														4.1	
015	ABS	thousand t	5.0	5.0	4.0	6.0														3.7	
016	M.P Total	thousand t	27.0	29.0	28.0	33.0														4.0	
017																					
018	SBR	thousand t	29.0	31.0	31.0	29.0														0.0	
019	GNP/POP	$/ perso	1909	2389	2521	2070		2152	2236	2324	2415	2510	2608	2710	2817	2927	3042	3161	3285	1.6	3.9
*019	G.P/POP	M ton/MIL	4.916	5.896	7.923	7.362		8.036	8.326	8.626	8.937	9.259	9.592	9.938	10.296	10.667	11.051	11.449	11.861	8.4	3.6
*020	S.F/POP	M ton/MIL	0.482	0.464	0.708	0.733		0.837	0.869	0.903	0.938	0.974	1.012	1.052	1.092	1.135	1.179	1.225	1.272	10.1	3.8
*021	M.P/POP	M ton/MIL	0.875	1.091	0.963	0.960		1.066	1.117	1.170	1.226	1.284	1.345	1.419	1.477	1.547	1.621	1.698	1.779	1.8	4.7
*022	SBR/POP	M ton/MIL	1.087	1.120	1.080	1.031		1.116	1.153	1.191	1.231	1.272	1.314	1.358	1.403	1.450	1.498	1.548	1.599	-1.0	3.3
*023	LDPE/G.P	Mton/Mton	0.523	0.421	0.545	0.439	-0.002	0.437	0.435	0.433	0.431	0.429	0.427	0.425	0.423	0.421	0.419	0.417	0.415	-3.4	-0.4
*024	HDPE/G.P	Mton/Mton	0.100	0.138	0.112	0.125	0.002	0.127	0.129	0.131	0.133	0.135	0.137	0.139	0.141	0.143	0.145	0.147	0.149	4.6	1.4
*025	PVC /G.P	Mton/Mton	0.284	0.325	0.238	0.313	-0.002	0.311	0.309	0.307	0.305	0.303	0.301	0.299	0.297	0.295	0.293	0.291	0.289	1.9	-0.6
*026	PP /G.P	Mton/Mton	0.092	0.114	0.103	0.121	0.002	0.123	0.125	0.127	0.129	0.131	0.133	0.135	0.137	0.139	0.141	0.143	0.145	5.5	1.4
*027	EG /S.F	Mton/Mton	0.428	0.230	0.250	0.272	0.002	0.274	0.276	0.278	0.280	0.282	0.284	0.286	0.288	0.290	0.292	0.294	0.296	-8.6	0.7
	AN /S.F	Mton/Mton	0.571	0.769	0.750	0.727	-0.002	0.725	0.723	0.721	0.719	0.717	0.715	0.713	0.711	0.709	0.707	0.705	0.703	4.9	-0.2
*028	PS /M.P	Mton/Mton	0.814	0.827	0.857	0.818	0.002	0.820	0.822	0.824	0.826	0.828	0.830	0.832	0.834	0.836	0.838	0.840	0.842	0.0	0.2
*030	ABS /M.P	Mton/Mton	0.185	0.172	0.142	0.181	-0.002	0.179	0.177	0.175	0.173	0.171	0.169	0.167	0.165	0.163	0.161	0.159	0.157	-0.3	-1.1
031	G.P Total	M ton	129.7	163.3	225.0	217.9		242.6	256.4	270.9	286.3	302.5	319.7	337.9	357.0	377.3	398.7	421.3	445.2	18.9	5.6
032	S.P Total	M ton	12.7	12.8	20.1	23.1		25.2	26.7	28.3	30.0	31.8	33.7	35.7	37.9	40.1	42.5	45.0	47.7	12.7	5.9
033	M.P Total	M ton	23.1	30.2	27.3	28.4		32.2	34.4	36.7	39.2	41.9	44.8	47.9	51.2	54.7	58.5	62.5	66.8	4.2	6.8
034	SBR	M ton	28.7	31.0	30.6	30.5		33.7	35.5	37.4	39.4	41.5	43.8	46.1	48.6	51.2	54.0	56.9	60.0	1.2	5.3

Table III-2-A3 (Continued)

ID	CONTENT		UNIT	78	80	82	83	Rate %	84	85	86	87	88	89	90	91	92	93	94	95	83/78	95/85
035	LDPE	capacity	M ton	35.0	35.0	225.0	225.0		225.0	225.0	225.0	225.0	225.0	225.0	225.0	225.0	225.0	225.0	225.0	225.0		
035		demand	M ton	67.8	68.8	122.7	118.0		102.4	111.6	117.4	123.5	129.9	136.6	143.7	151.2	159.0	167.2	175.9	185.0	11.6	5.1
*036		import	M ton	37.0	38.0	9.0	1.3		1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	-48.8	-100.0
*037		export	M ton	0.0	0.0	23.0	66.8		57.8	56.0	55.0	54.0	53.0	52.0	51.0	49.0	37.0	25.0	12.0	0.0		-100.0
038		product	M ton	30.8	30.8	136.7	183.0		136.5	166.6	171.4	176.5	181.9	187.6	193.7	200.2	196.0	192.2	187.9	185.0	42.7	1.0
039	HDPE	capacity	M ton	0.0	0.0	0.0	42.0		88.5	58.3	53.5	80.4	75.0	69.3	63.2	56.7	60.9	64.7	69.0	71.9		
039		demand	M ton	12.9	22.6	25.3	37.8		38.5	39.2	41.6	44.2	47.0	49.9	53.1	56.5	60.1	64.0	68.1	72.5	23.8	6.3
*040		import	M ton	12.9	22.6	25.3	29.8		23.3	12.0	6.0	3.0	2.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	18.2	-100.0
*041		export	M ton	0.0	0.0	0.0	9.0		6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
042		prduct	M ton	0.0	0.0	0.0	17.0		21.6	27.2	35.6	41.2	45.0	48.9	52.1	56.5	60.1	64.0	68.1	72.5	192.9	10.3
043	PVC	capacity	M ton				57.5		59.0	59.0	59.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0		
043		demand	M ton	36.9	53.1	53.5	70.9		69.1	79.4	83.4	87.5	91.9	96.5	101.3	106.3	111.6	117.1	123.0	129.0	13.9	4.9
*044		import	M ton	5.0	20.0	7.0	18.4		15.6	20.4	24.4	28.0	15.0	10.0	5.0	0.0	0.0	0.1	6.0	12.0	29.7	-5.1
*045		export	M ton	1.0	1.0	0.0	0.3		0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
046		prduct	M ton	32.9	34.1	46.5	52.8		53.6	59.0	59.0	67.5	76.9	86.5	96.3	106.3	111.6	117.0	117.0	117.0	9.8	7.0
047	EG	capacity	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
047		demand	M ton	5.4	2.9	5.0	6.3		7.9	7.4	7.9	8.4	9.0	9.6	10.2	10.9	11.6	12.4	13.2	14.1	2.9	6.7
*048		import	M ton	6.0	3.0	5.0	6.3		7.9	7.4	7.9	8.4	9.0	9.6	10.2	10.9	11.6	12.4	13.2	14.1	0.9	6.7
*049		export	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
050		product	M ton	-0.5	-0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-46.1	
051	PS	capacity	M ton	51.2	51.2	51.2	51.2		48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0		
051		demand	M ton	18.8	25.0	23.4	26.0		31.5	32.2	34.3	36.4	38.7	41.2	43.8	46.7	49.7	53.0	56.5	60.2	6.6	6.4
*052		import	M ton	0.0	3.0	1.0	0.7		3.1	2.0	2.0	2.0	2.0	2.0	1.0	0.0	1.7	5.0	8.5	12.2		19.8
*053		export	M ton	0.0	0.0	0.0	1.2		0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0		-100.0
054		prduct	M ton	18.8	22.0	22.4	26.5		29.3	31.2	33.3	35.4	37.7	40.2	43.8	46.7	48.0	48.0	48.0	48.0	7.0	4.3
055	ABS	capacity	M ton				6.0		11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		
055		demand	M ton	4.2	5.2	3.9	5.4		7.7	8.1	8.4	8.8	9.2	9.6	10.0	10.4	10.9	11.4	11.9	12.5	4.7	4.4
*056		import	M ton	1.0	1.0	1.0	0.4		0.0	2.0	2.0	2.0	2.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	-16.7	-100.0
*057		export	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
058		prduct	M ton	3.2	4.2	2.9	5.0		7.7	6.1	6.4	6.8	7.2	7.6	9.0	10.4	10.9	11.4	11.9	12.5	8.8	7.4
059	SBR	capacity	M ton	50.0	50.0	50.0	50.0		50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0		
059		demand	M ton	28.7	31.0	30.6	29.8		32.9	35.5	37.4	39.4	41.5	43.8	46.1	48.6	51.2	54.0	56.9	60.0	0.7	5.3
*060		import	M ton	5.0	3.0	3.0	1.1		0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	4.0	6.9	10.0	-26.1	25.9
*061		export	M ton	6.0	5.0	18.0	18.8		13.7	12.0	10.0	8.0	6.0	4.0	2.0	0.0	0.0	0.0	0.0	0.0	25.6	-100.0
062		prduct	M ton	29.7	33.0	45.6	47.5		46.0	46.5	46.4	46.4	46.5	46.8	47.1	47.6	50.0	50.0	50.0	50.0	9.8	8.7
063	SM	capacity	M ton	54.0	54.0	54.0	54.0		54.0	54.0	54.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0		
063		demand	M ton	30.6	35.3	39.1	48.3		52.0	49.8	52.0	54.3	56.9	59.7	64.1	67.7	69.9	70.1	70.3	70.5	9.5	3.5
*064		import	M ton	0.0	0.0	0.0	0.0		1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	4.9	5.1	5.3	5.5		
*065		export	M ton	0.0	13.0	9.0	4.4		6.0	5.0	4.0	3.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0		-100.0
066		product	M ton	30.6	48.3	48.1	54.7		57.1	54.8	56.0	57.3	58.9	60.7	64.1	65.0	65.0	65.0	65.0	65.0	12.2	1.7
073	E	capacity	M ton	54.0	54.0	254.0	254.0		254.0	254.0	254.0	299.0	307.0	307.0	307.0	307.0	307.0	307.0	307.0	307.0		
073		demand	M ton	45.7	50.9	159.9	203.1		211.0	227.0	241.2	257.3	272.4	288.3	304.4	321.6	323.8	326.7	326.5	328.1	34.7	3.7
*074		import	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.6	16.8	19.7	19.5	21.1		
*075		export	M ton	0.0	0.0	20.0	45.0		46.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
076		product	M ton	45.7	50.9	179.9	248.1		257.0	227.0	241.2	257.3	272.4	288.3	304.4	307.0	307.0	307.0	307.0	307.0	40.2	3.0

Table III-2-A3 (Continued)

I D	C O N T E N T		U N I T	78	80	82	83	Rate %	84	85	86	87	88	89	90	91	92	93	94	95	83/78	95/85
077	PP	capacity	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	20.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0		
077		demand	M ton	11.9	18.6	23.3	25.9		32.5	32.0	34.4	36.9	39.6	42.5	45.6	48.9	52.4	56.2	60.2	64.6	16.6	7.2
*078		import	M ton	11.9	18.6	23.3	25.9		32.5	32.0	34.4	36.9	19.6	2.5	5.6	8.9	12.4	16.2	20.2	24.6	16.8	-2.6
*079		export	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
080		prduct	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	20.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	-100.0	
081	AN	capacity	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
081		demand	M ton	7.2	9.8	15.0	15.8		13.5	19.3	20.4	21.6	22.8	24.1	25.5	26.9	28.4	30.0	31.8	33.5	16.7	5.6
*082		import	M ton	7.2	9.8	15.0	15.8		13.5	19.3	20.4	21.6	22.8	24.1	25.5	26.9	28.4	30.0	31.8	33.5	17.0	5.6
*083		export	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
084		product	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-100.0	
085	IPA	capacity	M ton	35.0	35.0	35.0	35.0		35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0		
*085		demand	M ton	12.0	15.0	16.0	14.9		15.4	16.3	17.3	18.3	19.4	20.6	21.8	23.1	24.5	26.0	27.6	29.2	4.4	6.0
*086		import	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*087		export	M ton	1.0	5.0	16.0	14.2		17.0	15.0	13.0	11.0	9.0	7.0	5.0	8.4	7.0	5.5	3.9	2.5	70.0	-16.4
088		product	M ton	13.0	20.0	32.0	29.1		32.4	31.3	30.3	29.3	28.4	27.6	26.8	31.5	31.5	31.5	31.5	31.7	17.4	0.1
089	P	capacity	M ton	42.0	42.0	62.0	62.0		148.8	148.8	148.8	148.8	148.8	148.8	148.8	148.8	148.8	148.8	148.8	148.8		
089		demand	M ton	5.4	9.7	18.4	16.0		17.6	17.6	16.9	16.1	38.6	65.6	64.8	69.9	69.9	69.9	69.9	70.2	23.9	14.7
*090		import	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*091		export	M ton	0.0	0.0	0.0	0.0		0.0	9.0	18.0	27.0	36.0	45.0	54.0	63.9	63.9	63.9	63.9	63.7		21.6
092		prduct	M ton	5.4	9.7	18.4	16.0		17.6	26.6	34.9	43.1	74.6	110.6	118.8	133.9	133.9	133.9	133.9	133.9	23.9	17.5
093	CX	capacity	M ton	42.0	42.0	42.0	42.0		42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0		
*093		demand	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*094		import	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*095		export	M ton	28.0	23.0	25.0	32.7		38.6	38.0	38.0	39.0	39.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	3.1	0.5
096		prduct	M ton	28.0	23.0	25.0	35.2		41.6	38.0	38.0	39.0	39.0	40.0	40.0	40.0	40.0	40.0	40.0	40.9	4.6	0.5
097	B	capacity	M ton	144.0	144.0	144.0	144.0		144.0	144.0	144.0	144.0	144.0	144.0	144.0	144.0	144.0	144.0	144.0	144.0		
097		demand	M ton	80.7	89.7	91.2	101.3		109.9	105.8	106.5	108.2	109.2	111.0	113.1	113.7	113.7	113.7	113.7	113.7	4.6	0.7
*098		import	M ton	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
*099		export	M ton	59.0	67.0	68.0	65.8		59.6	55.0	50.0	45.0	40.0	35.0	30.0	15.8	15.8	15.8	15.8	15.8	1.9	-11.6
100		product	M ton	139.7	156.7	159.2	166.3		169.5	168.8	156.5	153.2	149.2	146.0	143.1	129.6	129.6	129.6	129.6	129.6	3.5	-2.1
101	LDPE / E		ton / ton	0.688	0.617	0.774	0.752		0.541	0.748	0.724	0.699	0.681	0.663	0.649	0.665	0.651	0.638	0.624	0.614		
102	HDPE / E		ton / ton	0.001	0.000	0.000	0.069		0.085	0.122	0.150	0.163	0.168	0.173	0.174	0.187	0.199	0.212	0.226	0.241		
103	PVC / E		ton / ton	0.359	0.334	0.129	0.106		0.104	0.129	0.122	0.131	0.141	0.150	0.158	0.173	0.181	0.190	0.190	0.190		
104	EG / E		ton / ton	-0.007	-0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
105	SM / E		ton / ton	0.187	0.265	0.074	0.061		0.062	0.067	0.065	0.062	0.060	0.058	0.059	0.059	0.059	0.059	0.059	0.059		
108	PP / P		ton / ton	0.014	0.009	0.004	0.000		0.000	0.000	0.000	0.000	0.273	0.368	0.343	0.304	0.304	0.304	0.304	0.304		
109	AN / P		ton / ton	0.016	0.009	0.005	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		
110	IPA / P		ton / ton	1.783	1.535	1.303	1.363		1.378	0.879	0.650	0.509	0.285	0.186	0.169	0.176	0.176	0.176	0.176	0.177		
111	SM / B		ton / ton	0.180	0.253	0.248	0.269		0.276	0.279	0.293	0.307	0.323	0.340	0.367	0.411	0.411	0.411	0.411	0.411		
112	CX / B		ton / ton	0.186	0.136	0.146	0.196		0.228	0.219	0.225	0.236	0.243	0.254	0.259	0.287	0.287	0.287	0.287	0.287		
113	other/ B		ton / ton	0.633	0.610	0.605	0.533		0.495	0.500	0.480	0.456	0.432	0.404	0.372	0.301	0.301	0.301	0.301	0.301		
114	PS / SM		ton / ton	0.625	0.464	0.475	0.494		0.523	0.582	0.606	0.630	0.653	0.676	0.698	0.733	0.753	0.753	0.753	0.753		
115	ABS / SM		ton / ton	0.042	0.034	0.024	0.036		0.053	0.044	0.046	0.047	0.048	0.050	0.056	0.064	0.067	0.070	0.073	0.077		
116	SBR / SM		ton / ton	0.290	0.204	0.284	0.260		0.241	0.254	0.248	0.242	0.237	0.231	0.220	0.220	0.230	0.230	0.230	0.230		
117	Ethane		M ton	57.1	63.7	224.9	310.1		321.2	283.8	301.5	321.7	340.5	360.4	380.5	383.7	383.7	383.7	383.7	383.7		

2-A-3 Cost Comparison of Petrochemical Products (1986)

Table III-2-A4 Cost Comparison of Ethylene

1	Nation/Region	Japan			U S A			U S A			U S A	
2	Plant											
3	Capacity t/y	450000			450000			450000			450000	
4	Load %	80			80			80			80	
5	Production t/y	360000			360000			360000			360000	
6	Capital cost											
7	B/L M$	205			170			180			227	
8	Offsite M$	102.5			85			90			113.5	
9	New/Exisiting Plant	E			E			N			E	
10												
11		Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t
12												
13												
14	Raw material	Naphtha			Ethane			Ethane			Gas oil		
15		3.26	150	489.0	1.24	105.4	130.6	1.24	105.4	130.6	3.89	101.7	395.6
16	Utilities												
17	Power Kwh	50	0.051	2.5	25	0.032	0.8	25	0.032	0.8	65	0.032	2.0
18	Steam t												
19	Fuel MMkcal	6.5	11.5	74.7	4.6	9	41.4	4.6	9	41.4	7.3	9	65.7
20	Others			10.6			6.0			6.0			11.9
21	Sub-total			87.9			48.2			48.2			79.68
22	Byproduct credits												
23	Propyrene	0.53	315	166.9	0.08	301.5	24.1	0.08	301.5	24.1	0.56	301.5	168.8
24	Pyrol gasoline	0.76	125	95.0							0.7	101.7	71.1
25	C4 fraction	0.33	220	72.6							0.39	209	81.5
26	Fuel oil	0.12	140	16.8							0.73	114	83.2
27	Fuel gas	0.52	150	78.0	0.16	121.2	19.3	0.16	121.2	19.3	0.49	121.2	59.3
28	Others												
29	Sub-total			429.3			43.5			43.5			464.1
30	Variable cost			147.5			135.3			135.3			11.1
31	Operating costs												
32	Labour	45	16000	2.0	37	22500	2.3	37	22500	2.3	49	22500	3.0
33	Maintenance	(7)/(5)*6%		34.1	(7)/(5)*6%		28.3	(7)/(5)*6%		30.0	(7)/(5)*6%		37.8
34	Overhead expenses												
35	Depreciation	(7)/(5)*10%		56.9	(7)/(5)*10%		47.2	(7)/(5)*10%		50.0	(7)/(5)*10%		63.0
36	Tax/Insurance	(7)/(5)*2%		11.3	(7)/(5)*2%		9.4	(7)/(5)*2%		10.0	(7)/(5)*2%		12.6
37	Administration	(7)/(5)*2%		11.3	(7)/(5)*2%		9.4	(7)/(5)*2%		10.0	(7)/(5)*2%		12.6
38	Interest	(7)/(5)*5%		28.4	(7)/(5)*5%		23.6	(7)/(5)*5%		25.0	(7)/(5)*5%		31.5
39	Sales,R&D	(7)/(5)*4%		22.7	(7)/(5)*4%		18.8	(7)/(5)*4%		20.0	(7)/(5)*4%		25.2
40	Fixed cost			167.1			139.2			147.3			185.9
41	Net production cost			314.6			274.6			282.6			197.0
42	R O I	((7)+(8))/(5)*15%		128.1	((7)+(8))/(5)*15%		106.2	((7)+(8))/(5)*15%		112.5	((7)+(8))/(5)*15%		141.8
43	Transfer price			442.8			380.8			395.1			338.9

Table III-2-A4 (2)

		W Europe			N I C S			Saudi Arabia			Argentina		
1	Nation/Region												
2	Plant												
3	Capacity t/y	450000			450000			450000			450000		
4	Load %	80			80			80			80		
5	Production t/y	360000			360000			360000			360000		
6	Capital cost												
7	B/L M$	205			220			290			234		
8	Offsite M$	102.5			110			145			117		
9	New/Exisiting Plant	E			N			N			N		
10													
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13													
14	Raw material	Naphtha			Naphtha			Ethane			Ethane		
15		3.26	143.6	468.1	3.26	142.5	464.5	1.24	34.6	42.9	1.24	70.1	86.9
16	Utilities												
17	Power Kwh	50	0.047	2.3	50	0.046	2.3	25	0.02	0.5	25	0.04	1.0
18	Steam t												
19	Fuel MMkcal	6.5	11	71.5	6.5	10.9	70.8	4.6	2	9.2	4.6	2	9.2
20	Others			9.6			9.8			3.7			3.9
21	Sub-total			83.45			82.95			13.4			14.1
22	Byproduct credits												
23	Propyrene	0.53	301.5	159.7	0.53	299.3	158.6	0.08	73.2	5.8	0.08	96.6	7.7
24	Pyrol gasoline	0.76	119.6	90.8	0.76	118.8	90.2						
25	C4 fraction	0.33	210.5	69.4	0.33	209	68.9						
26	Fuel oil	0.12	134	16.0	0.12	133	15.9						
27	Fuel gas	0.52	145.7	75.7	0.52	144.7	75.2	0.16	32.5	5.2	0.16	50.3	8.0
28	Others												
29	Sub-total			412.0			409.0			11.0			15.7
30	Variable cost			139.5			138.4			45.2			85.2
31	Operating costs												
32	Labour	45	20500	2.5	45	4000	0.5	37	10000	1.0	37	6000	0.6
33	Maintenance	(7)/(5)*6%		34.1	(7)/(5)*6%		36.6	(7)/(5)*6%		48.3	(7)/(5)*6%		39.0
34	Overhead expenses												
35	Depreciation	(7)/(5)*10%		56.9	(7)/(5)*10%		61.1	(7)/(5)*10%		80.5	(7)/(5)*10%		65.0
36	Tax/Insurance	(7)/(5)*2%		11.3	(7)/(5)*2%		12.2	(7)/(5)*2%		16.1	(7)/(5)*2%		13.0
37	Administration	(7)/(5)*2%		11.3	(7)/(5)*2%		12.2	(7)/(5)*2%		16.1	(7)/(5)*2%		13.0
38	Interest	(7)/(5)*5%		28.4	(7)/(5)*5%		30.5	(7)/(5)*5%		40.2	(7)/(5)*5%		32.5
39	Sales,R&D	(7)/(5)*4%		22.7	(7)/(5)*4%		24.4	(7)/(5)*4%		32.2	(7)/(5)*4%		26.0
40	Fixed cost			167.7			177.7			234.6			189.1
41	Net production cost			307.2			316.1			279.8			274.3
42	R O I	((7)+(8))/(5)*15%		128.1	((7)+(8))/(5)*15%		137.4	((7)+(8))/(5)*15%		181.2	((7)+(8))/(5)*15%		146.2
43	Transfer price			435.4			453.6			461.1			420.6

