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Use of Emerging Technologies In The Commercial Forestry Industry: Case Studies for Botswana and Zimbabwe

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USE OF EMERGING TECHNOLOGIES IN THE COMMERCIAL FORESTRY INDUSTRY: CASE STUDIES FOR BOTSWANA AND ZIMBABWE

by

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The opinions expressed and the arguments employed in this paper are the responsibility of the author and do not necessarily represent those of ZIDS.

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ABSTRACT

There are significant commercial forestry activities in Botswana and in Zimbabwe. Operations in Botswana, unlike those in Zimbabwe, are limited to the felling and milling of indigenous timber. Zimbabwean operations include large- scale production, milling, and secondary conversion of timber.

Technologies used in all these operations are basically traditional but generally satisfactory with respect to reliability and with respect to meeting market product specifications.

In general, the industry in both countries takes a positive view to emerging technologies and attempts to keep abreast with developments in this area. The industry is, however, cautious about adopting these technologies. This caution derives mostly from the apparent satisfactory operations from the current technologies and from some fear of possible difficulties which may arise with respect to indigenizing these technologies once adopted.

Besides these considerations, capacity exists for Zimbabwe particularly to engage some of these technologies. The most promising ones for Zimbabwe are in the area of secondary biobleaching for the expanding pulp and paper industry, timber drying kilns to enable effective control of timber delivery times, and information technology for operations management.

ETs potential for Botswana is more limited. Prospects are greatest in timber waste conversion to charcoal and in localised power generation using timber wastes from field and sawmill operations.

Any acquisition or development of these technologies will, however, be individual company effort without any significant assistance from government or from parent multinational companies.

INTRODUCTION

This report investigates the potential for the application of emerging technologies[1] in the forestry industries of Botswana and Zimbabwe. The purpose of the investigation is to determine areas of such potential and to provide information which may be useful in establishing methods of diffusion for ETs in the industry.

To the latter end, the study provides detailed information on forest products output, regional trade, background economic activity, and timber production technology.

In general, both countries have a solid economic base to acquire the foreign exchange necessary for technology acquisition. Botswana's resources are based more on the of a single mineral product (diamonds) and very little else. Zimbabwe's resource base is more diverse. It includes a wide range of minerals, industrial products,and agricultural products. Botswana is, nonetheless, better placed in terms of foreign exchange availability to acquire foreign technology than Zimbabwe.

Timber production activities in Botswana are limited to harvesting and sawmilling indigenous timber. The country's exports in the forest product industry include mainly sawlogs sold to Zimbabwe and to South Africa. All operations are run by a Zimbabwe-based company, Chobe Forest Industries (CFI). The company has no ownership linkages with MNCs and operates quite independently.

Zimbabwean companies are relatively large and generally have ownership association with large MNCs or with Government.[2] These companies are, however, quite independent in their operations.

In both cases forest production is mainly for the local and regional market. There is no evidence of efforts to market beyond the region.

ETs are generally well known and appreciated but the enthusiasm to adopt these is dampened primarily by self- restraint and by the effects of some Government regulations relating mostly to the pricing of forest products.

All in all wide ranging prospects exist for ETs. However, some considerations relating to the need to maintain a robust production and marketing system in the industry have militated against a wholesale adoption of ETs in both Zimbabwe and Botswana.

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1 See Appendix I for a listing of some of these technologies.

2 See Appendix II for a brief description of selected attributes of some of these companies.

PART I

REVIEW OF THE COMMERCIAL FORESTRY INDUSTRY IN ZIMBABWE

Organization

Commercial forestry in Zimbabwe is carried out mainly by four organizations: The Forestry Commission, The Wattle Company, Border Timbers and Mutare Board and Paper Mills. The Forestry Commission is a parastatal organization responsible to the Ministry of Natural Resources and Tourism. The other three organizations are private companies. Border Timbers is a subsidiary of Lonhro Corporation (Lonhro Zimbabwe (Pvt) Ltd); the Wattle Company is a subsidiary of the Anglo American Corporation; Mutare Board and Paper Mills is a subsidiary of the Baringa Group of Companies and has a downstream factory for pulp and paper milling. Some smaller-scale producers exist but have very limited significance in terms of output and influencing broad activities in the forestry industry.

Plantations for the four major producers are located mainly in eastern Zimbabwe (the Eastern Highlands) as shown in Figure 1. Their current plantation areas are shown in Table 1.