Table III-2-A5 Cost Comparison of Linear Low Density Polyethylene (LLDPE)

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	100000			100000			100000			100000			100000			100000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	80000			80000			80000			80000			80000			80000		
6	Capital cost																		
7	B/L M$	48			48			48			48			60			60		
8	Offsite M$	24			24			24			24			30			30		
9	New/Exisiting Plant	N (Gaseous phase reaction)			ditto			ditto			ditto			ditto			ditto		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Ethylene	0.94	520	488.8	0.94	423	397.6	0.94	498	468.1	0.94	494	464.3	0.94	250	235.0	0.94	422	396.6
16	Butene-1	0.08	420	33.6	0.08	341.6	27.3	0.08	401.9	32.1	0.08	399	31.9	0.08	250	20.0	0.08	500	40.0
17	Sub-total			522.4			424.948			500.272			496.28			255			436.68
18	Utilities																		
19	Power Kwh	500	0.051	25.5	500	0.032	16.0	500	0.047	23.5	500	0.046	23.0	500	0.02	10.0	500	0.04	20.0
20	Steam t	0.35	18.1	6.3	0.35	13.2	4.6	0.35	14	4.9	0.35	15.5	5.4	0.35	3	1.0	0.35	11	3.8
21	Fuel MMkcal																		
22	Others			15.1			9.1			9.9			12.3			3.8			8.3
23	Sub-total			46.9			29.7			38.3			40.7			14.8			32.1
24	Variable cost			569.3			454.6			538.5			537.0			269.8			468.8
25	Operating costs																		
26	Labour	30	16000	6.0	30	22500	8.4	30	20500	7.6	30	4000	1.5	30	10000	3.7	30	6000	2.2
27	Maintenance	(7)/(5)*6%		36.0	(7)/(5)*6%		36.0	(7)/(5)*6%		36.0	(7)/(5)*6%		36.0	(7)/(5)*6%		45.0	(7)/(5)*6%		45.0
28	Overhead expenses																		
29	Depreciation	(7)/(5)*10%		60.0	(7)/(5)*10%		60.0	(7)/(5)*10%		60.0	(7)/(5)*10%		60.0	(7)/(5)*10%		75.0	(7)/(5)*10%		75.0
30	Tax/Insurance	(7)/(5)*2%		12.0	(7)/(5)*2%		12.0	(7)/(5)*2%		12.0	(7)/(5)*2%		12.0	(7)/(5)*2%		15.0	(7)/(5)*2%		15.0
31	Administration	(7)/(5)*2%		12.0	(7)/(5)*2%		12.0	(7)/(5)*2%		12.0	(7)/(5)*2%		12.0	(7)/(5)*2%		15.0	(7)/(5)*2%		15.0
32	Interest	(7)/(5)*5%		30.0	(7)/(5)*5%		30.0	(7)/(5)*5%		30.0	(7)/(5)*5%		30.0	(7)/(5)*5%		37.5	(7)/(5)*5%		37.5
33	Sales,R&D	(7)/(5)*4%		24.0	(7)/(5)*4%		24.0	(7)/(5)*4%		24.0	(7)/(5)*4%		24.0	(7)/(5)*4%		30.0	(7)/(5)*4%		30.0
34	Fixed cost			180.0			182.4			181.6			175.5			221.2			219.7
35	Net production cost			749.3			637.1			720.2			712.5			491.1			688.5
36	R O I	(7)+(8)/(5)*15%		135.0	(7)+(8)/(5)*15%		135.0	(7)+(8)/(5)*15%		135.0	(7)+(8)/(5)*15%		135.0	(7)+(8)/(5)*15%		168.7	(7)+(8)/(5)*15%		168.7
37	Transfer price			884.3			772.1			855.2			847.5			659.8			857.3

Table III-2-A6 Cost Comparison of High Density Polyethylene (HDPE)

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	100000			100000			100000			100000			100000			100000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	80000			80000			80000			80000			80000			80000		
6	Capital cost																		
7	B/L M$	64			64			64			69			87			87		
8	Offsite M$	32			32			32			34.5			43.5			43.5		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Ethylene	1.01	520	525.2	1.01	423	427.2	1.01	498	502.9	1.01	494	498.9	1.01	250	252.5	1.01	422	426.2
16																			
17	Utilities																		
18	Power Kwh	175	0.051	8.9	175	0.032	5.6	175	0.047	8.2	175	0.046	8.0	175	0.02	3.5	175	0.04	7.0
19	Steam t	0.25	18.1	4.5	0.25	13.2	3.3	0.25	14	3.5	0.25	15.5	3.8	0.25	3	0.7	0.25	11	2.7
20	Fuel MMkcal																		
21	Others			16.2			12.6			13.4			14.4			4.8			11.1
22	Sub-total			29.6			21.5			25.1			26.3			9.0			20.8
23	Variable cost			554.8			448.7			528.1			525.2			261.5			447.0
24	Operating costs																		
25	Labour	80	16000	16.0	80	22500	22.5	80	20500	20.5	80	4000	4.0	80	10000	10.0	80	6000	6.0
26	Maintenance	(7)/(5)*6%		48.0	(7)/(5)*6%		48.0	(7)/(5)*6%		48.0	(7)/(5)*6%		51.7	(7)/(5)*6%		65.2	(7)/(5)*6%		65.2
27	Overhead expenses																		
28	Depreciation	(7)/(5)*10%		80.0	(7)/(5)*10%		80.0	(7)/(5)*10%		80.0	(7)/(5)*10%		86.2	(7)/(5)*10%		108.7	(7)/(5)*10%		108.7
29	Tax/Insurance	(7)/(5)*2%		16.0	(7)/(5)*2%		16.0	(7)/(5)*2%		16.0	(7)/(5)*2%		17.2	(7)/(5)*2%		21.7	(7)/(5)*2%		21.7
30	Administration	(7)/(5)*2%		16.0	(7)/(5)*2%		16.0	(7)/(5)*2%		16.0	(7)/(5)*2%		17.2	(7)/(5)*2%		21.7	(7)/(5)*2%		21.7
31	Interest	(7)/(5)*5%		40.0	(7)/(5)*5%		40.0	(7)/(5)*5%		40.0	(7)/(5)*5%		43.1	(7)/(5)*5%		54.3	(7)/(5)*5%		54.3
32	Sales,R&D	(7)/(5)*8%		64.0	(7)/(5)*8%		64.0	(7)/(5)*8%		64.0	(7)/(5)*8%		69.0	(7)/(5)*8%		87.0	(7)/(5)*8%		87.0
33	Fixed cost			280.0			286.5			284.5			288.6			368.8			364.8
34	Net production cost			834.8			735.2			812.6			813.8			630.4			811.9
35	R O I	(7)+(8)/(5)*15%		180.0	(7)+(8)/(5)*15%		180.0	(7)+(8)/(5)*15%		180.0	(7)+(8)/(5)*15%		194.0	(7)+(8)/(5)*15%		244.6	(7)+(8)/(5)*15%		244.6
36	Transfer price			1014.8			915.2			992.6			1007.9			875.1			1056.6

Table III-2-A7 Cost Comparison of Polyvinyl Chloride (PVC)

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	100000			100000			100000			100000			100000			100000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	80000			80000			80000			80000			80000			80000		
6	Capital cost																		
7	B/L M$	57			57			57			61			78			78		
8	Offsite M$	28.5			28.5			28.5			30.5			39			39		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	VCM	1.01	610	616.1	1.01	496	500.9	1.01	584	589.8	1.01	579	584.7	1.01	295	297.9	1.01	495	499.9
16																			
17	Utilities																		
18	Power Kwh	150	0.051	7.6	150	0.032	4.8	150	0.047	7.0	150	0.046	6.9	150	0.02	3.0	150	0.04	6.0
19	Steam t	1	18.1	18.1	1	13.2	13.2	1	14	14.0	1	15.5	15.5	1	3	3.0	1	11	11.0
20	Fuel MMkcal																		
21	Others			19.3			16.6			16.7			17.8			4.8			13.5
22	Sub-total			45.0			34.6			37.7			40.2			10.8			30.5
23	Variable cost			661.1			535.5			627.5			624.9			308.7			530.4
24	Operating costs																		
25	Labour	40	16000	8.0	40	22500	11.2	40	20500	10.2	40	4000	2.0	40	10000	5.0	40	6000	3.0
26	Maintenance	(7)/(5)*6%		42.7	(7)/(5)*6%		42.7	(7)/(5)*6%		42.7	(7)/(5)*6%		45.7	(7)/(5)*6%		58.5	(7)/(5)*6%		58.5
27	Overhead expenses																		
28	Depreciation	(7)/(5)*10%		71.2	(7)/(5)*10%		71.2	(7)/(5)*10%		71.2	(7)/(5)*10%		76.2	(7)/(5)*10%		97.5	(7)/(5)*10%		97.5
29	Tax/Insurance	(7)/(5)*2%		14.2	(7)/(5)*2%		14.2	(7)/(5)*2%		14.2	(7)/(5)*2%		15.2	(7)/(5)*2%		19.5	(7)/(5)*2%		19.5
30	Administration	(7)/(5)*2%		14.2	(7)/(5)*2%		14.2	(7)/(5)*2%		14.2	(7)/(5)*2%		15.2	(7)/(5)*2%		19.5	(7)/(5)*2%		19.5
31	Interest	(7)/(5)*5%		35.6	(7)/(5)*5%		35.6	(7)/(5)*5%		35.6	(7)/(5)*5%		38.1	(7)/(5)*5%		48.7	(7)/(5)*5%		48.7
32	Sales,R&D	(7)/(5)*8%		57.0	(7)/(5)*8%		57.0	(7)/(5)*8%		57.0	(7)/(5)*8%		61.0	(7)/(5)*8%		78.0	(7)/(5)*8%		78.0
33	Fixed cost			243.1			246.3			245.3			253.6			326.7			324.7
34	Net production cost			904.2			781.9			872.9			878.6			635.5			855.2
35	R O I	(7)+(8)/(5)*15%		160.3	(7)+(8)/(5)*15%		160.3	(7)+(8)/(5)*15%		160.3	(7)+(8)/(5)*15%		171.5	(7)+(8)/(5)*15%		219.3	(7)+(8)/(5)*15%		219.3
36	Transfer price			1064.5			942.2			1033.2			1050.1			854.8			1074.5

Table III-2-A8 Cost Comparison of Stylene (SM)

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	200000			200000			200000			200000			200000			200000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	160000			160000			160000			160000			160000			160000		
6	Capital cost																		
7	B/L M$	46			46			46			48.5			63			63		
8	Offsite M$	23			23			23			24.25			31.5			31.5		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Benzene	0.785	360	282.6	0.785	345	270.8	0.785	345	270.8	0.785	342	268.4	0.785	200	157.0	0.785	345	270.8
16	Ethylene	0.285	520	148.2	0.285	423	120.5	0.285	498	141.9	0.285	494	140.7	0.285	250	71.2	0.285	422	120.2
17	Sub-total			430.8			391.3			412.7			409.2			228.2			391.0
18	Utilities																		
19	Power Kwh	40	0.051	2.0	40	0.032	1.2	40	0.047	1.8	40	0.046	1.8	40	0.02	0.8	40	0.04	1.6
20	Steam t	1	18.1	18.1	1	13.2	13.2	1	14	14.0	1	15.5	15.5	1	3	3.0	1	11	11.0
21	Fuel MMkcal	1.55	11.5	17.8	1.55	9	13.9	1.55	11	17.0	1.55	10.9	16.8	1.55	2	3.1	1.55	2	3.1
22	Others			23.8			15.5			20.0			20.8			4.5			10.2
23	Sub-total			61.7			43.9			52.9			55.0			11.4			25.9
24	Byproduct credit																		
25	Toluene	0.024	325	7.8	0.024	311	7.4	0.024	311	7.4	0.024	309	7.4	0.024	180	4.3	0.024	311	7.4
26	Variable cost			484.7			427.8			458.2			456.8			235.3			409.5
27	Operating costs																		
28	Labour	20	16000	2.0	20	22500	2.8	20	20500	2.5	20	4000	0.5	20	10000	1.2	20	6000	0.7
29	Maintenance	(7)/(5)*6%		17.2	(7)/(5)*6%		17.2	(7)/(5)*6%		17.2	(7)/(5)*6%		18.1	(7)/(5)*6%		23.6	(7)/(5)*6%		23.6
30	Overhead expenses																		
31	Depreciation	(7)/(5)*10%		28.7	(7)/(5)*10%		28.7	(7)/(5)*10%		28.7	(7)/(5)*10%		30.3	(7)/(5)*10%		39.3	(7)/(5)*10%		39.3
32	Tax/Insurance	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		6.0	(7)/(5)*2%		7.8	(7)/(5)*2%		7.8
33	Administration	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		6.0	(7)/(5)*2%		7.8	(7)/(5)*2%		7.8
34	Interest	(7)/(5)*5%		14.3	(7)/(5)*5%		14.3	(7)/(5)*5%		14.3	(7)/(5)*5%		15.1	(7)/(5)*5%		19.6	(7)/(5)*5%		19.6
35	Sales,R&D	(7)/(5)*4%		11.5	(7)/(5)*4%		11.5	(7)/(5)*4%		11.5	(7)/(5)*4%		12.1	(7)/(5)*4%		15.7	(7)/(5)*4%		15.7
36	Fixed cost			85.3			86.1			85.9			88.4			115.4			114.9
37	Net production cost			570.1			514.0			544.1			545.2			350.7			524.4
38	R O I	(7)+(8)/(5)*15%		64.6	(7)+(8)/(5)*15%		64.6	(7)+(8)/(5)*15%		64.6	(7)+(8)/(5)*15%		68.2	(7)+(8)/(5)*15%		88.5	(7)+(8)/(5)*15%		88.5
39	Transfer price			634.8			578.7			608.8			613.4			439.3			613.0

Table III-2-A9 Cost Comparison of Polypropylene (PP)

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	100000			100000			100000			100000			100000			100000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	80000			80000			80000			80000			80000			80000		
6	Capital cost																		
7	B/L M$	35			35			35			35			45.5			45.5		
8	Offsite M$	17.5			17.5			17.5			17.5			22.75			22.75		
9	New/Exisiting Plant	N (Improved process)			N (Improved process)			N (Improved process)			N (Improved process)			N (Improved process)			N (Improved process)		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Propylene	1.01	315	318.1	1.01	301.5	304.5	1.01	301.5	304.5	1.01	299.3	302.2	1.01	250	252.5	1.01	125	126.2
16																			
17	Utilities																		
18	Power Kwh	150	0.051	7.6	150	0.032	4.8	150	0.047	7.0	150	0.046	6.9	150	0.02	3.0	150	0.04	6.0
19	Steam t	0.3	18.1	5.4	0.3	13.2	3.9	0.3	14	4.2	0.3	15.5	4.6	0.3	3	0.9	0.3	11	3.3
20	Fuel MMkcal																		
21	Others			35.2			31.9			32.3			32.9			11.2			26.8
22	Sub-total			48.2			40.6			43.5			44.4			15.1			36.1
23	Variable cost			366.4			345.1			348.0			346.7			267.6			162.3
24	Operating costs																		
25	Labour	20	16000	4.0	20	22500	5.6	20	20500	5.1	20	4000	1.0	20	10000	2.5	20	6000	1.5
26	Maintenance	(7)/(5)*6%		26.2	(7)/(5)*6%		26.2	(7)/(5)*6%		26.2	(7)/(5)*6%		26.2	(7)/(5)*6%		34.1	(7)/(5)*6%		34.1
27	Overhead expenses																		
28	Depreciation	(7)/(5)*10%		43.7	(7)/(5)*10%		43.7	(7)/(5)*10%		43.7	(7)/(5)*10%		43.7	(7)/(5)*10%		56.8	(7)/(5)*10%		56.8
29	Tax/Insurance	(7)/(5)*2%		8.7	(7)/(5)*2%		8.7	(7)/(5)*2%		8.7	(7)/(5)*2%		8.7	(7)/(5)*2%		11.3	(7)/(5)*2%		11.3
30	Administration	(7)/(5)*2%		8.7	(7)/(5)*2%		8.7	(7)/(5)*2%		8.7	(7)/(5)*2%		8.7	(7)/(5)*2%		11.3	(7)/(5)*2%		11.3
31	Interest	(7)/(5)*5%		21.8	(7)/(5)*5%		21.8	(7)/(5)*5%		21.8	(7)/(5)*5%		21.8	(7)/(5)*5%		28.4	(7)/(5)*5%		28.4
32	Sales,R&D	(7)/(5)*8%		35.0	(7)/(5)*8%		35.0	(7)/(5)*8%		35.0	(7)/(5)*8%		35.0	(7)/(5)*8%		45.5	(7)/(5)*8%		45.5
33	Fixed cost			148.3			150.0			149.5			145.3			190.1			189.1
34	Net production cost			514.8			495.1			497.5			492.1			457.7			351.5
35	R O I	(7)+(8)/(5)*15%		98.4	(7)+(8)/(5)*15%		98.4	(7)+(8)/(5)*15%		98.4	(7)+(8)/(5)*15%		98.4	(7)+(8)/(5)*15%		127.9	(7)+(8)/(5)*15%		127.9
36	Transfer price			613.2			593.6			596.0			590.5			585.7			479.5

Table III-2-A10 Cost Comparison of Acrylonitrile (AN)

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	100000			100000			100000			100000			100000			100000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	80000			80000			80000			80000			80000			80000		
6	Capital cost																		
7	B/L M$	66			66			66			70			90			90		
8	Offsite M$	33			33			33			35			45			45		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Propylene	1.12	315	352.8	1.12	301.5	337.6	1.12	301.5	337.6	1.12	299.3	335.2	1.12	250	280.0	1.12	125	140.0
16	Ammonia	0.45	395	177.7	0.45	321	144.4	0.45	378	170.1	0.45	375	168.7	0.45	190	85.5	0.45	378	170.1
17	Sub-total			530.5			482.1			507.7			503.9			365.5			310.1
18	Utilities																		
19	Power Kwh	200	0.051	10.2	200	0.032	6.4	200	0.047	9.4	200	0.046	9.2	200	0.02	4.0	200	0.04	8.0
20	Steam t																		
21	Fuel MMkcal																		
22	Others			53.4			48.8			49.9			51.0			21.2			42.5
23	Sub-total			63.6			55.2			59.3			60.2			25.2			50.5
24	Byproduct credit																		
25	Acetonitrile	0.05	82.8	4.1	0.05	64.8	3.2	0.05	79.2	3.9	0.05	78.5	3.9	0.05	14.4	0.7	0.05	14.4	0.7
26	Hydrocyanic acid	0.025	55.2	1.3	0.025	43.2	1.0	0.025	52.8	1.3	0.025	52.3	1.3	0.025	9.6	0.2	0.025	9.6	0.2
27	Sub-total			5.5			4.3			5.2			5.2			0.9			0.9
28	Variable cost			588.6			533.0			561.8			558.9			389.7			359.6
29	Operating costs																		
30	Labour	20	16000	4.0	20	22500	5.6	20	20500	5.1	20	4000	1.0	20	10000	2.5	20	6000	1.5
31	Maintenance	(7)/(5)*6%		49.5	(7)/(5)*6%		49.5	(7)/(5)*6%		49.5	(7)/(5)*6%		52.5	(7)/(5)*6%		67.5	(7)/(5)*6%		67.5
32	Overhead expenses																		
33	Depreciation	(7)/(5)*10%		82.5	(7)/(5)*10%		82.5	(7)/(5)*10%		82.5	(7)/(5)*10%		87.5	(7)/(5)*10%		112.5	(7)/(5)*10%		112.5
34	Tax/Insurance	(7)/(5)*2%		16.5	(7)/(5)*2%		16.5	(7)/(5)*2%		16.5	(7)/(5)*2%		17.5	(7)/(5)*2%		22.5	(7)/(5)*2%		22.5
35	Administration	(7)/(5)*2%		16.5	(7)/(5)*2%		16.5	(7)/(5)*2%		16.5	(7)/(5)*2%		17.5	(7)/(5)*2%		22.5	(7)/(5)*2%		22.5
36	Interest	(7)/(5)*5%		41.2	(7)/(5)*5%		41.2	(7)/(5)*5%		41.2	(7)/(5)*5%		43.7	(7)/(5)*5%		56.2	(7)/(5)*5%		56.2
37	Sales,R&D	(7)/(5)*4%		33.0	(7)/(5)*4%		33.0	(7)/(5)*4%		33.0	(7)/(5)*4%		35.0	(7)/(5)*4%		45.0	(7)/(5)*4%		45.0
38	Fixed cost			243.2			244.8			244.3			254.7			328.7			327.7
39	Net production cost			831.8			777.8			806.1			813.6			718.4			687.3
40	R O I	(7)+(8)/(5)*15%		185.6	(7)+(8)/(5)*15%		185.6	(7)+(8)/(5)*15%		185.6	(7)+(8)/(5)*15%		196.8	(7)+(8)/(5)*15%		253.1	(7)+(8)/(5)*15%		253.1
41	Transfer price			1017.5			963.5			991.8			1010.5			971.6			940.5

Table III-2-A11 Cost Comparison of Ethylhexanol

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	50000			50000			50000			50000			50000			50000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	40000			40000			40000			40000			40000			40000		
6	Capital cost																		
7	B/L M$	41			41			41			43			56			56		
8	Offsite M$	20.5			20.5			20.5			21.5			28			28		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Propylene	0.938	315	295.4	0.938	301.5	282.8	0.938	301.5	282.8	0.938	299.3	280.7	0.938	250	234.5	0.938	125	117.2
16	Oxogas	0.62	315	195.3	0.62	256	158.7	0.62	302	187.2	0.62	299	185.3	0.62	160	99.2	0.62	160	99.2
17	Hydrogene	0.04	330	13.2	0.04	257	10.2	0.04	315	12.6	0.04	312	12.4	0.04	160	6.4	0.04	160	6.4
18	Sub-total			503.9			451.8			482.6			478.6			340.1			222.8
19	Utilities																		
20	Power Kwh	400	0.051	20.4	400	0.032	12.8	400	0.047	18.8	400	0.046	18.4	400	0.02	8.0	400	0.04	16.0
21	Steam t	7	18.1	126.7	7	13.2	92.4	7	14	98.0	7	15.5	108.5	7	3	21.0	7	11	77.0
22	Fuel MMkcal																		
23	Others			56.9			37.9			55.3			45.7			13.7			44.0
24	Sub-total			204.0			143.1			172.1			172.6			42.7			137.0
25	Byproduct credit																		
26	Isobutanol	0.118	790	93.2	0.118	756	89.2	0.118	756	89.2	0.118	750	88.5	0.118	462	54.5	0.118	462	54.5
27	Fuel gas MMkcal	1.25	11.5	14.3	1.25	9	11.2	1.25	11	13.7	1.25	10.9	13.6	1.25	2	2.5	1.25	2	2.5
28	Sub-total			107.5			100.4			102.9			102.1			57.0			57.0
29	Variable cost			600.3			494.4			551.7			549.0			325.7			302.8
30	Operating costs																		
31	Labour	30	16000	12.0	30	22500	16.8	30	20500	15.3	30	4000	3.0	30	10000	7.5	30	6000	4.5
32	Maintenance	(7)/(5)*6%		61.5	(7)/(5)*6%		61.5	(7)/(5)*6%		61.5	(7)/(5)*6%		64.5	(7)/(5)*6%		84.0	(7)/(5)*6%		84.0
33	Overhead expenses																		
34	Depreciation	(7)/(5)*10%		102.5	(7)/(5)*10%		102.5	(7)/(5)*10%		102.5	(7)/(5)*10%		107.5	(7)/(5)*10%		140.0	(7)/(5)*10%		140.0
35	Tax/Insurance	(7)/(5)*2%		20.5	(7)/(5)*2%		20.5	(7)/(5)*2%		20.5	(7)/(5)*2%		21.5	(7)/(5)*2%		28.0	(7)/(5)*2%		28.0
36	Administration	(7)/(5)*2%		20.5	(7)/(5)*2%		20.5	(7)/(5)*2%		20.5	(7)/(5)*2%		21.5	(7)/(5)*2%		28.0	(7)/(5)*2%		28.0
37	Interest	(7)/(5)*5%		51.2	(7)/(5)*5%		51.2	(7)/(5)*5%		51.2	(7)/(5)*5%		53.7	(7)/(5)*5%		70.0	(7)/(5)*5%		70.0
38	Sales,R&D	(7)/(5)*4%		41.0	(7)/(5)*4%		41.0	(7)/(5)*4%		41.0	(7)/(5)*4%		43.0	(7)/(5)*4%		56.0	(7)/(5)*4%		56.0
39	Fixed cost			309.2			314.1			312.6			314.7			413.5			410.5
40	Net production cost			909.6			808.5			864.4			863.8			739.2			713.3
41	R O I	(7)+(8)/(5)*15%		230.6	(7)+(8)/(5)*15%		230.6	(7)+(8)/(5)*15%		230.6	(7)+(8)/(5)*15%		241.8	(7)+(8)/(5)*15%		315.0	(7)+(8)/(5)*15%		315.0
42	Transfer price			1140.2			1039.1			1095.0			1105.7			1054.2			1028.3

Table III-2-A12 Cost Comparison of Polystyrene (PS)

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	50000			50000			50000			50000			50000			50000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	40000			40000			40000			40000			40000			40000		
6	Capital cost																		
7	B/L M$	24.5			24.5			24.5			25.5			33			33		
8	Offsite M$	12.25			12.25			12.25			12.75			16.5			16.5		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	SM	0.98	590	578.2	0.98	565	553.7	0.98	565	553.7	0.98	560	548.8	0.98	377	369.4	0.98	565	553.7
16																			
17	Utilities																		
18	Power Kwh	135	0.051	6.8	135	0.032	4.3	135	0.047	6.3	135	0.046	6.2	135	0.02	2.7	135	0.04	5.4
19	Steam t																		
20	Fuel MMkcal	0.3	11.5	3.4	0.3	9	2.7	0.3	11	3.3	0.3	10.9	3.2	0.3	2	0.6	0.3	2	0.6
21	Others			19.8			17.3			18.0			14.0			6.0			9.6
22	Sub-total			30.1			24.3			27.6			23.4			9.3			15.6
23	Variable cost			608.3			578.0			581.3			572.2			378.7			568.3
24	Operating costs																		
25	Labour	50	16000	20.0	50	22500	28.1	50	20500	25.6	50	4000	5.0	50	10000	12.5	50	6000	7.5
26	Maintenance	(7)/(5)*6%		36.7	(7)/(5)*6%		36.7	(7)/(5)*6%		36.7	(7)/(5)*6%		38.2	(7)/(5)*6%		49.5	(7)/(5)*6%		49.5
27	Overhead expenses																		
28	Depreciation	(7)/(5)*10%		61.2	(7)/(5)*10%		61.2	(7)/(5)*10%		61.2	(7)/(5)*10%		63.7	(7)/(5)*10%		82.5	(7)/(5)*10%		82.5
29	Tax/Insurance	(7)/(5)*2%		12.2	(7)/(5)*2%		12.2	(7)/(5)*2%		12.2	(7)/(5)*2%		12.7	(7)/(5)*2%		16.5	(7)/(5)*2%		16.5
30	Administration	(7)/(5)*2%		12.2	(7)/(5)*2%		12.2	(7)/(5)*2%		12.2	(7)/(5)*2%		12.7	(7)/(5)*2%		16.5	(7)/(5)*2%		16.5
31	Interest	(7)/(5)*5%		30.6	(7)/(5)*5%		30.6	(7)/(5)*5%		30.6	(7)/(5)*5%		31.8	(7)/(5)*5%		41.2	(7)/(5)*5%		41.2
32	Sales,R&D	(7)/(5)*8%		49.0	(7)/(5)*8%		49.0	(7)/(5)*8%		49.0	(7)/(5)*8%		51.0	(7)/(5)*8%		66.0	(7)/(5)*8%		66.0
33	Fixed cost			222.1			230.2			227.7			215.3			284.7			279.7
34	Net production cost			830.4			808.2			809.0			787.6			663.5			849.0
35	R O I	(7)+(8)/(5)*15%		137.8	(7)+(8)/(5)*15%		137.8	(7)+(8)/(5)*15%		137.8	(7)+(8)/(5)*15%		143.4	(7)+(8)/(5)*15%		185.6	(7)+(8)/(5)*15%		185.6
36	Transfer price			968.2			946.0			946.9			931.0			849.1			1034.6

Table III-2-A13 Cost Comparison of Caprolactam

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	50000			50000			50000			50000			50000			50000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	40000			40000			40000			40000			40000			40000		
6	Capital cost																		
7	B/L M$	60			60			60			64			83			83		
8	Offsite M$	30			30			30			32			41.5			41.5		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Cycrohexane	1.06	545	577.7	1.06	522	553.3	1.06	522	553.3	1.06	518	549.0	1.06	548	580.8	1.06	548	580.8
16	Ammonia	0.805	395	317.9	0.805	321	258.4	0.805	378	304.2	0.805	375	301.8	0.805	190	152.9	0.805	378	304.2
17	F.Sulfulic acid	1.36	95	129.2	1.36	91	123.7	1.36	91	123.7	1.36	90	122.4	1.36	91	123.7	1.36	91	123.7
18	Hydrogene	0.09	330	29.7	0.09	257	23.1	0.09	315	28.3	0.09	312	28.0	0.09	160	14.4	0.09	160	14.4
19	Caustic soda	0.1	280	28.0	0.1	268	26.8	0.1	268	26.8	0.1	266	26.6	0.1	220	22.0	0.1	268	26.8
20	Sub-total			1082.5			985.4			1036.5			1028.0			893.9			1050.1
21	Utilities																		
22	Power Kwh	485	0.051	24.7	485	0.032	15.5	485	0.047	22.7	485	0.046	22.3	485	0.02	9.7	485	0.04	19.4
23	Steam t	13.5	18.1	244.3	13.5	13.2	178.2	13.5	14	189.0	13.5	15.5	209.2	13.5	3	40.5	13.5	11	148.5
24	Fuel MMkcal	0.19	11.5	2.1	0.19	9	1.7	0.19	11	2.0	0.19	10.9	2.0	0.19	2	0.3	0.19	2	0.3
25	Others																		
26	Sub-total			271.2			195.4			213.8			233.6			50.5			168.2
27	Byproduct credit																		
28	Ammonia sulfate	1.8	95	171.0	1.8	91	163.8	1.8	91	163.8	1.8	90	162.0	1.8	91	163.8	1.8	91	163.8
29	Variable cost			1182.8			1017.0			1086.6			1099.6			780.7			1054.6
30	Operating costs																		
31	Labour	50	16000	20.0	50	22500	28.1	50	20500	25.6	50	4000	5.0	50	10000	12.5	50	6000	7.5
32	Maintenance	(7)/(5)*6%		90.0	(7)/(5)*6%		90.0	(7)/(5)*6%		90.0	(7)/(5)*6%		96.0	(7)/(5)*6%		124.5	(7)/(5)*6%		124.5
33	Overhead expenses																		
34	Depreciation	(7)/(5)*10%		150.0	(7)/(5)*10%		150.0	(7)/(5)*10%		150.0	(7)/(5)*10%		160.0	(7)/(5)*10%		207.5	(7)/(5)*10%		207.5
35	Tax/Insurance	(7)/(5)*2%		30.0	(7)/(5)*2%		30.0	(7)/(5)*2%		30.0	(7)/(5)*2%		32.0	(7)/(5)*2%		41.5	(7)/(5)*2%		41.5
36	Administration	(7)/(5)*2%		30.0	(7)/(5)*2%		30.0	(7)/(5)*2%		30.0	(7)/(5)*2%		32.0	(7)/(5)*2%		41.5	(7)/(5)*2%		41.5
37	Interest	(7)/(5)*5%		75.0	(7)/(5)*5%		75.0	(7)/(5)*5%		75.0	(7)/(5)*5%		80.0	(7)/(5)*5%		103.7	(7)/(5)*5%		103.7
38	Sales,R&D	(7)/(5)*4%		60.0	(7)/(5)*4%		60.0	(7)/(5)*4%		60.0	(7)/(5)*4%		64.0	(7)/(5)*4%		83.0	(7)/(5)*4%		83.0
39	Fixed cost			455.0			463.1			460.6			469.0			614.2			609.2
40	Net production cost			1637.8			1480.1			1547.2			1568.6			1395.0			1663.8
41	R O I	(7)+(8)/(5)*15%		337.5	(7)+(8)/(5)*15%		337.5	(7)+(8)/(5)*15%		337.5	(7)+(8)/(5)*15%		360.0	(7)+(8)/(5)*15%		466.8	(7)+(8)/(5)*15%		466.8
42	Transfer price			1975.3			1817.6			1884.7			1928.6			1861.8			2130.7

Table III-2-A14 Cost Comparison of ABS

Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
Plant																		
Capacity t/y	50000			50000			50000			50000			50000			50000		
Load %	80			80			80			80			80			80		
Production t/y	40000			40000			40000			40000			40000			40000		
Capital cost																		
B/L M$	52.5			52.5			52.5			56			73			73		
Offsite M$	26.25			26.25			26.25			28			36.5			36.5		
New/Exisiting Plant	E			E			E			N			N			N		
	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t
Raw material																		
AN	0.266	1300	345.8	0.266	1245	331.1	0.266	1245	331.1	0.266	1235	328.5	0.266	1345	357.7	0.266	1345	357.7
Butadiene	0.319	520	165.8	0.319	498	158.8	0.319	498	158.8	0.319	494	157.5	0.319	498	158.8	0.319	598	190.7
SM	0.473	590	279.0	0.473	565	267.2	0.473	565	267.2	0.473	560	264.8	0.473	377	178.3	0.473	565	267.2
Sub-total			790.7			757.2			757.2			750.9			694.9			815.7
Utilities																		
Power Kwh	400	0.051	20.4	400	0.032	12.8	400	0.047	18.8	400	0.046	18.4	400	0.02	8.0	400	0.04	16.0
Steam t	4	18.1	72.4	4	13.2	52.8	4	14	56.0	4	15.5	62.0	4	3	12.0	4	11	44.0
Fuel MMkcal																		
Others			41.1			33.0			34.7			38.1			9.3			27.8
Sub-total			133.9			98.6			109.5			118.5			29.3			87.8
Variable cost			924.6			855.8			866.7			869.4			724.2			903.5
Operating costs																		
Labour	50	16000	20.0	50	22500	28.1	50	20500	25.6	50	4000	5.0	50	10000	12.5	50	6000	7.5
Maintenance	(7)/(5)*6%		78.7	(7)/(5)*6%		78.7	(7)/(5)*6%		78.7	(7)/(5)*6%		84.0	(7)/(5)*6%		109.5	(7)/(5)*6%		109.5
Overhead expenses																		
Depreciation	(7)/(5)*10%		131.2	(7)/(5)*10%		131.2	(7)/(5)*10%		131.2	(7)/(5)*10%		140.0	(7)/(5)*10%		182.5	(7)/(5)*10%		182.5
Tax/Insurance	(7)/(5)*2%		26.2	(7)/(5)*2%		26.2	(7)/(5)*2%		26.2	(7)/(5)*2%		28.0	(7)/(5)*2%		36.5	(7)/(5)*2%		36.5
Administration	(7)/(5)*2%		26.2	(7)/(5)*2%		26.2	(7)/(5)*2%		26.2	(7)/(5)*2%		28.0	(7)/(5)*2%		36.5	(7)/(5)*2%		36.5
Interest	(7)/(5)*5%		65.6	(7)/(5)*5%		65.6	(7)/(5)*5%		65.6	(7)/(5)*5%		70.0	(7)/(5)*5%		91.2	(7)/(5)*5%		91.2
Sales,R&D	(7)/(5)*8%		105.0	(7)/(5)*8%		105.0	(7)/(5)*8%		105.0	(7)/(5)*8%		112.0	(7)/(5)*8%		146.0	(7)/(5)*8%		146.0
Fixed cost			453.1			461.2			458.7			467.0			614.7			609.7
Net production cost			1377.7			1317.1			1325.5			1336.4			1339.0			1513.3
R O I	(7)+(8)/(5)*15%		295.3	(7)+(8)/(5)*15%		295.3	(7)+(8)/(5)*15%		295.3	(7)+(8)/(5)*15%		315.0	(7)+(8)/(5)*15%		410.6	(7)+(8)/(5)*15%		410.6
Transfer price			1673.0			1612.4			1620.8			1651.4			1749.6			1923.9

Table III-2-A15 Cost Comparison of MTBE

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	100000			100000			100000			100000			100000			100000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	80000			80000			80000			80000			80000			80000		
6	Capital cost																		
7	B/L M$	8.1			8.1			8.1			8.1			10.5			10.5		
8	Offsite M$	4.05			4.05			4.05			4.05			5.25			5.25		
9	New/Exisiting Plant	N			N			N			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	C4-- i-butene50%	0.645	220	141.9	0.645	210.5	135.7	0.645	210.5	135.7	0.645	209	134.8	0.645	210.5	135.7	0.645	125	80.6
16	Methanol	0.37	250	92.5	0.37	203	75.1	0.37	239	88.4	0.37	237	87.6	0.37	150	55.5	0.37	220	81.4
17	Sub-total			234.4			210.8			224.2			222.4			191.2			162.0
18	Utilities																		
19	Power Kwh	10	0.051	0.5	10	0.032	0.3	10	0.047	0.4	10	0.046	0.4	10	0.02	0.2	10	0.04	0.4
20	Steam t	0.5	18.1	9.0	0.5	13.2	6.6	0.5	14	7.0	0.5	15.5	7.7	0.5	3	1.5	0.5	11	5.5
21	Fuel MMkcal																		
22	Others			3.0			1.5			1.9			1.3			0.6			2.1
23	Sub-total			12.5			8.4			9.3			9.5			2.3			8.0
24	Variable cost			246.9			219.3			233.5			232.0			193.5			170.0
25	Operating costs																		
26	Labour	5	16000	1.0	5	22500	1.4	5	20500	1.2	5	4000	0.2	5	10000	0.6	5	6000	0.3
27	Maintenance	(7)/(5)*6%		6.0	(7)/(5)*6%		6.0	(7)/(5)*6%		6.0	(7)/(5)*6%		6.0	(7)/(5)*6%		7.8	(7)/(5)*6%		7.8
28	Overhead expenses																		
29	Depreciation	(7)/(5)*10%		10.1	(7)/(5)*10%		10.1	(7)/(5)*10%		10.1	(7)/(5)*10%		10.1	(7)/(5)*10%		13.1	(7)/(5)*10%		13.1
30	Tax/Insurance	(7)/(5)*2%		2.0	(7)/(5)*2%		2.0	(7)/(5)*2%		2.0	(7)/(5)*2%		2.0	(7)/(5)*2%		2.6	(7)/(5)*2%		2.6
31	Administration	(7)/(5)*2%		2.0	(7)/(5)*2%		2.0	(7)/(5)*2%		2.0	(7)/(5)*2%		2.0	(7)/(5)*2%		2.6	(7)/(5)*2%		2.6
32	Interest	(7)/(5)*5%		5.0	(7)/(5)*5%		5.0	(7)/(5)*5%		5.0	(7)/(5)*5%		5.0	(7)/(5)*5%		6.5	(7)/(5)*5%		6.5
33	Sales,R&D	(7)/(5)*4%		4.0	(7)/(5)*4%		4.0	(7)/(5)*4%		4.0	(7)/(5)*4%		4.0	(7)/(5)*4%		5.2	(7)/(5)*4%		5.2
34	Fixed cost			30.3			30.7			30.6			29.6			38.6			38.4
35	Net production cost			277.3			250.0			264.2			261.6			232.2			208.4
36	R O I	(7)+(8)/(5)*15%		22.7	(7)+(8)/(5)*15%		22.7	(7)+(8)/(5)*15%		22.7	(7)+(8)/(5)*15%		22.7	(7)+(8)/(5)*15%		29.5	(7)+(8)/(5)*15%		29.5
37	Transfer price			300.1			272.8			286.9			284.3			261.7			237.9

Table III-2-A16 Cost Comparison of Methanol

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y				500000			500000						500000			500000		
4	Load %				80			80						80			80		
5	Production t/y				400000			400000						400000			400000		
6	Capital cost																		
7	B/L M$				117			117						160			160		
8	Offsite M$				58.5			58.5						80			80		
9	New/Exisiting Plant				E			E						N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	N G MMkcal				7.2	9	64.8	7.2	11	79.2				7.2	2	14.4	7.2	2	14.4
16	Utilities																		
17	Power Kwh				10	0.032	0.3	30	0.047	1.4				10	0.02	0.2	10	0.04	0.4
18	Steam t																		
19	Fuel MMkcal																		
20	Others						1.9			1.4						0.2			0.4
21	Sub-total						2.2			2.8						0.4			0.8
22	Variable cost						67.0			82.0						14.8			15.2
23	Operating costs																		
24	Labour				25	22500	1.4	25	20500	1.2				25	10000	0.6	25	6000	0.3
25	Maintenance	(7)/(5)*6%			(7)/(5)*6%		17.5	(7)/(5)*6%		17.5	(7)/(5)*6%			(7)/(5)*6%		24.0	(7)/(5)*6%		24.0
26	Overhead expenses																		
27	Depreciation	(7)/(5)*10%			(7)/(5)*10%		29.2	(7)/(5)*10%		29.2	(7)/(5)*10%			(7)/(5)*10%		40.0	(7)/(5)*10%		40.0
28	Tax/Insurance	(7)/(5)*2%			(7)/(5)*2%		5.8	(7)/(5)*2%		5.8	(7)/(5)*2%			(7)/(5)*2%		8.0	(7)/(5)*2%		8.0
29	Administration	(7)/(5)*2%			(7)/(5)*2%		5.8	(7)/(5)*2%		5.8	(7)/(5)*2%			(7)/(5)*2%		8.0	(7)/(5)*2%		8.0
30	Interest	(7)/(5)*5%			(7)/(5)*5%		14.6	(7)/(5)*5%		14.6	(7)/(5)*5%			(7)/(5)*5%		20.0	(7)/(5)*5%		20.0
31	Sales,R&D	(7)/(5)*4%			(7)/(5)*4%		11.7	(7)/(5)*4%		11.7	(7)/(5)*4%			(7)/(5)*4%		16.0	(7)/(5)*4%		16.0
32	Fixed cost						86.2			86.1						116.6			116.3
33	Net production cost						153.2			168.1						131.4			131.5
34	R O I	(7)+(8)/(5)*15%			(7)+(8)/(5)*15%		65.8	(7)+(8)/(5)*15%		65.8	(7)+(8)/(5)*15%			(7)+(8)/(5)*15%		90.0	(7)+(8)/(5)*15%		90.0
35	Transfer price						219.0			233.9						221.4			221.5

Table III-2-A17 Cost Comparison of Ammonia

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
	Plant																		
	Capacity t/y	500000			500000			500000			500000			500000			500000		
	Load %	80			80			80			80			80			80		
	Production t/y	400000			400000			400000			400000			400000			400000		
	Capital cost																		
	B/L M$	115			115			115			122			150			150		
	Offsite M$	57.5			57.5			57.5			61			75			75		
	New/Exisiting Plant	E			E			E			E			N			N		
		Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t	Qt'y/t t/t	Price $/t	Unit cost $/t
	Raw material																		
	Naphtha MMkcal	8.9	14.2	126.3							8.9	13.4	119.2						
	N G MMkcal				6.6	9	59.4	6.6	11	72.6				6.6	2	13.2	6.6	2	13.2
	Utilities																		
	Power Kwh	24	0.051	1.2	20	0.032	0.6	20	0.047	0.9	24	0.046	1.1	20	0.02	0.4	20	0.04	0.8
	Steam t																		
	Fuel MMkcal																		
	Others			7.4			4.1			4.8			6.2			2.1			4.3
	Sub-total			8.6			4.7			5.7			7.3			2.5			5.1
	Variable cost			135.0			64.1			78.3			126.5			15.7			18.3
	Operating costs																		
	Labour	30	16000	1.2	30	22500	1.6	30	20500	1.5	30	4000	0.3	30	10000	0.7	30	6000	0.4
	Maintenance	(7)/(5)*6%		17.2	(7)/(5)*6%		17.2	(7)/(5)*6%		17.2	(7)/(5)*6%		18.3	(7)/(5)*6%		22.5	(7)/(5)*6%		22.5
	Overhead expenses																		
	Depreciation	(7)/(5)*10%		28.7	(7)/(5)*10%		28.7	(7)/(5)*10%		28.7	(7)/(5)*10%		30.5	(7)/(5)*10%		37.5	(7)/(5)*10%		37.5
	Tax/Insurance	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		6.1	(7)/(5)*2%		7.5	(7)/(5)*2%		7.5
	Administration	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		5.7	(7)/(5)*2%		6.1	(7)/(5)*2%		7.5	(7)/(5)*2%		7.5
	Interest	(7)/(5)*5%		14.3	(7)/(5)*5%		14.3	(7)/(5)*5%		14.3	(7)/(5)*5%		15.2	(7)/(5)*5%		18.7	(7)/(5)*5%		18.7
	Sales,R&D	(7)/(5)*4%		11.5	(7)/(5)*4%		11.5	(7)/(5)*4%		11.5	(7)/(5)*4%		12.2	(7)/(5)*4%		15.0	(7)/(5)*4%		15.0
	Fixed cost			84.5			85.0			84.9			88.7			109.5			109.2
	Net.production cost			219.5			149.2			163.2			215.3			125.2			127.5
	R O I	(7)+(8)/(5)*15%		64.6	(7)+(8)/(5)*15%		64.6	(7)+(8)/(5)*15%		64.6	(7)+(8)/(5)*15%		68.6	(7)+(8)/(5)*15%		84.3	(7)+(8)/(5)*15%		84.3
	Transfer price			284.2			213.8			227.9			283.9			209.5			211.8

Table III-2-A18 Cost Comparison of Urea

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	500000			500000			500000			500000			500000			500000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	400000			400000			400000			400000			400000			400000		
6	Capital cost																		
7	B/L M$	60			60			60			65			83			83		
8	Offsite M$	30			30			30			32.5			41.5			41.5		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	Ammonia	0.57	395	225.1	0.57	321	182.9	0.57	378	215.4	0.57	375	213.7	0.57	190	108.3	0.57	378	215.4
16	CO2	0.75	157.5	118.1	0.75	128.5	96.3	0.75	151	113.2	0.75	156	117.0	0.75	80	60.0	0.75	80	60.0
17	Sub-total			343.2			279.3			328.7			330.7			168.3			275.4
18	Utilities																		
19	Power Kwh	50	0.051	2.5	50	0.032	1.6	50	0.047	2.3	50	0.046	2.3	50	0.02	1.0	50	0.04	2.0
20	Steam t	0.7	18.1	12.6	0.7	13.2	9.2	0.7	14	9.8	0.7	15.5	10.8	0.7	3	2.1	0.7	11	7.7
21	Fuel MMkcal																		
22	Others			1.8			1.8			1.1			1.3			0.4			1.3
23	Sub-total			17.0			12.6			13.2			14.4			3.5			11.0
24	Variable cost			360.2			291.9			341.9			345.2			171.8			286.4
25	Operating costs																		
26	Labour	20	16000	0.8	20	22500	1.1	20	20500	1.0	20	4000	0.2	20	10000	0.5	20	6000	0.3
27	Maintenance	(7)/(5)*6%		9.0	(7)/(5)*6%		9.0	(7)/(5)*6%		9.0	(7)/(5)*6%		9.7	(7)/(5)*6%		12.4	(7)/(5)*6%		12.4
28	Overhead expenses																		
29	Depreciation	(7)/(5)*10%		15.0	(7)/(5)*10%		15.0	(7)/(5)*10%		15.0	(7)/(5)*10%		16.2	(7)/(5)*10%		20.7	(7)/(5)*10%		20.7
30	Tax/Insurance	(7)/(5)*2%		3.0	(7)/(5)*2%		3.0	(7)/(5)*2%		3.0	(7)/(5)*2%		3.2	(7)/(5)*2%		4.1	(7)/(5)*2%		4.1
31	Administration	(7)/(5)*2%		3.0	(7)/(5)*2%		3.0	(7)/(5)*2%		3.0	(7)/(5)*2%		3.2	(7)/(5)*2%		4.1	(7)/(5)*2%		4.1
32	Interest	(7)/(5)*5%		7.5	(7)/(5)*5%		7.5	(7)/(5)*5%		7.5	(7)/(5)*5%		8.1	(7)/(5)*5%		10.3	(7)/(5)*5%		10.3
33	Sales, R&D	(7)/(5)*4%		6.0	(7)/(5)*4%		6.0	(7)/(5)*4%		6.0	(7)/(5)*4%		6.5	(7)/(5)*4%		8.3	(7)/(5)*4%		8.3
34	Fixed cost			44.3			44.5			44.5			47.3			60.6			60.4
35	Net production cost			404.5			336.6			386.4			392.5			232.4			346.9
36	R O I	(7)+(8)/(5)*15%		33.7	(7)+(8)/(5)*15%		33.7	(7)+(8)/(5)*15%		33.7	(7)+(8)/(5)*15%		36.5	(7)+(8)/(5)*15%		46.6	(7)+(8)/(5)*15%		46.6
37	Transfer price			438.3			370.3			420.2			429.0			279.1			393.6

Table III-2-A19 Cost Comparison of DMT

	Nation/Region	Japan			U S A			W Europe			N I C S			Saudi Arabia			Argentina		
2	Plant																		
3	Capacity t/y	100000			100000			100000			100000			100000			100000		
4	Load %	80			80			80			80			80			80		
5	Production t/y	80000			80000			80000			80000			80000			80000		
6	Capital cost																		
7	B/L M$	45			45			45			47			61			61		
8	Offsite M$	22.5			22.5			22.5			23.5			30.5			30.5		
9	New/Exisiting Plant	E			E			E			N			N			N		
10																			
11		Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost	Qt'y/t	Price	Unit cost
12		t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t	t/t	$/t	$/t
13																			
14	Raw material																		
15	o-Xylene	0.566	360	203.7	0.566	345	195.2	0.566	345	195.2	0.566	342	193.5	0.566	200	113.2	0.566	207	117.1
16	Methanol	0.366	250	91.5	0.366	203	74.2	0.366	239	87.4	0.366	237	86.7	0.366	150	54.9	0.366	200	73.2
17	Acetic acid	0.04	646	25.8	0.04	525	21.0	0.04	618	24.7	0.04	614	24.5	0.04	311	12.4	0.04	619	24.7
18	Sub-total			321.1			290.5			307.4			304.8			180.5			215.1
19	Utilities																		
20	Power Kwh	380	0.051	19.3	380	0.032	12.1	380	0.047	17.8	380	0.046	17.4	380	0.02	7.6	380	0.04	15.2
21	Steam t	-1.08	18.1	-19.5	-1.08	13.2	-14.2	-1.08	14	-15.1	-1.08	15.5	-16.7	-1.08	3	-3.2	-1.08	11	-11.8
22	Fuel MMkcal	1.17	11.5	13.4	1.17	9	10.5	1.17	11	12.8	1.17	10.9	12.7	1.17	2	2.3	1.17	2	2.3
23	Others			15.8			16.4			16.9			14.0			7.6			9.6
24	Sub-total			29.0			24.8			32.5			27.4			14.3			15.2
25	Variable cost			350.1			315.4			339.9			332.3			194.8			230.3
26	Operating costs																		
27	Labour	40	16000	8.0	40	22500	11.2	40	20500	10.2	40	4000	2.0	40	10000	5.0	40	6000	3.0
28	Maintenance	(7)/(5)*6%		33.7	(7)/(5)*6%		33.7	(7)/(5)*6%		33.7	(7)/(5)*6%		35.2	(7)/(5)*6%		45.7	(7)/(5)*6%		45.7
29	Overhead expenses																		
30	Depreciation	(7)/(5)*10%		56.2	(7)/(5)*10%		56.2	(7)/(5)*10%		56.2	(7)/(5)*10%		58.7	(7)/(5)*10%		76.2	(7)/(5)*10%		76.2
31	Tax/Insurance	(7)/(5)*2%		11.2	(7)/(5)*2%		11.2	(7)/(5)*2%		11.2	(7)/(5)*2%		11.7	(7)/(5)*2%		15.2	(7)/(5)*2%		15.2
32	Administration	(7)/(5)*2%		11.2	(7)/(5)*2%		11.2	(7)/(5)*2%		11.2	(7)/(5)*2%		11.7	(7)/(5)*2%		15.2	(7)/(5)*2%		15.2
33	Interest	(7)/(5)*5%		28.1	(7)/(5)*5%		28.1	(7)/(5)*5%		28.1	(7)/(5)*5%		29.3	(7)/(5)*5%		38.1	(7)/(5)*5%		38.1
34	Sales,R&D	(7)/(5)*4%		22.5	(7)/(5)*4%		22.5	(7)/(5)*4%		22.5	(7)/(5)*4%		23.5	(7)/(5)*4%		30.5	(7)/(5)*4%		30.5
35	Fixed cost			171.1			174.3			173.3			172.3			226.1			224.1
36	Net production cost			521.3			489.7			513.3			504.7			420.9			454.5
37	R O I	(7)+(8)/(5)*15%		126.5	(7)+(8)/(5)*15%		126.5	(7)+(8)/(5)*15%		126.5	(7)+(8)/(5)*15%		132.1	(7)+(8)/(5)*15%		171.5	(7)+(8)/(5)*15%		171.5
38	Transfer price			647.8			616.3			639.9			636.9			592.5			626.0

2-A-4 Producers in Petrochemical Industry in Argentina

Petrochemical Producers in Argentina (T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in Capital
1. ATANOR S.A.M. (ATANOR)	(1) Rio Tercero, Cordoba	1 Methanol	14,000	Natural Gas	D.G.F.M ; 20% Argentine private capital ; 80%
		2 Acetaldehyde	3,300		
		3 Acetic Acid	4,300		
	(2) Munro, Buenos Aires	1 Acetaldehyde	2,600		
		2 Acetic Acid	3,300		
		3 Formaldehyde	48,000	Methanol	
	(3) Baradero, Buenos Aires	1 Acetaldehyde	5,600		
		2 Acetic Acid	7,300		
		3 Acetic Anhydride	2,140		
2. CARBOCLOR INDUSTRIAS QUIMICAS S.A.I.C. (CARBOCLOR)	(1) Campana, Buenos Aires	1 Acetone	12,000	Refinery Cuts (C_3, C_4)	Astra-CAPSA ; 50% Lahusen y Cia, Ltda ; 50%
		2 Isopropanol	35,600		
		3 Solvents	38,000		
3. COMPANIA CASCO S.A.I.C. (CASCO)	(1) Pilar, Buenos Aires	1 Formaldehyde	40,000	Methanol	Borden Inc. ; 99%
		2 Methanol	20,000	Natural Gas	
		3 Resins	?	Formaldehyde	
4. COMPANIA QUIMICA S.A. (COMPANIA QUIMICA)	(1) Dock Sud, Buenos Aires	1 Phthalic Anhydride	14,000		Argentine private capital ; 100%
		2 Pesticides	?		
		3 Fertilizers	?		
		4 Household Products	?		

Source ; 1986 Worldwide Petrochemical Directory
Anuario Petroquimico Latino Americano 1985

Petrochemical Producers in Argentina (T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
5. DIRECCION GENERAL DE FABRICACIONES MILITARES MINISTERIO DE DEFENSE (D.G.F.M.)	(1) Campana, Buenos Aires	1 Aromatics	27,000	Naphtha	Subsidaries and affiliates ATANOR ; 21% PETROQUIMICA BAHIA BLANKA ; 17% P.G.M. ; 50% PETROQUIMICA RIO III ; 8.59% POLISUR ; 30%
	(2) Rio Tercero, Cordoba	1 Ammonia	12,000	Synthetic Gas	
		2 Nitric Acid	43,000	Ammonia	
	(3) Avellaneda, B.A. (4) La Plata, B.A. (5) Pilar, B.A. (6) San Francisco, Cordoba (7) Rosario, Santa Fe (8) Fray Luis Beltran, St.Fe (9) Palpala, Jujuy (10) Andalgala, Catamarca (11) San Martin, B.A.				Products and their capacity are not shown.
6. DUCILO S.A. (DUCILO)	(1) Berazategui, B.A.	1 Nylon 66	21,000	Hexamethylene -diamine	E.I. Dupont de Nemours & Co.; 82.81% Argentine private capital; 17.19%
		?	?		
	(2) Mercedes, B.A.	2 Nylon 6	1,400	Caprolactam	Cellophane, Freon, Carpet Fibers and polypropylene film are produced.
7. DUPERIAL S.A.I.C. (DUPERIAL)	(1) San Lorenzo, Santa Fe	1 Ethylene	15,000	Naphtha	
		2 Carbon bisulfide	14,000	Natural Gas, Sulfur	Imperial Chemical Ind. ; 100% (I.C.I.)
		3 Phthalic Anhydride	14,000	O-Xylene	
		4 Polyethylene (LDPE)	20,000	Ethylene	
		5 Plasticizers	18,000		
		6 Propylene/butadiene	6,000	Naphtha	
		7 Aromatics	13,000	"	

Source ; 1986 Worldwide Petrochemical Directory
Anuario Petroquimico Latino Americano 1985

Petrochemical Producers in Argentina (Unit; T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
8. ELECTROCLOR S.A. (ELECTROCLOR)	(1) Cap. Bermudez, St. Fe	1 Acetylene	30,000	Calcium Carbide	DUPERIAL ; 30% Celulosa Argentina S.A. ; 30% Argentine private capital ; 40%
		2 Ammonia	3,000	Electrolysis H_2,N_2	
		3 Polyvinyl Chloride	29,000	V.C.M	
		4 Vinyl Chloride	30,500	Acetylene, Chlorine	
	(2) Bahia Blanca, B.A.	1 Polyvinyl Chloride	41,500	V.C.M	Future project
9. HISISA ARGENTINA S.A.I.C.I.F. (HISISA)	(1) Baradero, B.A.	1 Acrylic Fibers	16,500	AN	Argentine private capital ; 100%
		2 Poly Acrylonitrile	14,400	AN, Methyl Acrylate	
10. INDOQUIM S.A. (INDOQUIM)	(1) San Lorenzo, St. Fe	1 SBR Latex	5,000	SM, BD	DOW Chemical ; 100%
		2 Agrochemicals	?		
		3 Polyolefins	?		Starting up in 1982
11. INDUPA S.A. (INDUPA)	(1) Cinco Saltos, Rio Negro	1 Acetylene	7,500	Calcium Carbide	Argentine private group ; 100%
		2 Vinyl Chloride	38,000	Acetylene, Chlorine	
		3 Polyvinyl Chloride	30,000	V.C.M.	
	(2) Bahia Blanca, B.A.	1 Vinyl Chloride	130,000	Ethylene, Chlorine	Under construction
		2 Polyvinyl Chloride	56,000	VCM	

Source ; 1986 Worldwide Petrochemical Directory
Anuario Petroquimico Latino Americano 1985

Petrochemical Producers in Argentina (Unit; T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
12. INDUSTRIAL PETROQUIMICAS ARGENTINAS S.A. (IPAKO)	(1) Ensenada, B.A.	1 Ethylene	15,000	Refinery Products	Group of Garavaglia & Zorraquin ; 65% Argentine private capital; 35% Subsidaries and affiliates
		2 Polyethylene	14,000	Ethylene	
	(2) Florencio Varela, B.A.	1 Polystyrene	12,000	SM	PETROQUIMICA BAHIA BLANCA; 21.2% POLISUR ; 70%
13. MALEIC S.A. (MALEIC)	(1) Ensenada, B.A.	1 Maleic Anhydride	7,000	Butane	Argentine private capital; 100%
14. MONSANTO ARGENTINA S.A. (MONSANTO)	(1) Zarate, Buenos Aires	1 ABS & SAN	16,000	AN, BD, SM	Monsanto Overseas S.A. ; 100%
		2 Polystyrene	40,000	SM	
	(2) Florencio Varela, B.A.	1 Polystyrene		SM	
15. PETROQUIMICA ARGENTINA S.A. (PASA)	(1) San Lorenzo, Santa Fe	1 Ethylene	23,000	Propane	
		2 Aromatics	150,000	Naphtha	
		3 Butadiene	37,000	n-Butane	
		4 Ethylbenzene	65,000	Ethylene, Benzene	Amocorp S.A. ; 25% Vista Chemical Co. ; 25% Uniroyal Inc. ; 25% Witco Chemical Corp. ; 13.5% Fish Inter America Inc. ; 11.5%
		5 Styrene	54,000	EB	
		6 SBR	54,000	SM, BD	
		7 NR	2,000	AN, BD	

Source ; 1986 Worldwide Petrochemical Directory
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Petrochemical Producers in Argentina (Unit; T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
16. PETROQUIMICA BAHIA BLANCA (P.B.B.)	(1) Bahia Blanca, B.A.	1 Ethylene	200,000	Ethane & Propane	GDE ; 17% C.Itoh & Co. Ltd.; 9% YPF ; 17% INDUPA ; 5.5% DGFM; 17% Others ; 2.6% IPAKO ; 21.2% ELECTROCLOR ; 10.6%
		2 Propylene	20,000	"	
		3 C_4's	14,400	"	
		4 Ethylene Expansion	(1) 45,000	Ethane	By the end of 1986 (1)
		5 Ethylene Expansion	(2) 120,000	"	Future project (2)
		6 Propylene Expansion	(1) 1,300	"	
		7 Propylene Expansion	(2) 2,800	"	
		8 C_4's Expansion	(1) 2,275	"	
		9 C_4's Expansion	(2) 4,900	"	
		10 H_2 + Methane	(1) 9,750	"	
		11 H_2 + Methane	(2) 21,000	"	
		12 Pyrolisis Gasoline	(1) 1,625	"	
		13 Pyrolisis Gasoline	(2) 3,500	"	
17. PETROQUIMICA GENERAL MOSCONI S.A.I.C. (P.G.M.)	(1) Ensenada, B.A.	1 Benzene	67,000	Straight-run Naphtha	YPF ; 50% DGFM ; 50%
		2 Toluene	38,000		
		3 o-Xylene	23,000		
		4 p-Xylene	32,000		
		5 mix-Xylene	9,000		
		6 Cyclohexane	33,000		
		7 Gasoline Hydrogenation	25,000		

Source ; 1986 Worldwide Petrochemical Directory
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Petrochemical Producers in Argentina (Unit; T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
18. PETROQUIMICA RIO TERCERO S.A. (P.R. III)	(1) Rio Tercero, Cordoba	1 Toluene Diisocyanate(TDI)	16,000	Toluene, Nitric Acid	Starting up in 1980 ATANOR ; 51% YPF ; 38% DGFM ; 11%
19. PETROQUIMICA SUDAMERICANA S.A.	(1) La Plata, B.A.	1 Dimethyl Terephthalate (D.M.T)	14,000	p-Xylene	
20. PETROSUR S.A. (PETROSUR)	(1) Campana, B.A.	1 Ammonia 2 Urea	72,600 99,000	Natural Gas Ammonia, CO_2	Empresa Sudamericana Consolidada S.A. (Panama) ; 100%
21. POLIBUTENOS ARGENTINAS S.A. (POLIBUTENOS)	(1) Ensenada, B.A.	1 Polybutene 2 Polyisobutene	9,000	Butene, Butylene	
22. POLIMIDAS ARGENTINAS S.A.	(1) San Martin, B.A.	1 Petrochemical Resins	?		
23. POLISUR S.A. (POLISUR)	(1) Bahia Blanca, B.A.	1 Polyethylenes (LLDPE & LDPE)	190,000		IPAKO ; 70% DGFM ; 30%
24. QUIMICA HOECHST S.A.	(1) Buenos Aires	1 Specialities for the Petroleum Industry	?		
25. SIPAK	(1) Buenos Aires	1 Resins	?		
26. SUDAMTEX S.A. TEXTIL SUDAMERICANA (SUDAMTEX)	(1) Azul, Buenos Aires	1 Polyester Chips & Fibers	6,500	D.M.T, EG	

Source ; 1986 Worldwide Petrochemical Directory
Anuario Petroquimico Latino Americano 1985

Petrochemical Producers in Argentina (Unit; T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
27. VIPLASTIC S.A. (VIPLASTIC)	(1) Chacaras de Coria,Mendoza	1 Acetylene	3,000	Calcium Carbide	
		2 Vinyl Chloride	6,000	Acetylene, Chlorine	
		3 Polyvinyl Chloride	6,000	VCM	
28. YACIMENTOS PETROLIFEROS FISCALES S.A. (YPF)	(1) Campo-Duran Salta	1 Topper	28,000 B.D.		Argentine Government Agency, Established in 1907
	(2) Plaza Huincil, Neuquen	1 Topper	5,000 B.D.		Subsidaries and Affiliates
	(3) San Lorenzo, St. Fe	1 Topper	33,000 B.D.		P.B.B ; 17%
		2 Thermal Cracking	4,000 B.D.		P.G.M ; 50%
		3 Visbreaker	12,000 B.D.		P.R. III ; 38%
	(4) Dock Sud, B.A.	1 Topper	4,000 B.D.		
		2 Thermal Cracking	2,000 B.D.		
	(5) Lujan de Cuyo, Mendoza	1 Topper	113,000 B.D.		
		2 Reformer	9,000 B.D.		
		3 F.C.C.	20,000 B.D.		
		4 Hydrocracking	20,000 B.D.		
		5 Coker	22,000 B.D.		
		6 Visbreaker	10,000 B.D.		
		7 Propylene	30,000 T/Y	F.C.C. Off Gas	

Source ; 1986 Worldwide Petrochemical Directory
Anuario Petroquimico Latino Americano 1985

Petrochemical Producers in Argentina (Unit; T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
28. YACIMENTOS PETROLIFEROS FISCALES S.A. (YPF)	(6) Ensenada, B.A.	1 Topper	230,000 B.D.		
		2 Reformer	9,000 B.D.		
		3 F.C.C.	41,000 B.D.		
		4 Coker	23,000 B.D.		
		5 Alkylation	3,000 B.D.		
		6 Propylene	61,500 T/Y	F.C.C. Off Gas	
		7 Butylene	6,100 T/Y		
		8 Oligomers	19,000 T/Y		
		9 Cumene	46,000 T/Y	Propylene, Benzene	
		10 Alkylbenzene	40,000 T/Y	Oligomers, Benzene	
29. ASTRASUR, REFINERAS PATAGONICAS DE PETROLEO S.A.	(1) Commodoro, Rivadavia	1 Topper	7,000 B.D.		Governmental share; 14.3%
		2 Visbreaker	3,000 B.D.		
		3 Thermal Cracker	2,000 B.D.		
30. DESTILERIA ARGENTINA DE PETROLEO S.A.	(1) Lomas de Zamora	1 Topper	2,000 B.D.		
31. ESSO SAPA	(1) Campana, B.A	1 Topper	92,000 B.D.		
		2 Reformer	8,000 B.D.		
		3 F.C.C.	18,000 B.D.		
		4 Coker	14,000 B.D.		
		5 Propylene	36,500 T/Y	FCC Off Gas	
		6 Butylene	70,100 T/Y	"	Including butene
	(2) Galvan	1 Topper	17,000 B.D.		

Source ; 1986 Worldwide Petrochemical Directory
Anuario Petroquimico Latino Americano 1985

Petrochemical Producers in Argentina (Unit; T/Y)

COMPANY	LOCATION	PRODUCTS	CAPACITY (T/Y)	RAW MATERIALS	REMARKS and Shares in capital
32. REFINERIA DE PETROLEO 'LA ISAURA' S.A.	(1) Bahia Blanca, B.A.	1 Topper	24,000 B.D.		
		2 F.C.C.	6,000 B.D.		
		3 Visbreaker	4,000 B.D.		
33. SHELL CAMPANIA ARGENTINA DE PETROLEO S.A.	(1) Dock Sud, B.A.	1 Topper	115,000 B.D.		
		2 Reformer	9,000 B.D.		
		3 F.C.C.	21,000 B.D.		
		4 Visbreaker	25,000 B.D.		
		5 Alkylation	2,000 B.D.		
		6 Propylene	24,000 T/Y	FCC Off Gas	
		7 Butylene	26,000 T/Y	"	

Source ; 1986 Worldwide Petrochemical Directory
Anuario Petroquimico Latino Americano 1985

3. ELECTRONICS (COMPUTER-RELATED INDUSTRY)

3-1 Computer Industry

3-1-1 Characteristics of Computer Industry

(1) Introduction

The Argentine government started to promote domestic computer production by recognizing its importance for the future development of Argentine economy. The computer industry comprises a greater variety of products and activities than other industrial sectors, and it has a major influence on both society and the economy. In designing promotional measures, therefore, it is important to understand the special characteristics of the computer industry. It is desirable in Argentina that the development policy for the information industry would be implemented in a flexible way through the collaborative efforts of the government and the private sector.

In this section following points will be discussed: 1) the major features of the computer industry; 2) the present status and problems of the industry in Argentina; 3) the major issues to be dealt with in the future and the direction of future policy and 4) some suggestions.

(2) Characteristics of computer industry

The followings are the special characteristics of the computer industry.

(a) Popularization of computer usage and wide range of associated industries

In every country, computers applications are becoming common in all industrial fields such as office automotion, factory automation and process control. Also there are a large number of associated industries which are expected to grow rapidly like the semi-conductor and IC (Integrated Circuit) industry. The information service industry is another important sector, and it will give large influence on all other industries.

(b) International aspect of computer industry

The computer industry has been develoepd on an international scale since its beginnings. Especially IBM has been taking a leading role keeping the share of more than 50% of world market. Also at present, US mainframers have share of about 80%. The development of information systems will not be confined to any one nation's framework but will inevitably spread on a global scale along with the expansion of international activities of those US

manufacturers. Therefore, the development of a computer industry and computerization in Argentina must be carried out with international perspective.

(c) Rapid advancement of technology and its diversified influence

The computer industry has a great impact on development of other industries due to its advanced nature of technology and the aforementioned links with other industrial sectors. Furthermore, as can be seen from the recent trends in VLSIs (Very Large Scale Integrated Circuit) and micro-processors, the speed of technological advancement is quite rapid and the life cycle of new products is quite short.

(d) Increase of demand in different areas

Along with the rapid progress in hardware, software and systems technology, computer technologies are applied to diversified areas being not only sophisticated scientific areas but also such common areas as education and hobbies. In particular, an increase in the use of micro-computers is noticeable in many fields such as office, automation, factory automation, research and development systems, systems for home use.

(e) Wide business range and diversified activities

Unlike most other industries, the computer business is not concerned with simply marketing products, but includes a major aspect of providing information, functions or services required by users. In addition it includes a wide variety of business activities as cited below:

- Research and development of new technology and new products in response to rapid technological advancements and market fluctuations, as well as maintaining consistency of product lines
- Production of hardware and software to create optimum systems
- Training service and system support staff for users
- Installation and operation of hardware at users' establishments
- Regular maintenance of hardware and software
- Complicated forms of marketing and services for users

(f) Large investment over long period

An enormous amount of funds and manpower are required in various phases of the business for the following purposes:

- Long-term continuous investments in research and development to cope with the rapid technological progress, requiring a large number of skilled workers for software development

- Procurement and replacement of high-precision instruments and cost-saving production equipment to cope with the short product cycle

- Marketing funds for renting and leasing products

- Set up of marketing system and support and maintenance services for users

(g) Linkage between computers and communications

The progress in the development of information systems and a higher demand for computer networks will further promote the link between computers and communications.

(h) Importance of software and emerge as an industry

The development and improvement of software (OS language) for the efficient operation of computer systems as well as for efficient job processing and data processing by users require more capital than the development of hardware. Thus, software has come to be considered even more important than hardware, its value and price structure having been accepted by the market. Accordingly the software business, which includes information services, is now becoming an independent industry.

In light of all these features, the government's role is quite important for nurturing and strengthening the computer industry, especially in the initial stage. In consideration of today's world market trends, were it not for the government's promotional policies and assistance, it would be extremely difficult for a computer industry to grow from a primitive level to being capable of contributing to a nation's economic and social development. Moreover, the diversity of this industry requires a well-balanced approach. Otherwise, even if some promotional measures were successful, they would not lead to the smooth development of the industry as a whole, and the net result of such efforts would amount to very little.

It is therefore essential for the Argentine government, based on a long-range perspective and taking into account the current conditions of the nation such as technological level, market conditions, financial capacity, economic trends and potential, to work out a long-term consistent policy to determine in what areas and under what timetable domestic production should be accomplished and how foreign technology should be used to achieve that goal. It must also continue its persistent efforts in overcoming all difficulties that may arise. This policy should be broken down into concrete execution programs so that the concerned government agencies and private enterprises can follow them easily. The programs should also be assessed and reviewed continuously so as to be flexible enough to adjust to changes in surrounding conditions.

3-1-2 Present Situation of Argentina's Computer Industry

(1) Computer market

In Argentina, computerization started recently. Total number of computer introduced per year was less than 100 until 1975. After 1976, because of the liberalization trade policy in Argentina and the diffusion of micro-computer in worldwide, number of introduction jumped to 1,000. Nowadays, although the number of introduction has been increasing, large share has been occupied by home computer and micro-computer and not by general purpose computer (Table III-3-1).

Regarding general purpose computer (class 1 to 5) the largest share is occupied by IBM (22.1%) and then Burroughs (14.6%). Other companies share are quite small less than 10%. In the sector of home computer and micro-computer, Texas Instruments is enjoying quite large share (65%). This is due to their large sales of home computer (Table III-3-2). According to the table, it can be said that tempo of computerlization has been quite slow. If home computer and micro-computer is excluded, the number of introduction per year has leveled off at about 1,500 for these four years.

Computers are used primarily for accounting in financial, manufacturing, and merchandising and service businesses. Especially in the merchandising and service industry the number of micro-computer has increased remarkably. At present, the Argentine economy is still in a state of stagnation, and the country suffers from a shortage of funds. Accordingly, as mentioned above, the demand for computers except for micro-computers has not increased. On the other hand, the demand for micro-computers has increased due to substantial price reductions and rapid improvement of performance. As a result, they have been successfully introduced for home use chiefly for education and games due to their low price, and for business use due to high performance.

Given these market conditions, major domestic companies and other firms which have been engaged in the import and sale of computers, development of software and systems support services have examined expanding into domestic production of micro-computers for the past several years. Many of them are looking at joint venture businesses with foreign manufacturers and other existing project models in line with the Government's domestic production policy under Resolution 44.

(2) Production, marketing and research

The computer market in Argentina had been occupied primarily by imported American products along with some Japanese, European and Brazilian ones. However, some movement toward domestic production has been appeared recently.

In 1976, Microsistema, for the first time, put a domestically-developed model of micro-computer, the MS101, on the market. Since then, new models have been developed continuously by the company, which is now selling the MS61 at a rate of 60 units per month. This quantity is expected to jump to 100 units per month with release of the new MS Axis.

Table III-3-1 Trend of Computer Market

Year	Home	Micros	Word Processor	Class 1	Class 2 to 4	Class 5	Total
1965					1		1
1966					4		4
1967					3		3
1968					12		12
1969					12		12
1970				19	16		35
1971				9	12		21
1972				86	23	2	111
1973				57	30		87
1974				59	29	1	89
1975				53	43		96
1976				98	42	2	142
1977				133	94	2	229
1978				237	188	2	427
1979		61	7	619	497	22	1,206
1980	11	291	56	1,067	1,016	13	2,454
1981	413	765	156	973	1,013	6	3,326
1982	1,202	712	92	401	518	10	2,935
1983	7,346	2,902	181	676	863	8	11.976
1984	12,351	5,768	73	105	1,376	25	19,698
Total	21,323	10,499	565	4,592	5,792	93	42,864

Source: Secretaria de Ciencia y Tecnica, Estadisticas sobre Informatica.

Note : For reference example of each category is shown below.
Home ; T1 - 99/4A
Micro ; Apple II, IBM 5150, 5160
Word Processor; IBM 6580
Class 1; IBM 5110, 5322
Class 2; IBM 1131, 1620, 2020, 4952, 4953, 4954, 4955, 5320, 5324, 5340, 5360, 5362, 5406, 5408, 8130
Class 3; IBM 2025, 3115, 4331, 5381, 5410, 5412
Class 4; IBM 2030, 2040, 2044, 2050, 3125, 3135, 3138, 3145, 3148
Class 5; IBM 3031, 3032, 3033, 3081, 3083, 3158, 4381

In the early 1980s, several domestic companies started domestic production of micro-computers which had imported foreign micro-computers and had sold them in combination with their own software. Their production method has been to use imported assembly kits or to import ICs and other high quality sophisticated parts, and fit them with frames and electronic parts manufactured in Argentina. Manufacturers avoided large capital investments by this assembly type of production. Some of those companies applied Resolution 44.

As the largest foreign company in the market, IBM produces peripheral computer equipments (chiefly various printers and, since 1985, magnetic tapes) and exports most of them reaching export amount to US$125 million in 1985. The company has invested more than US$10 million per year in plant and equipment for the past two to three years. Texas Instruments, the largest supplier of micro-computers in the country, started importing and selling around 1980 and is now producing domestically 60 to 80 high performance professional micro-computers a month in Argentina.

Subconstractors of the above-mentioned foreign companies have a relatively high level of technological capacity under the technical guidance of foreign companies. For instance, IBM usually provides technical training for the employees of subcontractors in IBM factory for a couple of months. This indicates that even among Argentine companies, there are many manufacturers that can produce high quality products at low cost if only given clear specifications and proper training.

These foreign companies such as IBM and Texas Instruments have no desire to establish minority-owned overseas production facilities, so they have not applied for participation under Resolution 44.

Although there are several research institutes related to electronics, so far the National Institute for Industrial Technology (INTI) is the largest. INTI has 1,544 members but its yearly budget is limited. With a small budget, it will be difficult not only to increase the number of staff, but also to upgrade research equipment and even to maintain the present machines. According to INTI officials, the number of research staff in charge of electronics was limited in past but is now increasing to about 60. These 60 staffs are allocated as follows:

- application development of micro-computers: about 30 persons
- the Computer Center: about 20 persons
- NC robots: about 10 persons

Despite the relatively small staff, they play important roles such as a) participation in industrial promotion programs as advisers and b) assistance in R&D (research and development) in the industrial sector.

For the Resolution 44, domestic production program, and other various projects relating to technology development and its application INTI will undoubtedly be given the central role in the

Table III-3-2 Computer Market (December 1984)

	Microcomputer/ Personal Computer		General Purpose	
	Unit	Share (%)	Unit	Share (%)
Apple	546	1.69	0	0.00
Burroughs	4	0.01	1,528	14.58
Bull	54	0.17	596	5.69
CBM	124	0.38	0	0.00
Compucorp	6	0.02	118	1.13
Compusyst	0	0.00	274	2.62
CRT	175	0.54	0	0.00
Casio	219	0.68	0	0.00
Digital	22	0.07	311	2.97
Data General	0	0.00	146	1.39
Durango	0	0.00	203	1.94
Hewlett-Packerd	1,136	3.51	370	3.53
IBM	1,493	4.61	2,317	22.12
Latindata	894	2.76	233	2.22
MS	991	3.06	0	0.00
NCR	886	2.74	1,237	11.81
NEC	104	0.32	251	2.40
North Telcom	25	0.08	143	1.36
Osborne	144	0.44	0	0.00
Olivetti	178	0.55	320	3.05
Pertec	108	0.33	0	0.00
Qantel	0	0.00	135	1.29
Radio Shack	766	2.37	0	0.00
Sharp	1,842	5.69	0	0.00
Telvideo	9	0.03	219	2.09
TK	150	0.46	0	0.00
Texas	21,282	65.71	413	3.94
Wang	824	2.54	794	7.58
Others	405	1.25	869	8.29
Total	32,387	100.00	10,477	100.00

Sorce: Secretaria de Ciencia y Tecnica, Estadisticas sobre Informatica.

technology phases. For this reason, the reinforcement of INTI as an organization will be quite important in the near future.

(3) Domestic production plan for micro-computers

The liberalization trade policy of the late 1970s drove most of Argentina's industries to a disastrous state. Production activities and research and development were brought to a standstill, and the scars remain evident even today after a lapse of more than ten years. The last decade, having brought a period of the fastest technological growth in history has also caused Argentina's industry to lag far behind the rest of the world. This gap cannot be made up in the short term with world technological innovation in electronics progressing so rapidly. It can be achieved only by continuous efforts over a long period of time.

The series of measures for promoting the information industry, which started with the creation of the National Commission for Information (Comision Nacional de Informatica; CNI) in 1984, are considered quite reasonable since they are based on the widely accepted understanding that an information industry is most essential to the modernization of society, being the nucleus for development of the national economy. The domestic production program for computers in particular, announced in January 1985, although opinion is divided about its contents, appears to be valued highly in general since the government, has published its policy clearly and invited private firms to participate in the program under Resolution 44. However, there is now apprehension about the realization of the program because of the subsequent more-than-one-year postponement of the schedule, the replacement of government officials responsible for the program and the partial modification of the program. The firms authorized by the government for each segment have also been compelled to not only make major revisions of their plans but also to consider countermeasures in the event of possible failure of the entire program.

Since the domestic production program is the first and foremost of the promotional measures for the information industry, its success or failure will no doubt have a great impact on the future success of other industrial promotion measures. Although opinion is divided about the domestic production of hardware, the contents of Resolution 44 are considered basically sound, provided the program is adequately detailed and implemented properly.

To begin with, a study will be made of the contents of the domestic production program as outlined under Resolution 44. Under Resolution 44, micro-computer business is divided into eight segments (A - H) and were opened for bidding. In segment A and B, super micro-computer mounted the UNIX (one of the operating system developed by the Bell Laboratories of the USA) are to be produced. In segment C and D, home computers and peripherals are to be produced respectively (Table III-3-3).

Segment E and F are intended to keep the niche for computer business for the small and medium sized companies. Segment G is for the production of banking terminals and segment H is its application.

The number of domestic companies which have applied for participation and have been approved by the government is 10, and they are classified into two types. One type consists of leading domestic business groups which have achieved recognition in other industrial fields and plan to enter and invest in the electronics industry as a new venture. The business groups CAM (BRIDAS) is example. They have established new companies jointly with foreign firms which have superior technology. Their strong financial and managerial power, high credit worthiness and history as computer users will be powerful tools in the progress of the new business. The other type consists of companies which have been engaged in the computer business already and are aiming at further development. That is, they have long experience in import and sales, domestic production, development of software or systems support of micro-computers, and they aim to tackle full-scale domestic production on this basis. Micro Sistemas, Sisteco, Autorede, and Czerweny are examples.

As for foreign companies, IBM, which has the largest market share in Argentina and large scale peripheral equipment factories there, will not consider production by a minority-owned company due to corporate policy. Texas Instruments, which is producing micro-computers in Argentina, also has not applied for participation in Resolution 44 for the same reason. Burroughs has applied for participation through IDAT, which has been established jointly with the BRIDAS group, a leading Argentine company. In addition, Bull (France) and Digirede (Brazil) have applied for participation through new companies which they each have established jointly with leading domestic firms. The reason other foreign companies have not responded is thought to be because of the small size of the Argentine market.

Major issues in Resolution 44 are cited as follows:

- Production is divided into eight segments (A to H).
- Importance of enhancement of competition in a segment.
- Incentives are given mainly by preferential tax treatment alone, and little emphasis is placed on financial assitance which is of the greatest necessity.
- No backup measures are specified for arousing demand for computers.
- Importance of flexible policy to domestic value added ratio.
- Avoidance of excessive government intervention in the implementation of the program.

The above issues are reviewed in order as follows:

1) Production is divided into eight segments

Since the products covered under the Resolution 44 domestic production program are closely connected with each other, being technologically associated products or systems, and can interchange common parts and components, the placing of limits on these products

Table III-3-3 Segments of Computer Business under Resolution 44

Segment / Production	A	B	C	D	E	F	G	H
OBLIGATORY	(Supermicros) - Micro processors based computers multi uses, multi task (typically UNIX based mediums up to 16 users) - Peripherals for supermicros	- Personal computers - Peripherals	- Home computers	- Peripherals or supermicros & Personal computers & Home computers	- Small software houses	- Small hardware companies wholly owned by local companies up to US$1 mill. gross sales	- Banking terminals & communication equipment	- Systems integrators for banking networks Software Development Communication network, integration, etc.
OPTIONAL	- Personal computers - Peripherals for Personal computers	- Supermicros - Peripherals	- Personal computers - Peripherals			- Modems - Lan's etc.	- Applications of specific terminals (game playing terminals) for distributed networks	- Hardware from G
Number of seats opened	3 Companies	2 Companies	2 Companies	2 Companies	4 Companies	8 Companies	2 Companies	2 Companies
Applied & approved companies	ITRON CNL-BULL IDAT	Microsistemas Sisteco	Czerweny (1 vacant)	Fimpar (1 vacant)		25 offers	Microsistemas Digirede	CNL-BULL IDAT

Source: Study Team

could possibly have adverse effects on scale of economy and hinder the extension of technology and the relationship between products. On the other hand, Resolution 44 stipulates certain groups of associated products which can be manufactured in addition to the mandatory items, thus decreasing the possibility of adverse effects. However, in order to realize the economy of scale, flexible operation of the program is required according to the lapse of time and changes in circumstances.

2) Importance of enhancement of competition in a segment

In light of the size of Argentina's computer market, the number of computer producers, 25, would appear to be too large at a first glance. However, through competition among producers, some of them would drop out and competition will strengthen the remained producers' capabilities. The government should not take the policy which will prevent the free competition among applicants.

3) Limited incentives

Unless they make a profit, producers cannot enjoy the benefit of preferential tax treatment, except for import taxes. This is not so attractive to producers in consideration of the growth of computer demand in Argentina and of the necessary scale of initial production. In the present unfavorable economic environment in which funds are scarce and interest rates are high, low-interest financial assistance on a long-term basis including a grace period will be much more effective in creating incentive. In view of the characteristics of the computer industry, long-term financing at low interest rates is very important.

4) Stimulation of demand

Business cannot exist where there is no demand, and business cannot grow if demand does not expand. In Argentina, both the public and private sectors suffers from a serious shortage of funds for investment and modernization. In that sense, measures to promote continued expansion of demand are thought to be very important.

5) Importance of flexible policy to domestic value added ratio

It is necessary to clearly specify targeted domestic value added ratio in a promotion program. However, since the economic climate and business situation are changeable very much, rigid target figures irrespective of changes in the environment may lead to the failure of the program. It is suggested, therefore, that as the situation changes, the best course of action be decided from both the long-term and short-term points of view, and flexible measures including the revision of target figures should be considered.

6) Government intervention in program implementation

Generally speaking, there are many cases in which excessive intervention or mishandled intervention of the government will

adversely affect the activities of the private sector or hinder smooth implementation of the policy. In addition, excessive intervention tends to lead to industrial protectionism, hampering the sound development of industry.

Although there are several problems involved in this domestic production policy of micro-computer, and there are many opinions which oppose promotion of the domestic production of computers under the present conditions in Argentina. We, however, wish to note the following points regarding domestic production in support of the realization of the policy:

a) The electronics industry is the most promising field, especially, because computer technology exerts a great influence over the technological progress of other fields, and its products permeate the entire society, help to modernize it and encourage overall industrial development. For these reasons alone, it is extremely valuable to support computer technology and its development on a national basis.

b) It will become possible to maintain, foster and develop technology only if related industries exist. The computer field especially affords many avenues for accumulating and developing technological processes throughout the entire business community, such as design, development, manufacturing and systems applications for both hardware and software.

3-1-3 Suggestions

It is the consensus of the Argentine government and private sector that development of the computer industry and computerization are an inevitable worldwide trend and that Argentina also should promote the industry and the computerization. Most people are also aware of the fact that there are many problems to be solved to reach that goal. Because of the relatively small domestic market and the high speed of technological progresses in this industry in the world, the government will have to bear a considerable burden in order to implement the proposed computer nationalization program. For the development of the computer industry in Argentina, the following points are suggested.

(1) Long-term promotion program for the computer industry

It is essential to formulate a well-thought-out long-term program through close coordination and exchange of opinions with the private sector. A long-term program, facing many unknown factors, will work well only if it is carried out adequately. Hence, stress tends to be placed on the formulation and execution of short-term action programs lasting for not more than three years together with long-term plan. This holds true especially in Argentina today where the economic climate is highly unstable. A long-term program has many advantages as mentioned below, and it is suggested that a long-term program be designed and carried out with the short-term action programs.

1) Since the formulation of a long-term program requires a wider-ranging and long-term analytical study of the project

environment than a short-term program, the entire picture of the project can be depicted including expected changes and various countermeasures that may be considered.

2) The formulation of a long-term program requires the clarification of project objectives and relevant activities and necessitates the consideration of timing and methods for attaining the objectives.

3) The existence of a long-term program is helpful in keeping the short-term programs on track and avoiding unnecessary confusion caused by sudden temporary changes in the environment. The long-term strategy provides an effective consistent guideline for the activities of the government officials concerned.

It is useless if the program is not put into practice. In this respect, a concrete action program specifying actual activities must be detailed, carried out and followed up continuously. To lead this effort, a powerful system for program promotion must be established. As the program progresses, various related conditions and unforeseen problems will become clear and sufficient course alterations will be possible.

In Japan, although the names of relevant laws have been altered slightly with the times since 1957, the policies for the promotion of the electronics industry and the information processing industry have been continued on a consistent basis for thirty years. During this period, adjusting to the times and changes in the industrial climate, proper subjects were chosen for supportive measures focusing on specific areas and successful execution with a flexible implementation of policies (see appendix of this section, 3-1-A). To put into practice the promotion policy for the industry, the Japanese government set up programs to accelerate the activity, such as creating the Machinery-Information Industry Bureau, formulating various regulations and executing promotional measures.

(2) Computer nationalization program

The proposed program for nationalizing computer production is to manufacture 32-bit supermicro-computers with the UNIX operating system. The targetting this product, of which production costs are not so high compared with large sized computers, is justifiable as the starting of domestic production of computers. As discussed already in 3-1-2(3), the following points will be necessary to take into account for the promotion of this program.

1) The proposed computer nationalization program divides the related components into eight segments. However, in order to benefit from possible economies of scale, it is not advisable to stick to the eight segments. It will be important to readjust the segmentation flexibly and to promote competition. This will in the end serve to improve international competitiveness of the industry.

2) The participating companies in the program are provided with fiscal incentives like tax exemptions or reductions. But it is

also desirable to offer financial incentives of low-interest loans.

(3) Promotion of demand expansion

Growth of demand makes it possible for the industry to exist, expand and make a profit. In this sense, expansion of demand can be said to be one of the requisites of industrial development. Especially for computers, the growth of demand encourages the improvement of technological capability, not only on the part of producers of hardware and software, but also on the part of users. It is necessary to stimulate the potential domestic demand.

In this connection, a computer lease system was introduced in Japan. In 1961, as a result of an arrangement between the government and the industry, a computer rental company, called Japan Electronic Computer Company, Ltd. (JECC), was established with joint financing by seven computer producers (one of which withdrew after several years). Its purpose was to start a system of renting the computers purchased from the manufacturers to the users. Funding from member companies and Japan Development Bank, JECC purchases computers worth 230 billion yen annually and rents to users. Their total amount of asset is 500 billion yen at book value. Their total amount of purchase since the establishment reached to 2.6 trillion yen. This system, which was highly effective in financially supporting the producers, was also well-received by users and greatly contributed to the expansion of demand by encouraging active use of computers especially at the early stage. Under the rental system, users are able to acquire a computer by paying a monthly rental fee equivalent to about one-fortieth of the computer's price. They, thus, avoid making a large investment, and they are able to cancel the contract after the 15-month initial period or replace their old model with a new one. This system is still being used extensively today. Meanwhile, the introduction of computers is encouraged as part of the measures for modernizing other industries and for developing medium- and small-scale businesses.

(4) Coordination of research and development activities

Without the technology development, it is impossible to promote the industry. Particularly in the electronics industry and above all in computer industry, this aspect is decisive. At present, although, the profound importance of research and development has been recognized in Argentina, the national R&D budget is small. In order to utilize the limited funds more efficiently, it is desirable to integrate the computer-related research projects which are now separately carried out by different institutions.

Having grasped the present actual state of research organizations (including research departments of universities) throughout the country, it is desirable for the government to set up an organization which oversees and coordinates important basic research in line with the industrial promotion policy. Especially, the integration of relevant organizations should be considered for the establishment of new organization in order to prevent overlooking important research subjects and to avoid biased research and wasteful duplication of research and thus effectively utilize limited resources.

In order to promote the organization, the following points are desirable to be considered:

1) Management of the organization based on the national consensus,

2) Independence of each laboratory and appreciation of its speciality,

3) When necessary, integration or abolition of facilities, as well as exchange of staff,

4) Equal distribution and application of all research results.

(5) Utilization of foreign technology

The development of computer technology has been remarkable in recent years, and its rapid progress will continue in the future. Great efforts have been made not only in LSIs and hardware, but also recently in the development of software-related technology. Hence, the introduction and efficient application of advanced foreign technologies can be effective to improve the technological level of domestic industry. However, advanced technology must not be adopted recklessly, ignoring the current level of domestic technology. Its adoption must be planned properly, with an understanding of the changing trends of the technology. It is important that the introduction of technology must be efficiently utilized by private sector so that the reactivation of industry can be realized. Moreover, it will be necessary to make efforts toward the acquisition of software and application systems and to understand their trends as well.

3-1-A Appendix: Japan's Measures for Promotion of Computer-related Industry

Policy measures for the promotion of the computer-related industry are listed chronologically below.

- Temporary Measures Law for the Promotion of Electronics Industry (June 1957 - March 1964: 7 years)
- Extension of the Law (April 1964 - March 1971: 7 years)
- Temporary Measures Law for the Promotion of Specified Electronics Industries and Machinery Industries (April 1971 - March 1978: 7 years)
- Temporary Measures Law for the Promotion of Specified Machinery - Information Industries (July 1978 - March 1985: 7 years)
- Law Pertaining to Information Processing Industry Promotional Association (IPA Law) (May 1970 - March 1986)
- Law Pertaining to Promotion of Information Processing (partial revision of IPA Law) (April 1986 -)

The contents and background of these policy measures are summarized as follows.

(1) Temporary Measures Law for the Promotion of Electronics Industry

With the end of postwar rehabilitation and the advent of a time for renewed economic growth, this Law was enacted to promote the electronics industry as an industry that would lead industrial growth and to play the key role in the development of technology. The law, covering principal electronics materials, parts, components, equipment and systems, had the following contents:

1) Subsidization of technological development for projects requiring large amount of funds.
2) Long-term financing at special low-interest rates under the fiscal investment and loan program for projects requiring acceleration of production start-up or increased production (financed by the Japan Development Bank).
3) Application of a special amortization system.

The Law had the expected results during the effective period of seven years, but was extended for another seven years in view of the mounting requirements for the liberalization of trade and capital and also due to the rise of the computer industry itself, whose importance was beginning to be recognized at that time.

(2) Temporary Measures Law for the Promotion of Specified Electronics Industries and Machinery Industries

Although promotional measures were taken separately for electronics and machinery, combined measures were introduced for the two industries under this Law in consideration of the close relations of two industries. The Law covered, in effect, the same points as the former law.

(3) Temporary Measures Law for the Promotion Specified Machinery-Information Industries

In the 1970s, along with significant progress in electronics technology including computers, the relationship between the electronics and machinery industries became even closer, and the importance of software in the computer industry became greater. This Law, therefore, considering these industries as an integrated machinery-information industry, aimed at promoting it as a frontrunner to take the lead in Japan's industrial development. A distinctive feature of this Law was the inclusion of promotional measures for the software industry. The computer industry's output in Japan, which was valued at 700 billion yen for 1977, grew sharply by an average annual rate of nearly 20% to over two trillion yen in 1984.

(4) Law Pertaining to Promotion of Information Processing

While promotional measures were taken mainly for computer hardware under the aforementioned laws, the importance of software - its role in the more efficient use of computers and in research/development costs for technology and products - had grown greater than that of hardware, thus requiring strong promotional measures. In 1970, the Information Technology Promotion Agency (IPA) was created as an organization to work toward: a) the promotion of computer utilization, b) the promotion of the development and distribution of software and c) the growth of information processing services and software businesses.

To enforce this fundamental legislation, the Japanese government set up programs to accelerate the activity, such as creating the Machinery-Information Industry Bureau, formulating various regulations and executing promotional measures. At the same time, to keep pace with the rapid progress in private sector computerization, computer use in government agencies and local administrative organizations was actively accelerated. Furthermore, complete capital and import liberalization regarding computers was effected in 1976, and at present no import duty is charged on such equipment.

3-2 Information Service Industry

The Argentine government has planned the domestic production of computers under Resolution 44, which will be practically implemented soon. In the history of computerization in Argentina, which has relied on imported computers for a long time, this is an epoch-making event. When Resolution 44 has been fully implemented and the expected goals achieved, the computerization of Argentina will have greatly advanced, and it is expected to contribute greatly to development and consolidation in various areas such as the economy, society, welfare.

Needless to say, however, the computerization of Argentina cannot be accomplished only by means of super micro-computers, micro-computers, and home computers produced under Resolution 44. The effective application of various types of computers presently in the country and to be imported in the future is necessary. Computers prove their capability only if utilized effectively. Unless applied suitably for the purpose, computers could in fact hinder smooth business operations. Although the number of units installed is often referred to as an index of the degree of computerization of a nation, such figures do not necessarily reflect accurately the degree of effective contribution to the social and economic development of the nation.

What is in question here is the effective application of computers. It has been generally accepted that in normal practice, purchasers of computers would write programs and operate them for themselves. However, with the expansion of the application of computers, it has become clear that such practices do not bring good enough results, so professionals specializing in support for effective application of computers have come onto the scene. This is called the information service industry. Thanks to the information service industry, the inexperienced person, after simple introductory training, can use the micro-computer effectively for his or her work with the use of application software.

Argentina, in spite of its capable population, rich natural resources and high level of culture, is suffering from economic stagnation and enormous foreign debt. What Argentina needs now is the revitalization of its economy and society, and increases in its export capability. Progress in computerization can provide the one of the keys to solving these problems rapidly and effectively.

3-2-1 Characteristics of Information Service Industry

(1) Classification of information service industry

The software development industry is an industry or service which supports effective application of the hardware installed. In fact, the industry or service which supports effective application of hardware is not limited to the software business, but also includes information processing services, data base services and many other types of service, among which communications (data transmission) services play an important role. Without the support of the

information service industry, the computerization of a nation cannot complete its development, and in the USA or Japan, businesses in this field maintain a 20 ~ 25% annual growth rate.

This type of industry is still undeveloped in Argentina in comparison of other industrialized countries. It is essential, however, for the future development of computerization in this country.

(a) Classification of information service industry

Figure III-3-1 shows the classification of the information service industry. Business of each information service industry is described as follows.

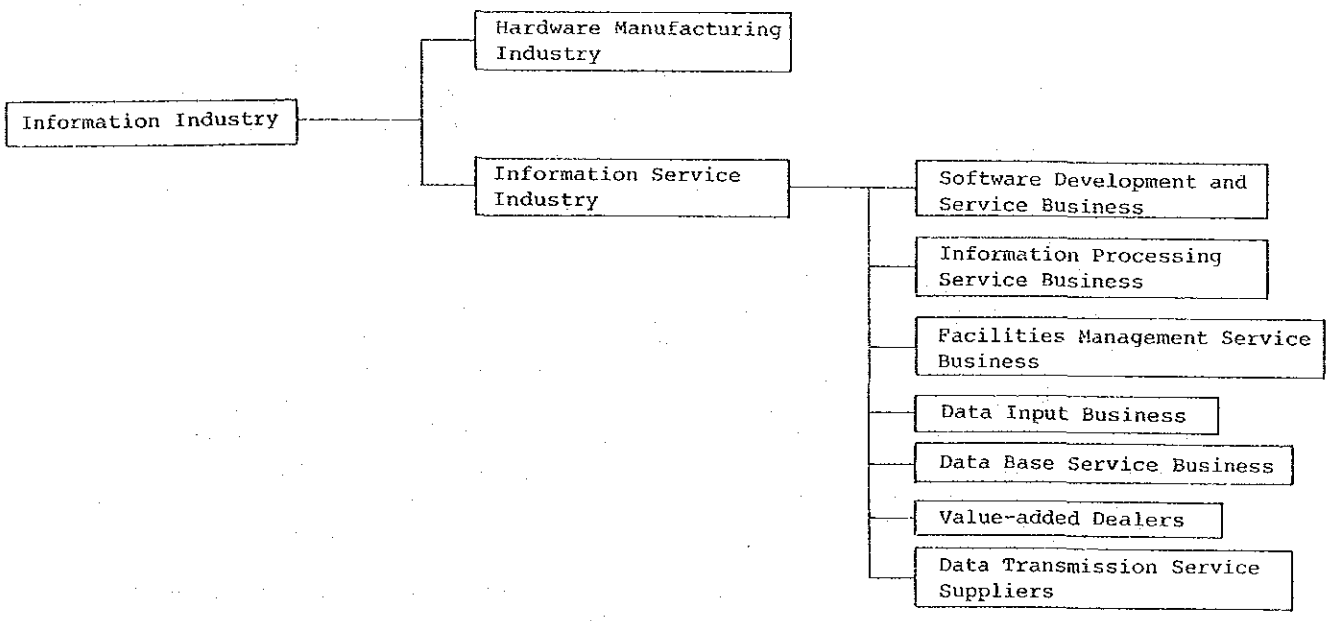
1) Software development and service business

Software developed by the software industry includes the following three categories.

a. Fundamental software: OS (Operating System), i.e., fundamental programs indispensable for computer applications such as programming languages.

b. General-purpose utility software: Software for effective use of computers such as data base, data communications, sort, merge, etc.

Figure III-3-1 Information Industry



c. Application programs: Programs which serve specific applications of computer users. This category can be further sub-divided into the following three categories:

- Tailor-made programs specially developed to the individual specifications of users.
- Ready-made package programs for applications such as sales management or wage calculation which are commonly used by an indefinite number of computer owners.
- General-purpose package programs suitable for various applications (such as Multiplan, Lotus 1-2-3, Symphony)

2) Information processing service business

This can be roughly divided into the following three categories:

- Services for clients who have not introduced computers. Service for those who cannot afford the introduction of their own computers.
- Processing of on-line network for customers.
- Processing as an on-line network center for a number of different companies.

3) Facilities management service business

This can be roughly divided into the following two categories:

- Facilities management in its original sense of the term, in which operation of the customers' computer installations is undertaken.
- Facilities management in wider sense in which program development is undertaken for the customer by visiting his facilities.

4) Data input business

In this type of business, the original documents are input into media which are readable for machine, so that they can be input into the customers' computer systems.

5) Data base service business

This business is not related, directly or indirectly, to information processing for the type of clients as described above, but is a service centered around an independent computer center. In this computer center information related to the economy, technology, etc., which is expected to be required by the clients, is stored in data form, and maintained and supplied on an on-line or off-line basis, in response to requests from the clients.

6) Value-added dealers

Dealers of small-sized computers or micro-computers who supply their merchandise in combination with appropriate application

systems in the form of turn-key systems (that is, users do not have to prepare programs, etc., but can start operation upon delivery merely by turning the key).

7) Data transmission service suppliers

This term refers to the suppliers of tele-communication lines generally known as common carriers. Common carriers are usually classified within other categories outside the information industry, but since the service provided by them cannot be separated from the development of technology for computer applications, they will be considered as a part of the information service industry in this report.

(b) Progress in computer applications and development of information service industry

Progress in computer applications accompanies the development of the information service industry, while, development of the information service industry results in the progress of computer applications. The followings will illustrate this statement in relation to the various business areas of the information service industry.

1) Software development and service business

If computer users had to develop their own application programs, they would need a long period of learning and preliminary experiences before they were able to write programs suitable for actual work. This might be possible for government offices or large enterprises, but it is extremely difficult for small businesses who introduce micro-computers for the first time. Even government offices and large enterprises, do not always work at full capacity and therefore would have to carry excess personnel. Therefore, development of businesses of program development makes it easier for small businesses to introduce computers and for government offices and large businesses to plan effective program development. Especially, the supply of application programs for micro-computers will greatly benefit the inexperienced medium- or small-sized business.

2) Information processing service business

This type of business contributed greatly when computers were very expensive, undertaking data processing for businesses who had not yet introduced computers. However, with the recent spread of micro-computers, medium- and small-sized businesses have begun to process the data by themselves, so the demand in this area is decreasing. On the other hand, the role of a network center for enterprises is gaining importance - that is to say, the role as the center of a network connecting a number of banks, or a network of multiple dealers or multiple retailers.

3) Facilities management service business

Users introduce computers as effective tools for accomplishing tasks in the management of their business. Therefore it is reasonable to conclude that company staff should concentrate on the main business of the company, and operation of tools in the form of computers can be more effectively carried out by specialists from outside the company. This is how the facilities management service industry came into existence. Of course since accumulation of know-how within the business is also important, a complete switch-over to outside management is not often found. However, a change towards expanding of this type of business is taking place in the developed countries. The development of a facilities management service industry will make the introduction and management of computers easy and greatly contribute to the expansion of computer applications.

4) Data input business

Computer systems used to employ paper punched cards, which developed a data input business. However recently computers have changed to systems where users directly input data by means of a keyboard, so the number of businesses specializing in data input has decreased. However, in the information processing service business, the data input business still exists as a side business, although there are no longer companies specializing in this business.

5) Data base service business

Since the purpose of computer applications has been upgraded from processing of everyday routine work to supporting high-level decision-making, it has become necessary to develop functions which accumulate various data which is necessary for decision-making. Functions which retrieve information and deliver it promptly become also important. The data base service business emerged, in response to a market requirement, and it has recently made remarkable progress in the developed nations. Furthermore, the birth of this industry has greatly contributed to the sophistication of information processing in this country.

6) Value-added dealers

This type of business emerged after micro-computers became inexpensive and were popularized, particularly for business use. Inexperienced users of computers often hold the mistaken belief that if they merely buy computer hardware they can use it for their work immediately. Furthermore, to acquire a full command of computer usage, a great amount of technical knowledge and development of applications programs are required. The role of filling this gap is taken by the value-added dealers.

7) Data transmission service suppliers

Computer applications have developed from batch processing, to on-line processing within companies and on-line processing for other

companies within a certain business sector, and finally to on-line communication between different businesses or across all kinds of social units, including family households. Such an expansion of data processing business would have been impossible without data transmission channels. Moreover, if the development of data transmission lines lags behind, even if there is a good opportunity to expand computer applications, it will be missed, and in turn, economic development might suffer.

In Japan, this connection has attracted much attention since the early days of computerization, and great efforts have been made for the arrangement and consolidation of data transmission lines and computers called "Computers and Communications".

(2) Characteristics of information service industry

As the information service industry is one of the business categories under the information industry in the wider sense of the term, it shares some common characteristics with the hardware manufacturing industry, while at the same time retaining some special characteristics of its own.

(a) Complementability of information service industry with computer users

Since the hardware manufacturing industry produces hardware items and supplies them to the users, it plays an important role. However, as regards the information service industry, there are many areas where this industry complements users' own software developing capabilities. Major users are capable of developing applications programs by themselves. Equally, small enterprises and individuals who are users of micro-computers are quite often able to develop programs.

In data processing also, many users own computers and have the ability to operate them. From this viewpoint, information service industry is usually regarded as an auxiliary or complementary type of industry. However, business enterprises who own data base services or transmission lines are very rare. The information service industry plays a very important role of complementing the computer usage ability of organizations which lack such capabilities. In this regard, computer processing capability and the ability to make effective applications in one country must be considered as the total sum of users' ability and the information service industry's ability.

(b) Growing industry

The information service industry was born and developed as a sector of the industry to complement the lack of processing ability of users, or to supply services within this field which users cannot provide. Therefore, as the needs of computer applications increase, the information service industry develops and sometimes even becomes the leading force accelerating the pace of computer applications in that nation. As mentioned previously, the information service industry has shown a high growth of 20 - 25% annually over a long period in Japan and the USA.

(c) Labor-intensive intellectual industry

As represented by the software development business the major characteristics of this industry are labor-intensiveness and intellectuality. Development of programs consists of various activities including planning, analysis, design, coding, testing and documentation, most of which involve brain-power. Data base services, while they do use large-scale machines, rely largely on human abilities for planning, investigation, data input and data maintenance, etc. Thus, the information service industry is said to be a representative of the most suitable type of industry to employ highly intelligent staff.

(d) Necessity of equipment investment

While it is a labor-intensive business, it is also a capital intensive business in some aspect. A large amount of equipment investment is necessary for the laying of data transmission lines and for the establishment of related equipment and devices. A large-scale information processing service business requires a large-sized computer. In addition, even in software development, which is considered to be a typical labor-intensive area a system of program development which makes use of computers on a time-sharing basis is developing in order to raise productivity.

(e) Rapid progress of technology

The pace of progress in computers is fast. This means not only progress in hardware, but also the progress of the field of software and applications.

(f) Necessity of practical business knowledge

The majority of its business consists of responding to specific requests from clients based on their needs. The development of application programs is a typical example for which practical knowledge of the clients' business is essential. This type of business requires not only computer specialists but also business specialists and those who have practical experience of business in various fields.

(g) Importance of education

As characteristics of the information service industry, three items have been enumerated, namely, intellectual labor, technical progress, and knowledge of the business world. These characteristics illustrate the importance of education for workers engaged in the information service industry.

It was previously stated that the information service industry complement with the users' processing capabilities. This highlights the necessity of widely available computer-related education covering all those who are concerned with computer applications.

It is not sufficient to provide high-level specialized education in theoretical knowledge areas such as computer theory, operating

systems, computer languages, data base/data communications, local area networks. For the realization of effective applications of computers, in addition to the above, practical professional training regarding the actual use of computers is necessary. It is also important to provide education for executives and managers who do not directly come into contact with computers. This is important because decisions related to computer introduction are made by those people.

Education on computers for people in this category is not technical education such as programming, but should cover such subjects as the necessity and usefulness of computer applications in today's society, or measures for realizing the effective applications of computers.

3-2-2 Present Situation of Computer Applications and Information Service Industry in Argentina

(1) Present situation and problems of computer applications

(a) General review

The status of computer applications in Argentina is described in detail in "Estadisticas sobre Informatica" prepared by the Secretariat of Science and Technology.

The number of computers installed as of December 31, 1984 was 42,864 units (Table III-3-4). However, when 21,323 home computers of insufficient capacity for business use and 565 word processors with insufficient data processing functions are excluded, the number is reduced to 20,976 units. Of this figure, 10,499 units or one half are micro-computers. The peak periods of introduction of those micro-computers have centered around the last year or two (see Table III-3-1).

Table III-3-4 Computer Application by Sector

Class	Private	Public	Unknown	Total
Home Computer	7,465	1,511	12,347	21,323
Micro Computer	6,855	357	3,287	10,499
Word Processor	370	75	120	565
Class 1	3,609	402	581	4,592
Class 2 to 4	3,696	416	1,680	5,792
Class 5	25	12	56	93
Total	22,020	2,773	18,071	42,864

Source: Subsecretaria de Informatica y Desarrollo, Estadisticas sobre Informatica.
Note : Classification of computers is shown in the note of Table III-3-1.

Considering the potentiality of Argentina and the relatively high level of industrialization, the degree of computer diffusion is considered to be still relatively low in Argentina.

(b) Ownership classified by type of owner

The status of computer introduction is as follows: private 22,020 units; public 2,773 units; unknown 18,071 units. It is assumed that the majority of computers classified as unknown are being used in the private sector.

Government offices and large companies have introduced computers in the past, and their needs are generally regarded as satisfied. Among the medium-sized enterprises which had not been able to afford to introduce computers and instead relied on placing outside orders for computation, a large number of businesses have introduced small-sized computers, which have become less expensive recently, and ceased to place outside orders. Small-sized business enterprises which had felt little need for computers due to the small amount of processing required, has been interested in the introduction of computers.

In spite of the general economic trend of stagnation, and a lack of funds especially for long-term loans for investment, the promotion of computerization is making progress. Thus, if proper measures are taken allowing suitable access to loans, the possibility of rapid popularization of computers is high.

(c) Status of computer ownership classified by application field

Computer ownership as classified by industrial sector is shown in Table III-3-5. As shown, the greater number of computers for business use is employed in the commerce and service sectors, and most of them are being used for management such as sales and inventory control, and for daily routine processing such as accounting, or salary calculation. Sophisticated applications of computers for the use of administrative decisions have not yet been achieved.

In the industrial sector, oil refining, steel manufacturing are major users of computers for various areas. Medium- and small-size enterprises so far utilize computers only for limited area.

(d) Status of application classified by form of application

There are two major characteristics in computer application of Argentina. The first is centralized processing using large-sized computers.

Since there is a centralization of population and economic activities in Capital Federal and Buenos Aires Province in Argentina, it is inevitable that centralization is also seen in the field of computers (Table III-3-6). As a result of excessive centralized processing using a small number of large-sized computers, there is a tendency that data could easily be processed in local regions is now processed centrally.

Table III-3-5 Computer Application by Sector

	Home	Micro	Word Processor	Class 1	Class 2 to 4	Class 5	Total
Agriculture	59	106	1	65	43	-	274
Mining & Exploration	5	26	9	23	39	1	103
Manufacturing	336	788	49	567	1,000	27	2,762
Utilities (Electricity, Gas, etc.)	6	58	8	64	57	-	193
Construction	18	270	13	130	108	2	541
Commerce, Restaurant, Hotel	1,173	2,101	25	1,316	923	1	5,539
Transportation, Telecommunication	12	118	20	90	116	4	360
Finance, Insurance	113	1,931	285	1,052	1,764	17	5,162
Services	6,153	803	82	523	952	19	8,532
Unknown	13,448	4,298	73	767	790	22	19,398
Total	21,323	10,499	565	4,592	5,797	93	42,864

Source: Subsecretaria de Informatica y Desarrollo, Estadisticas sobre Informatica.
Note : Classification of computers is shown in the note of Table III-3-1.

The second major characteristic is that volume of on-line processing remained a low level. The reason for this is not that the demand for on-line processing is low, but that data transmission lines are not well prepared. Users have attempted to cope with the situation by laying private transmission lines, but there is a limit to such efforts. There is no doubt that if transmission lines were properly consolidated in Argentina, information processing would make rapid progress in terms of both quality and quantity.

(2) Present situation and problems of information service industry

(a) General view

The history of the information service industry in Argentina extends back more than ten years. Financial service businesses such as banks and insurance companies have been major clients of the information service industry. Also, along with the upsurge in micro-computer introduction in recent years, a large number of software house which develop application programs has appeared. In general, however, Argentina's information service industry is in the course of development.

Table III-3-6 Computer Installment by Province

	Home	Micro	Word Processor	Class 1	Class 2 to 4	Class 5	Total
Buenos Aires	1,799	2,912	47	1,048	1,188	16	7,010
Capital Federal	4,600	3,446	427	2,322	3,113	72	13,980
Catamarca	71	8	-	1	7	-	87
Chaco	166	44	1	28	45	-	284
Chubut	24	84	-	28	26	-	162
Cordoba	313	804	43	244	371	1	1,776
Corrientes	70	31	1	23	18	-	143
Entre Rios	123	33	1	67	75	-	299
Formosa	86	6	-	9	12	-	113
Jujuy	56	16	-	10	43	-	125
La Pampa	132	39	1	12	8	-	192
La Rioja	20	6	-	2	4	-	32
Mendoza	374	210	11	159	193	3	950
Misiones	148	77	2	43	32	-	302
Neuquen	70	71	1	24	35	-	201
Río Negro	23	55	-	28	35	-	141
Salta	290	67	-	22	45	-	424
San Juan	152	50	6	28	37	-	273
San Luis	57	6	-	6	12	-	81
Santa Cruz	57	14	-	9	13	-	93
Santa Fe	538	634	9	401	370	1	1,953
Santiago del Estero	43	14	-	4	11	-	72
Tierra del Fuego	76	13	1	4	8	-	102
Tucuman	242	155	5	68	87	-	557
Unknown	11,793	1,704	9	2	4	-	13,512
Total	21,323	10,499	565	4,597	5,792	93	42,864

Source: Subsecretaria de Informatica y Desarrollo, Estadisticas sobre Informatica.

Note : Classification of computer is shown in the note of Table III-3-1.

(b) Software development and service business

In Argentina fundamental software such as OS, utility software for general use and package programs for general use have been developed and are supplied by overseas computer manufacturers and overseas outstanding software businesses. Generally Argentine software companies' business is limited to the application programs.

Since the major users such as government offices and large business have a strong tendency to develop the programs for themselves, small orders from medium and small businesses or development of application program have become their main business. Most of the businesses of this category are small businesses and their technical capacity in most cases is also low.

In fact the member companies of Software Companies Association (Camera de Empresas de Software) is 80, but among them only five have more than 80 employees. Major users of computer software point out the lack of experience and low technical ability of the small sized software houses in Argentina. They are inclined to develop the software by themselves.

Also, there are other problems for software houses such as 1) inability to get loans for software development because of a lack of collateral, 2) sales of software will not increase because the programs are easily copied under no legal protection of original program.

(c) Information processing service business

This field of business is roughly divided into the following two categories. The first category consists of large sized companies which works as a data processing centers for financial institutions. This type of companies performs a large amount of batch processing work, but has not made satisfactory progress in on-line processing due to inadequate communications lines.

The other category comprises medium and small companies which carry out computation under contract with medium- or small-sized companies. However, since the number of small companies introducing micro-computers has increased, the amount of available work has declined and some companies engaged in information processing could no longer remain in this business.

With the lowering of the prices of computers, users who process the data by themselves is increasing and volume of contracted computation has been decreasing. However, if data transmission lines were properly prepared, as in developed countries, on-line processing work would increase. Particularly on-line network center services for different businesses would certainly expand. Therefore, the future of this business field in Argentina may be said to depend solely on the consolidation of the data transmission lines.

(d) Facilities management service industry

In developed nations, the facilities management business shows a tendency of expansion. Outside specialists who have greater knowledge and experience about computers can make great savings in cost and time for computer owners.

In Argentina as a result of this study, it becomes clear that a facilities management service industry does not exist as such in industrialized countries. This is due to the fact that the major users are strongly inclined to undertake everything related to computer management by themselves.

(e) Data base service industry

It seems that the data base service industry is not existing in Argentina. The only companies providing anything like a data base service are businesses which accumulate information on stocks, and respond to inquiries by telephone. The reasons why the data base service industry is undeveloped in Argentina are as follows. Computer applications have concentrated on everyday routine processing, and have not yet reached high-level functions such as aids to business management decision-making. Also data transmission lines are not prepared yet.

However, in Argentina, sophistication of business management and increase of exports are urgent tasks, the rapid consolidation of businesses which organize and supply data base is required. Actually, certain large companies which use overseas data bases to obtain various economic data are emphasizing the necessity of domestic service of data base in Argentina.

(f) Value added dealers

The value added dealer in Argentina is a new concept and its numbers are still small. However, the business has a large potentiality in Argentina.

This business has been developing in industrialized nations. It grew out of the fact that small business attempting to introduce micro-computers lacked knowledge in computers, while conventional micro-computer dealers only sold machines and did not support inexperienced users. Therefore, there have been many cases in which micro-computers were introduced but were not effectively utilized.

The future expansion of computer applications in Argentina depends on the use of domestic computers, on Resolution 44, to some extent. The activities of value added dealers will become very important under the domestic production policy which provide the machines adding application programs appropriate to the present level of development in Argentina. Strengthening support for value added dealers will be an important issue in near future.

(g) Data transmission service suppliers

The greatest problem concerning computer applications in Argentina is undeveloped data transmission lines. This has been *referred to previously, so no futher explanation is necessary.*

At present, computer applications in the world are progressing from batch operations to on-line and to networking. What forms the basis for this progress is the data transmission line. The most suitable line for computer data transmission is a digitalized transmission line. Analog telephone lines may also be used, but they present problems in transmission speed and quality and do not match the requirements for high-speed high-quality transmission.

In Argentina, the plan to expand one million circuit telephone lines is now being implemented. However, the plan is centered around the acquisition of the additional telephone equipment, and it is said that the complete replacement of the old circuits with high-speed high-quality transmission lines is not being fully considered. As a result, in areas where old circuits and old switchboards are used, transmission lines will remain unsatisfactory for coping with new computer networks.

(3) Present situation and problems in computer-related education

(a) General view

In Argentina computer-related education was started in the 1960s in universities, and graduates are now actively engaged in computer-related businesses mostly in overseas. However, considering the educational system as a whole, diffusion of computer-related education is generally low reflecting the underdeveloped level of computer usage compared to industrialized nations.

In this age, called "the second industrial revolution" or "computer revolution", when the application of computers greatly influences the progress and development of a nation's economy, computer-related education should not be limited to theoretical studies and high-level technical discussion. Actual application of computers to real business situations and management need to be taught.

Especially in Argentina today, where the revitalization of industry and the promotion of exports are urgent tasks, not to slight high-level theoretical education, actual business-related education which applies the results of the computer revolution to business situations and thus contributes to the further development of society and the economy should be considered a higher priority.

(b) Universities

Computer education in Argentine universities has a long history and many graduates are now working overseas. Thus, in appearance, the program is well prepared. However, it is said that the number of computers in universities is small, and students have few chances to actually use computers, therefore much of the study is done on the blackboard and in notebooks.

This is a reflection of the slow pace of computer diffusion influenced by economic stagnation. Tendency of graduates' of computer science to obtain job in overseas also indicates they cannot get jobs domestically. Needless to say, computer education in universities forms the core of the nation's computer-related education. Therefore, further expansion of computer-related education at universities is desirable.

(c) Latin American Superior School of Informatics (ESLAI)

In April 1986, the Latin American Superior School of Informatics (Escuela Superior Latinoamericana de Informatica: ESLAI) was opened under the Cooperation of Intergovernmental Bureau of Information in Rome and UNESCO. This school aims at the education of professional researchers and not for practical training.

There is a possibility that ESLAI graduates will not be able to find a job in Argentina and finally will go out of Argentina to work. If that is a case, the education can not be utilized for the reactivation of Argentine industry. Measures to avoid this situation are highly recommended.

(d) Technical schools under CONET (ENET)

Under the Nacional Council for Technical Education (Consejo Nacional de Education Tecnica: CONET), there are 362 technical schools (Escuela Nacional de Educacion Tecnica: ENET) all over the nation which offer to elementary school graduates specialized technical education in such subjects as architecture, chemistry, electricity, mechanics and electronics. Only ten ENET currently have computer course. ENET has very important role to offer specialized vocational education for young people, so its further expansion of computer education is awaited.

(e) Education by manufacturers and dealers

In addition to the computer education offered by public education facilities, there is private computer education. Typically, this is offered by computer companies and dealers.

Foreign computer companies and dealers have well-organized education courses and offer them to users. With the recent popularization of micro-computers, these courses become quite popular and they are playing an important role in computer education in Argentina.

(f) Privately established computer schools

In addition to the computer courses provided by manufacturers and dealers, private computer education facilities have been increasing recently. Some of them give one to three years of computer education, but most of them give only a few days or up to two weeks of classes. These have received much criticism as not being effective for actual business.

3-2-3 Suggestions

Balanced development of hardware and software technologies is indispensable to the steady growth of the computer industry. The computer nationalization plan must be accompanied by measures which will stimulate the development of computer application technology and increase computer users. Development of user-oriented computer application technology helps the economy run more efficiently, expands

the demand for related products, and leads to the growth of new logistic industries such as data base service, network data processing. Therefore, government policies to foster the computer software business are just as important as those aimed at computer manufaturers.

The Resolution 44 announced by the Government aims to produce small-size, low-priced and sophisticated computers. In terms of the size of the potential demand in Argentina, the choice of micro-computers for domestic production is justifiable. For the implemention of this computer nationalization plan, it is necessary to consider the following issues from the viewpoint of increasing the domestic demand for computers.

Firstly, care should be taken to avoid the excessive protection of domestic computer manufacturers, because lack of competition tends to raise the price of micro-computers and thus discourage prospective users from buying them. Lack of competition also tends to stagnate technology development efforts and to deliver obsolete machines to users.

Secondly, it is not advisable to restrict imports of medium- and large-size computers. Larger computers are different from micro-computers in their functional characteristics and they cannot be replaced by micro-computers in many situations. Thus, the imposition of heavy duties on their imports in order to protect the domestic micro-computer industry is not advisable. Rather, the encouragement of the introduction of medium- and large-size computers will serve to increase the computer use in the society, which is beneficial to the computer-related industry as a whole in the long run.

Thirdly, it is not advisable to impose high import tariffs on software programs developed in other countries. The availability of computer application technology is essential for increased use of computers, and competition is necessary for the development of better software programs.

The promotion of the domestic computer software business (or software houses), requires governmental supports and actions in addition to the private sector's own efforts. Important measures are as follows.

1) Financing of software program development

Software companies need operating capital when they develop application programs, especially packaged programs for which there are no specific clients. But they usually find it difficult to obtain loans from commercial banks for such knowledge-intensive development efforts. There is thus a need to establish a system to improve their access to external financing.

In Japan, the Information-technology Promotion Agency, which was established in 1970 jointly by the government and the related industries, guarantees bank loans to software companies. The agency also provides funds for the development of promising general-purpose system programs or application programs proposed by software companies and assists the promotion of these programs among potential users. These activities significantly contributed to the growth of the domestic software business.

2) Promotion of software development technologies

There is a need to facilitate the technological innovations which improve the productivity of software development. In Japan, in order to solve the shortage of software suppliers relative to the sharp increase of demand for application programs, the above-mentioned Agency has organized software companies to implement the joint project called Operation Sigma which aims to automate the process of program development.

3) Promotion of custom-order program development

The growth of the computer software industry naturally depends on the increase of demand for software programs. The demand for software programs can be classified into two types. One is the demand for packaged programs which users purchase from the software market, and the other is the custom-order demand. The government has a role to play in increasing the latter type of demand directly and indirectly.

In Argentina, software companies are yet underdeveloped, and because of their inadequate experiences and knowhows, custom-order program development of some complexity involves risks to the clients. On the other hand, software companies cannot improve their knowhows because they receive few orders. In order to break this vicious cycle, the government can take two steps.

One is for the government itself to place orders for software program development. The other step is to provide tax incentives like shortened depreciation periods for the private sector users which place custom orders to software companies. In the beginning, it may be necessary to form an association of software companies which receives orders, organize project teams and takes the responsibility of program development.

4) Development of the software distribution market

Because the growth of the software market is a recent phenomenon, copyrights of software programs are not well established in many countries. In Japan, the Copyright Act was revised only in 1985 to include computer software programs. In order to facilitate the orderly development of the software market, especially with respect to packaged programs which are sold in larger quantity, it is necessary to provide legal protections for software companies.

With respect to custom-order programs which software companies developed for particular clients, it is advisable to establish a system of the central registry and referral so that other potential users can have access to them with the consent of the original clients.

5) Strengthening of computer education

It is said that university graduates who obtained computer-related education in Argentina often find it difficult to get proper employment due to the generally low level of computerization of the Argentine society. Moreover, their education is lecture-oriented

mainly because the number of computers available for their training is very limited.

As mentioned already, only ten ENETs have special computer courses for the training of middle-level technicians. Despite the economic stagnation, there is an annual demand for 10,000 units of micro-computers in Argentina, and it will be necessary to train an adequate number of computer operators.

Needless to say, the availability of competent software engineers and computer operators is essential for the development of the software industry. And in Argentina, it is especially important to upgrade their practical training both at the university and the ENET levels.

The qualification test for software engineers is about to be instituted in Argentina in order to improve the technical level of software development and to assess the level of competency among existing engineers. This is a very timely initiative. In Japan, the Information Processing Engineers Test began in 1969, and the number of the applicants who passed the test exceeded 100,000 persons.

6) Promotional campaigns and market research

On the part of computer manufacturers, dealers, software houses and other information service companies, it will be necessary to organize joint public relations campaigns for the popularization of computer use. They can also combine their forces to cultivate new users through market research on the possibilities of computerization in various businesses.

Public promotional campaigns can be organized jointly by the public and the private sectors. In Japan, October is designated as "Information Month", and various promotional activities are sponsored jointly by local governments, chambers of commerce and industry, and computer-related industries.

7) Promotion of the related information service industry

When it is linked with the development of communication technology, computerization opens up new business opportunities such as network information processing and data base service. Although it will be difficult to accomplish in a short space of time, it is nonetheless necessary to start investing in the development of data transmission lines to prepare for the age of computerized communications.

3-3 Numerical Control (NC) Machine Tool Industry

3-3-1 Characteristics of NC Machine Tool Industry

(1) Introduction

More than thirty years have passed since the prototype of a numerical control (NC) machine tool was first developed. During this period, the machine tool has attained remarkable progress in terms of function, so that it is now considered to be the most important component of all production machines. In major industrial countries the machine tool industry has taken a leading part.

The machine tool was developed as a result of the combination of electronics and mechanical technology, both of which have attained great progress after World War II. This combination is now called "Integrated Technology". NC machine tool is the good example of this Integrated Technology.

A machine tool forms an indispensable part of the production system, so that it is called the machine to manufacture a machine, or the "mother machine". Accordingly, the technical level for a machine tool represents that of the whole industry in a country.

In addition, the NC machine tool, which has been in full scale use since the 1960s, exerts wide influence on the industry because of its innovational features and great applicability. The influence of NC machine tool is highly evaluated not only by manufacturers but also by users and workers. Therefore, it is now said that the technology relating to NC machine tool, indicates the potentiality of technological development in a country.

The NC machine tool industry is a key industry in the major industrial countries to improve the standard of the existing machine industry.

In this section firstly we refer to the characteristics of the NC machine industry. In order to understand this industry, we will briefly describe 1) technology, 2) market and 3) future trend, based on the experience of the industry in Japan and other major countries. Secondly we refer to the present conditions, problems and tasks of the NC machine tool industry in Argentina, based on the results of the current study. Thirdly we present policy suggestions for promotion of the NC machine tool industry in Argentina. We will especially detail concrete implementation measures for encouraging the industry, by focusing on ways to increase demand and to improve technology, based on the understanding of the current conditions in the Argentine industrial environment.

(2) Characteristics of NC machine tool industry

(a) Necessity of developing and accumulating innovational technology

(i) From development to accumulation of new technology

The technology of the NC machine tool has been developed after World War II. Development of the NC machine tool originated in the basic research conducted by Mr. J.C. Parsons in 1974 in the USA. His research aimed at the development of high-accuracy machine tool technology through the combination of the electronic technology with the high-level machine tool technology for machining airplane parts attained in the USA during the war. The prototype of the NC machine tool was the NC milling machine, released by the Massachusetts Institute of Technology (MIT) in the USA in 1952. Later, the machining center was developed in 1958, which is said to be a core machine among the current NC machine tools.

The progress in the development of the controlling system in the NC machine tool can be classified into several steps. The controlling system at the time the prototype was released was called "the first generation" system and contained vacuum tubes. In 1958, it had been developed to "the second generation" system with transistors. In 1964, "the third generation" system had built-in ICs (integrated circuits), and in 1970 "the fourth generation" system appeared. It made use of a minicomputer which had been an outcome of the development of the microprocessor by INTEL. In 1975, "the fifth generation" NC machine tool, with a built-in CPU, the result of development of the one chip microcomputer and its application, was put on the market. Since then, the CNC (computerized numerical control) machine tool has shown rapid progress.

The NC machine tool is operated by the instructions by a perforated tape in accordance with the numerical information representing a machining process. For this numerical control, the following processes are necessary: 1) preparation of the instruction tape, 2) a controlling system to perform information processing through the instruction tape, and 3) a servo-mechanism to operate the machine efficiently in accordance with signals from the controlling system.

The first process is called the program preparation stage. Here, the automatic programming system accompanying a computer is used when the program is to be prepared for complicated three dimensional work. For this purpose, the subroutine called ART-1 for PERT program was developed between 1952 and 1954. This APT (Automatically Programmed Tools) had been upgraded to APT-IV (developed in 1971) and supported the foundation of the NC language. It is the development of the ART that can be said to be the pioneer of NC software.

The new technology has been developed through the combination of new machine tool technologies such as mechanics, electronics and information technology (software technology), all of which were developed in the USA. Let us consider how this new technology has spread to other countries by studying the case of Japan which took up the new technology from the very beginning.

Around 1950, Japan lagged very much in electronic and information technology, being far behind Western countries. However, the effort to bridge the gap in NC machine tool technology was started very early. Table III-3-7 shows time lags between development in the USA and introduction of the developed technology to Japan.

In the USA, the fundamental research on the NC machine tool began in 1947. In Japan, in contrast, such research was commenced seven years later by the University of Tokyo and Tokyo Institute of Technology in 1954.

Regarding the development of a prototype, MIT's research information about the NC machine reached Japan one year after the development in the USA (1953), but Japan started the development as late as 1958.

However, with the completion of the industrial production and of commercialized machines, these time lags were shortened to three years. And in trial manufacture of a machining center, the time lag was shortened to two years.

The delay in beginning the fundamental research can be explained by looking at the history of the NC machine tool development. Japan had no necessity at that time to perform such sophisticated machining because of the lack of the aircraft industry. However, the shortening of the time lag is accomplished in the process of the development of the technology for commercialization and the capacity to adapt imported technologies. Meanwhile the development of software was actively carried out by the associated industries in line with the domestic production policy for computers in the mid-1960s. This suggests that the Japanese technical potentiality had reached a considerably high level. Accordingly, the time lag with the USA in the controlling technology, which is peripheral to the NC machine tool, had been shortened to one or two years by around 1965.

However, it could not be said that the Japanese NC machine tool had caught up with the world standard in 1965. Even if the differential became smaller in the middle of 1960s, Japan had to make effort to maintain high technological levels in related fields as well as accumulated technology. This is because the more sophisticated the technology was, the greater the effort had to be to develop it. Moreover, if creditability in the international market was taken into account, the differential between Japan and the USA became even clearer at that time.

In this connection, the Japanese output of NC machine tools was 39 units in 1965, while that of the USA was 2,100 units (54 times greater). In 1966, the US output was 2,926 units in contrast with the Japanese output of 90 units. In that year, the ratio between the output of the USA and Japan was lowered to 33 times. When these figures are indicated by the percentage of the NC machines among all machine tools, or the NC ratio, the percentage in terms of amount is 15.8% for the USA while 1.0% for Japan and in terms of number of units, it was 1.2% for the USA while 0.1% for Japan.

Table III-3-7 USA-Japan Technological Differentials in Development of NC Machine Tools

Stages of Developing NC Machine Tools

Technological Progress	The USA		Japan		Time Lag
Start of fundamental research	1947	J.C. Parsons	1954	Tokyo Institute of Technology, Ikegai Iron Works, Ltd. Fundamental research on NC machine tools	7
Prototype machine	1952	M.I.T. NC Milling Machine	1958	Makino Milling Machine, NC Milling Machine	6
Completion of industrial production	1955	Gidding & Lewis, NC Profile Milling Machine	1958	Makino Milling Machine	3
Machine on Sales	1956	Burg, NC Turret Drilling Machine	1959	Hitachi Seiki Co., Ltd. Fujitsu, Ltd., Mitsubishi NC High-Speed Milling Machine	3
Machining Center	1958	Keaney & Trecker	1960	Hitachi	2

NC Machine Tool Controlling Technology

Positioning control	1955	APT-1	1956	Fujitsu, Ltd., Punchpress	1
Use of IC in NC circuit	1965	Bendix	1966	Fujitsu, Ltd., Mitsubishi Electric Corporation	1
Group automatic control	1966	Banker Ram Simultaneous control for 10 milling machines	1968	Ikegai Iron Works, Ltd. Simultaneous control for six NC lathes	2

Source: Japan Society for the Promotion of Machine Industry Economic Research Institute, Research on Differentials in Technological Level, 1968.

(ii) Characteristics of integrated technology

NC machine tool technology has been brought about by the integration of mechanical and electronic technology. In Japan, such a technology is commonly called "mechatronics," a new technological innovation.

The NC machine tool is a typical example of this innovation. In Japan the innovation in the NC machine tool technology has been made possible by the cooperation of Fanuc Ltd., which has developed small controllers (NC unit), Nippon Seiko K.K., which has developed ball screws, and material manufactures which have developed the Teflon technology. That is to say, the technological innovation of this type has been realized through the integration of many related businesses.

When we consider technological innovation, two types of innovation can be cited. One is the conventional "Technological Breakthrough" innovation. This type is typically represented by the "transistor revolution", and is the field at which Western countries are highly skilled. The other is the "Technological Fusion" innovation, typically represented by "mechatronics", and is the field at which Japan excels.

Table III-3-8 shows the characteristics of this type as cited by Prof. Kodama of Saitama University. As shown in the table, this Technological Fusion can be realized by integration of related businesses at the development stage. The effects of the development of this type of innovation extends to all related industries and promotes their growth.

"Technological Fusion" type of innovation begins when a company becomes interested in other fields than its major business. Different companies of different industries will, then, begin to invest in mutual research and development. In Japan, these activities were prevalent in the 1970s according to the analysis for 13 years from 1970 to 1982. For mechatronics technology, the fusion of machinery and electronics occurred in 1971, while that of the machinery, electronics machinery, electronics communication and precision machinery has taken place since 1975. When the fusion of technology among these four industries matures, the establishment of the "mechatronic technology" is said to have occurred. This coincides with the period of the Japanese NC machine tool industry's rapid growth. In 1982, the technological fusion relationship between ceramic, electrical and machine industries was formed, signalling the appearance of the "new ceramics technology". Moreover, in the 1980s, the new fusion has been appearing between the machining and assembling sector with the nucleus machinery-electricity relationship and the basic industrial sector with chemistry as a core. This has heralded the commencement of the "new materials innovation".

Table III-3-8 Comparison of Characteristics of Two Types of Technological Innovation

Types / Characteristics	Technological Fusion	Technological Breakthrough
1	Can be realized by integrated R&D between related business.	Can be realized by leadership of a prominent company in a specific industry.
2	Contributes to the gradual growth of associated industries. The Japanese machine tool industry has grown by "mechatronics innovation", based on existing businesses.	Contributes to rapid growth of a specific business. Under the "transistor revolution", many vacuum tube manufacturers lost the business, while new enterprise such as Texas Instruments, Inc. have grown rapidly.
3	Conducted by the industrial policy. In Japan, the "Machinery and Electricity Act" was enacted in 1971 by combining the existing "Machine Industry Promotion Law" and "Electronic Industry Promotion Law". Under this new act, the "machinery-electronic industrial fusion" was realized.	Realized through the intensive research related defense.

Source: Fumio Kodama, Advocation of the Technological Fusion and its Analysis, Vol. 86, No. 806 Japan Machinery Society's Publication, January, 1986.

(iii) Necessity of improving the machine tool technology

At present, there are two basic movements in NC machine tool technology. One is toward the application of the micro-electronics technology to all production systems and the other is toward the application of the technology of super-precision machine. However, these two goals are not separate but can be achieved through mutual development.

The first trend can be seen in machine tool-based production system. This trend had been reinforced since 1970, with FMS (Flexible Manufacturing System) being introduced in the 1980s. In FMS, multiple NC machine tools are linked on unmanned carriages and controlled by computer. This system is being developed with FA (Factory Automation), in which production controlling softwares such as CAD/CAM (Computer-Aided Design/Computer-Aided Manufacturing System) and robots are integrated. The integration of production process aided by computers are called CIM (Computer Integrated Manufacturing). Completion of this highly sophisticated system is supposed to appear early next century.

In Japan, the research and development for the prototype of this production systems was conducted by the Ministry of International Trade and Industry from 1976 to 1983. The ministry specified the system to "Super-High Performance Laser Application Multiple Production System" and spent 13 billion yen.

Regarding the application of the technology of super-precision machining, users of machine tool prefers higher precision machine tools. From the beginning, improvement of the degree of precision in precision machine tools has been an important issue. At present, the precision required for general machinery is the 10-micron mark. However the sub-micron mark is required in the advanced industry. For this purpose, the more advanced machining method utilizing such as electrons, ion and electromagnetic waves is being tackled as a future development task.

Also in the NC unit, the one micron scale has become a matter of course, while the scale of 0.1 micron has recently been released. For many machine tools, the revolving speed of the main spindle has changed from the conventional level of 3,000 - 5,000 r.p.m. (revolutions per minute) to 10,000 r.p.m. Furthermore, in order to secure simple and easy use of the NC machine tool, the development of the automatic programming device, interactive CNC system and graphic display is under way.

(b) Market expansion and business dynamism

(i) Rapid switchover to NC machine tools

The full-scale production of NC machine tools started when Gidding and Lewis (USA) manufactured the NC profile milling machine. The market rapidly expanded, especially with orders from the aircraft and missile industries. From 1960 to the beginning of the 1970s, the market continued to expand, chiefly in the USA.

As a result, output of NC machine tools rapidly increased and the share in total output of machine tools rose sharply. In 1966, the so-called "NC ratio" was 15.8% in terms of amount in the USA, 1.0% in Japan and slightly above 1.0% in European countries other than Britain and France (both having a 2% ratio). In 1970, the ratio was 20.6% in the USA, exceeding the 20% for the first time. Meanwhile, the ratio in Japan rose to 17.3% in the same year, and reached 22.4% in 1976, similar to the ratio of the USA in that year.

Since then, the NC ratio in the USA has remained between 20% and 30%, recording 29.2% in 1980. The ratio in Japan reached 29.4% in 1978, 49.8% in 1980, and was as high as 70.9% in 1985. About 70% of the total output of machine tools in Japan is represented by NC machine tools.

The number of production of NC machine in 1977 amounted to 5,197 in Japan, exceeding the output of the USA. Furthermore, the number reached a record high of 45,524 units in 1985. This figure is about nine times the output, 5,124 units of the USA, and about 4.5 times the output, 9,966 units of West Germany, for the same year.

Table III-3-9 shows the trends of production of NC machine tools and its custom tariff in Japan. There was a drastic increase of production for the 20 years from 1965 to 1985.

Among NC machine tools, the NC turning machine and machining center are typical types. Each type occupies about 30% of the total output of NC machine tools in major industrial countries.

The conventional turning machines have been rapidly replaced with the NC turning machine with the increasing replacement rate in Japan. For example, the NC ratio of the turning machine in 1980 was about 35% in terms of units and 69% in terms of value amount. The ratio was raised to 53% and 80% respectively in 1985. This shows that the switchover from the conventional turning machine has progressed remarkably over the past five years.

As shown above, switchover to the NC turning machine from conventional type has progressed rapidly. Under such circumstances, the existence of a country's machine tool industry in addition to continuation of its domestic turning machine businesses, depends on whether the country can acquire the NC technology or not.

(ii) Trends in the diffusion of NC machine tools

The demand for NC machine tools is maintaining a remarkably rapid growth in all countries. The output of the NC machine tools in major countries was about 60,000 units in total around 1985. Further, the potential demand seems to be unlimited. Output of NC machine tools in 1984 was 38,036 units in Japan, 9,960 in West Germany, 5,150 in the USA, 2,630 in Britain, 1,294 in France, and 57,036 in total.

With regard to the demand, two trends are evident. One trend is in the demand for high precision machinery in the aircraft, missile and atomic energy industries. The other trend is in the demand for high quality and low cost machinery in machine tool, agricultural machine, construction machine and automobile industries.

Table III-3-9 Production of NC Machine Tools and its Custom Tariff in Japan

Year	Until 1971	After Jan. 1, 1972	Revised on April 1, 1973		Revised on April 1, 1978	Present
Custom Tariff on NC Machinery	10%, 15%, 25% on different type July 1, 1968 to Dec. 31, 1969 10%, 15%,19%	1. Multi-spindle automatic turning machine 2. Profile milling machine 3. Surface grinding machine 4. Thread grinding machine 5. Gear showing machine On the above: 10% On others: 15%	Provisional custom tariff 9% 13.5%	Effective custom tariff 7.2% 10.8%	Effective custom tariff 7.2% 8.0%	0%
Production of NC Machine	1965: 39 units 1966: 90 units Total number of production of machine tools: 108,000 units NC ratio: 0.08%	1972: 1,387 units NC ratio in terms of value amount: Japan 12.0% U.S.A. 16.7%	1973: 2,583 units NC ratio in terms of value amount: Japan 15.6% U.S.A. 18.1%		1978: 7,386 units NC ratio unit base: 5.4% Value amount base: 33.6% U.S.A.: 21.5% in value amount base	1985: 45,524 units NC ratio Unit base: 26.0% Value amount base: 70.9% U.S.A.: 5,124 units in 1984

Source: Study Team

However, since the oil crises in the 1970s, the demand has been directed to energy saving and cost reducing type machines in line with attempts at completion of rationalized production. This demand has resulted in medium and small sized NC machine tools with high reliability. Since Japan was a pioneer in the development and introduction of such machines, the demand for Japanese producers has rapidly expanded in not only domestic market but also in export market.

Most of the demand for the NC machine tools nowadays comes from the machine industry. In this connection, Japanese shipments of NC machine tools in 1985 were chiefly for the general machine industry (about 26%), automobile industry (12%) electric machine industry (6%), and exports (37%). Moreover, the demand from medium and small sized businesses amounted to about 60% of the total demand, of which small companies with 30 employees or less represented as much as 42% of demand. This reflects the spread of NC machine tools to small businesses.

In the comparison of Japan and the USA, the number of NC machine tools equipped is about 26,000 units of a total of 720,000 units of machine tools, the NC ratio being 3.6% in Japan. On the other hand, in the USA, the number of NC machine tools equipped is about 94,000 units out of 1,700,000 units of machine tools, or a ratio of 5.5%. Until the previous survey (1976 to 1978), the ratio was as low as 0.2% in the USA. Therefore, the USA made efforts to overcome the delay in introduction of the NC machine tool.

(iii) Business activities and dynamism

The comparison of business conditions between Japan and the USA, in 1977, which is the year of the census in the latter country is shown in Table III-3-10. The size of a company in machine tool industry is generally small in both countries. Small business with 20 employees or less accounts for 80% and 67% in Japan and the USA respectively. Of those with 100 employees or less, the percentage is 95% in Japan and 90% in the USA. Regarding the companies of more than 1,000 employees the number of companies is only three in Japan and eight in the USA. This shows that the machine tool businesses in both countries remain small.

Table III-3-10 Machine Tool Industry in Japan and the USA (1977)

	Japan	USA
Number of Establishment	1,814	917
Number of Employees	47,700	59,400
Shipments	US$1,890 million	US$2,813 million

Source: Ministry of International Trade and Industry of Japan and US Department of Commerce

In the USA, the size of the company remained small since they could not accumulate the capital and preferred being specialized company. In contrast, Japanese machine tool businesses can accumulate capital and have reinforced the manufacturing and product developing technologies, despite their small scale. This is because they are subsidiaries or affiliated companies of large enterprises. However, since their market is very competitive, the Japanese machine tool manufacturers' net profit ratio against sales is 4%, being half of the counterparts in the USA. Since even in the USA the profit of the machine tool is said to be low also, improvement of the profit ratio is a future task for the Japanese manufacturers.

The factors which determine the competitiveness in international market are price and quality. Price competitiveness is achieved by lowering the price of product by efficient use of production process. For this purpose, the trend of labor productivity should be examined. For example, in 1981, the wage per hour of the US employees in the machine tool industries was about US$9.2. In Japan, it was US$6.2, including welfare charges. The output per hour is calculated at US$231 in Japan and US$130 in the USA, based on the performance in 1979. In 1981, the average price per one unit of NC machine tool in Japan was about half the price of that in the USA. Although Japan has attained superiority over Western countries in price competition, it will not always be able to maintain the superiority in the future, considering the present rate of wage rises and exchange rate.

In the area of non-price competition, there are many factors influencing the competitiveness of the machine tool, such as quality, fulfillment of ordered delivery date, after-sales service, maintenance and easiness of operation. The "quality" and "fulfillment of ordered delivery date" are the most important factors. The request for "after-sales service" has been increasing as automatization of the machine tools progresses. The "fulfillment of ordered delivery date" is defined as the speed of the response to market demand. As for the "quality control", maintaining high quality is deemed as the most important task in production strategy. In Japan, the "QC circle" system, in which the quality control is performed in production process, is well established. The Japanese quality control has clearly taken the lead, although Western countries have begun to introduce such systems.

3-3-2 Present Situation of Argentina's NC Machine Tool Industry

(1) Present situation of NC machine tool industry

The production activities of machine tool industry are shown in Table III-3-11, which indicates a peak in 1977, followed by a sharp decline down to 2,516 in 1982. In contrast, imports drastically increased from about 15,000 in 1980 to some 18,000 in the following year. Imports have notably decreased due to the strict limitation on imports that was enacted just after the establishment of new government, and such decreases have not yet been made up by corresponding increases in domestic production.

Table III-3-11 Number of Machine Tools in Argentina

(Units)

	Production	Exports	Imports	Domestic demand	Domestic procurement ratio (%)
1970	14,254	2,599	2,861	14,516	80.3
1971	13,809	1,353	2,157	14,608	85.2
1972	17,000	1,661	982	17,221	94.3
1973	22,500	2,132	957	21,325	95.5
1974	20,251	5,138	7,763	22,876	66.0
1975	15,064	2,081	1,445	14,423	89.9
1976	16,243	3,402	1,620	14,461	88.7
1977	18,000	2,757	2,136	17,379	87.7
1978	12,640	1,890	3,117	13,867	77.5
1979	10,608	2,059	6,882	15,432	55.4
1980	9,094	2,362	15,068	21,800	30.8
1981	4,417	1,412	17,978	20,983	14.3
1982	2,516	318	1,394	3,592	61.1
1983	3,081	82	2,797	5,796	53.2

Source: D. Chudnovsky, The Diffusion of Electronics Technology in the Capital Goods Sector: the Argentine case, UNCTAD, 1985.

NC machine tools were first imported around 1970. 6 NC lathes, 1 NC milling machine and 2 MCs (machining centers), 9 in total were imported in 1970. They are regarded as small to medium size because of the averaged unit price of some US$36,000 per NC lathe and of around US$77,000 per MC. Since then, imports continued to increase, sharply increasing after 1976 when the import restrictions were abolished. The peak of 46 units was recorded in 1981. Imports, however, suddenly dropped in 1982 because of alterations in the trade policy enacted in the preceding year, with an increase in the imports of MCs.

Regarding the domestic production of NC machine tools, the first output was in 1979 as seen in Table III-3-12, followed by continuous production activities, reaching 10 units in 1983. It is expected that around 20 units were to be manufactured in 1985. For 1986, the top NC lathe manufacturer is reportedly going to produce 30 to 36 units, so that the total domestic production including those from other manufacturers can be expected to reach around 40 units. As to the number of existing units of NC machine tools, no accurate statistical data was found. The previous record on domestic sales suggests the figure is around 350 units, while some experts and industrial associations believe it to be over 500 units. Judging from this figure, the country's present production level corresponds to that of Japan in 1966.

Table III-3-12 NC Machine Tool in Argentina: Imports and Local Sales

(Units)

	NC lathes			NC milling and NC drilling machines	Machining centres	Total Im-	
	Imported	Local	Sub-total	Imported	Imported	ported	Total
1970	6	-	6	1	2	9	9
1971	2	-	2	-	1	3	3
1972	-	-	-	-	1	1	1
1973	2	-	2	-	3	5	5
1974	1	-	1	2	2	5	5
1975	2	-	2	2	4	8	8
1976	5	-	5	1	1	7	7
1977	9	-	9	-	-	9	9
1978	20	-	20	1	3	24	24
1979	23	1	24	2	5[1)]	30	31
1980	29	2	31	4	6	39	41
1981	37	8	45	5	4	46	54
1982	2	7	9	4	5	11	18
1983[2)]	1	10	11	2	5	8	18
Total	139	28	167	24	42	205	233

Source: D. Chudnovsky, The Diffusion of Electronics Technology in the Capital Goods Sector: the Argentine Case, UNCTAD, 1985.

Notes : 1) Estimated
2) Eleven months

It has been reported that new and powerful NC lathes and MCs were exhibited in the Argentine International Fair of Machine Tools (EMAQH '86). These machines are of international standard, with components made mainly in West Germany.

Table III-3-13 lists the total existing number of machine tools in Argentina: 388,306 units in 1980, of which some 44% includes vintage of 10-years or less, and 56% between 10 and 20 years. There are a very few NC machine tools that have been introduced after 1976. Meanwhile there are many old machine tools - used for 20 years or longer - installed in the 1960s. Replacing old machines is essential for the promotion of Argentine industry, and such replacement will lead to a potential market for NC machine tools.

Table III-3-13 Number of Machine Tool Equipped in Argentina

Year	Units
1963	201,700
1964	208,237
1965	217,953
1966	223,748
1967	227,930
1968	235,807
1969	245,537
1970	257,598
1971	269,630
1972	284,155
1973	302,638
1974	322,237
1975	333,379
1976	342,840
1977	355,077
1978	363,618
1979	373,059
1980	388,306

Source: CIMHEA, Evolucion Reciente del Control Numerico en la Argentina, Perspectiva y Efectos de su Difusion 1983.

(2) NC machine tool manufacturers

In Argentina, there are six manufacturers of NC machine tools at present: the three leading companies - Turri, PROMECOR and CORACERO - and DARJE, and two press-related enterprises, DIAMINT and DAISA. In this study, the leading three and DARJE, a NC milling machine manufacturer, were surveyed (see 3-3-A(1)).

In 1985, about 20 NC machine tools were produced in Argentina, 70% by Turri. The company made 14 units, including 3 for export to the USA. PROMECOR, the second largest, began production in 1984 and manufactured 4 units in 1985, while CORACERO began production as recently as May 1986. DARJE displayed its Series 7 module type NC milling machine in the Machine Tool Show held in May, 1986. These moves represent the emerge of the NC machine tool industry in Argentina.

(a) Development activities

Turri, PROMECOR and CORACERO began to develop their own NC lathes in 1979, while DARJE started development of the NC milling machine under technological license from a foreign company in 1980.

According to the officers of a NC machine tools company, there are two reasons why they developed NC machine tools through their own technology, which are regarded reasonable. First, license-based production though promoting production, will delay the licensees' developments of basic technology due to restrictions imposed by the licensers to use specified components. Second, it is important to establish systems which provide complete services to customers, especially after-sales services of products through their own technology.

On the other hand, the DARJE which concentrated on milling machine manufacturing, through experience from its license contract, has recently succeeded in developing its own machines capable of satisfying international standards. Also, one of the three leading lathe manufacturers started development using its own technology, together with the production under a license agreement with a foreign company, and has recently commercialized sophisticated high-speed and high-precision machines under license and also using its own technology.

The introduction of overseas technology quite often enhances the domestic technology. In such cases, efficient learning to use this imported technology in the short term as well as improving their own technology will be a very important point.

For instance, in Japan, 58 different technologies were introduced relating to machine tools such as large NC lathes between 1970 and 1973 which is the first peak of technological introduction. In the same period, a special committee for NC machine tools was organized in the Japanese Association for Machine Tool Industry to strengthen technology for the performance and quality of NC lathes and MCs.

(b) Production systems

There are two types of production systems found among the four companies. One is a mass production type, as seen in one NC lathe producer and one NC milling machine producer, both of them are producing small- and medium-size machines. The other is the so-called order production method seen in the other two companies who manufacture machines for use in automobile production. One of them is producing small-, medium- and large-size NC lathes and horizontal and vertical MCs, and is developing models of FMS that combine an MC and an unmanned flatcar.

These four major companies have the production facilities and processes which are similar to those in advanced countries. The plant of Turri, the largest producer of NC machine in Argentina has an annual production capacity of 1,000 units, equipped with 90 machines in total. Those are 13 lathes, 8 boring machines, 11 milling machine, 12 drilling machines, 9 planers, 13 grinders, 5 gear planers, and 13 miscellaneous devices including saws and broaching machines. Of these devices, there are two NC lathes, one NC milling machine and one MC. The other three companies also have their own NC machines and ultra-precision jig borers. The equipment of the top four makers can be regarded as relatively sophisticated.

It is observed that few NC machines have been installed in the four companies. Usually NC machines are manufactured by NC machines. The production of high-quality NC machine tools requires parts of high quality. Also technique on programming of machining data accumulated in the process of manufacturing NC machine tools is important. This accumulation of data cannot be obtained by the production of conventional machine tools. Japanese manufacturers of machine tools have actively introduced NC machines into their manufacturing processes, upgrading production technologies.

At present, in Argentina the main components such as NC units, spindle motors, servomotors and ball screws are imported, while saddles and heads are produced locally in Argentina. It is said that over 90% of the components are imported from abroad. Some of surveyed companies believe that in the government's plan for domestic production of NC machine tools, it will be necessary to start license-based production of sophysticated components.

(c) Marketing activities

The demand in the Argentine machine industry is now extremely stagnant, representing the inactive investment activities of industry as a whole. The demand for machine tools, which fell in the latter half of 1985, recovered slightly in the first half of 1986.

Turri is scheduled to produce 30 to 36 units in 1986, roughly double its production from 1985. DARJE and PROMECOR are preparing for the export of NC machine tools, with the latter company planning to produce NC machine tools in Brazil with increased efforts in after-sales service.

As mentioned above, the four companies put emphasis on capturing domestic demand and preparing for export market. However, measures to increase domestic demand does not appear to be enough. According to users of NC machine tools in Argentina, there are several reasons to introduce NC machine tools: Those are 1) to modernize and rationalize plants and to improve product quality by renewing facilities, 2) to cope with fluctuations in demand and 3) to complement the low quality of labor by NC machine.

Since there is a potential demand for NC machine tools in Argentina, practical measures to enlarge the market should be promoted. There are several possible measures for this purpose such as loans from the National Development Bank (BANADE) and introduction of a subsidizing system. If no demand-prompting measures are executed in parallel with loans from BANADE, the growth of the Argentine NC machine tool industry will not be easy.

Also scrap-and-build policy to promote the replacement of vast numbers of existing machine tools in Argentina can be considered worthwhile. A similar measure was implemented in Japan in the 1960s during the era of facilities modernization.

On the other hand, all four companies regard Argentina's foreign trade policy as the key to the development of future markets. The development of markets in Latin American countries is very important to have enough room to absorb the products from Argentina.

It is a question of whether Latin American countries, which were once great markets for Argentina's traditional lathes, will buy NC machine tools from Argentina to replace their existing tools. Such strong demand will not come back to Argentina without the implemention of a appropriate supporting trade policy that promotes the export of NC machine tools.

(3) NC machine tool market

This section will provide an overview of the present situation of the NC machine tool market in Argentina, on the basis of opinions of users obtained in this study.

A major purchaser of NC machine tools is the machining industry. Three machining companies were surveyed in this field study (Profiles of these three companies are shown in 3-3-A (2)).

1) RESORTES ARGENTINA S.A.I.C., though not directly using NC machine tools, is a leading maker of coil springs for automobiles and it uses a number of automated machines.

2) METALURGICA ROMA S.C.C. is a high-precision parts processing company producing line printer parts, gear column parts for NC machines, and transmission box parts for automobiles. It employs four machine center.

3) VENTURI HNOS. S.A. manufactures machine and assembly parts for farming tractors, diesel engines and hydraulic transmissions; and industrial and construction machines such as forklifts and steamrollers.

Users of NC machine say that domestically produced machines will be considered for the next installation if quality is acceptable. Most companies are taking a policy that imported machines will be used to produce sophisticated products for export, and domestic machines are used for the production of lower quality. This is because of short history of the domestic NC machine tool industry in Argentina. It is judged that the reliability of NC lathes are high although that of MCs is lower in Argentina. The only way to overcome this problem is to accumulate the experience obtained through the actual use of MCs to improve the reliability.

(4) Present industrial policy

In Argentina, at present, no integrated policy exists for the promotion of the NC machine tool industry. It is reported, however, that new policy for the promotion of the NC machine industry is expected to be enacted late 1986.