Table 1

EASTERN DISTRICTS FOREST PLANTATIONS (ha)

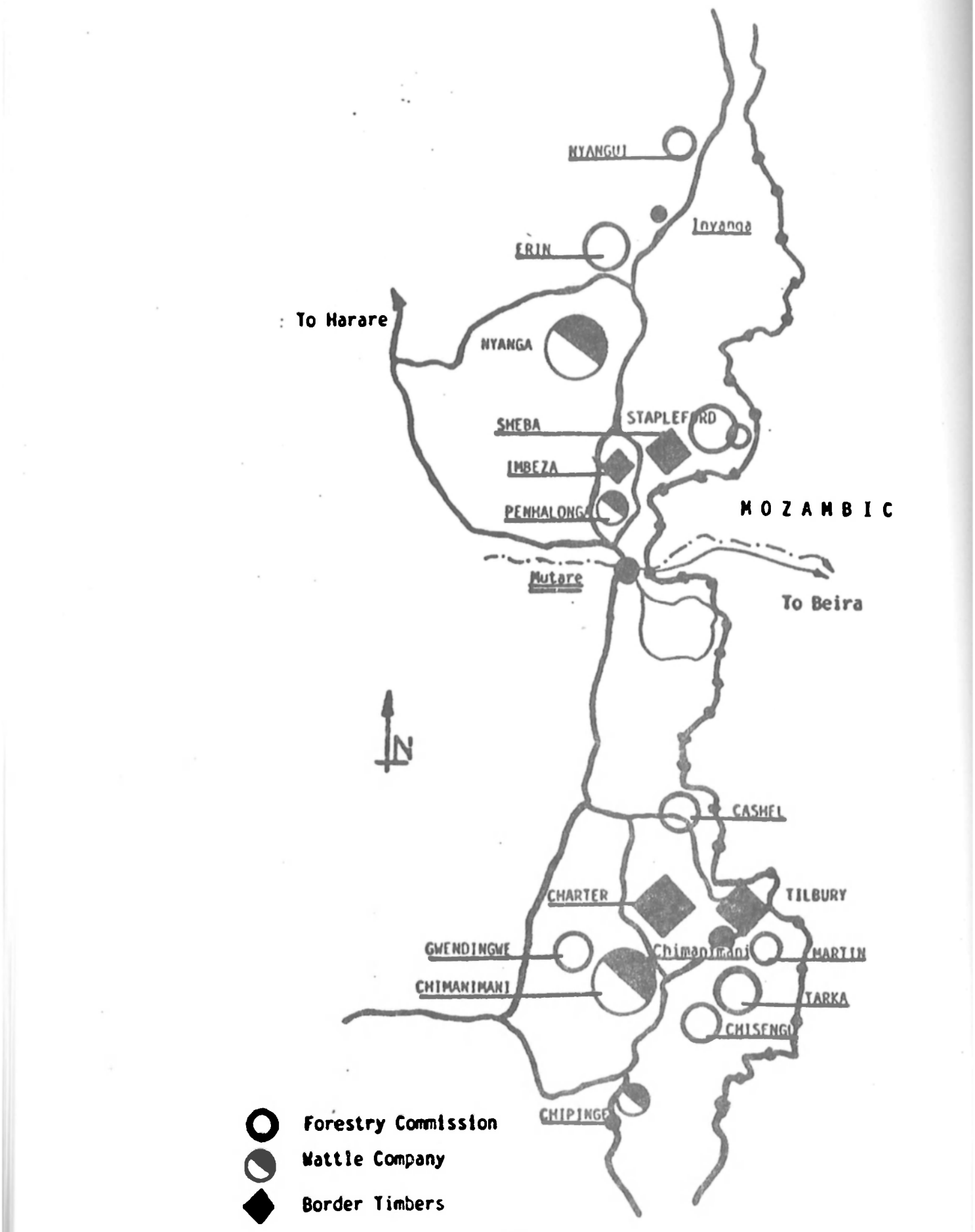
Producer	Conifers	Wattle	Gum	Total
Forestry Commission	30 217	1 104	3 244	34 565
Border Timbers	23 992	0	2 909	26 901
Wattle Company	5 840	13 158	576	19 574
Mutare Board	2 719	47	30	2 796
TOTAL	62 768	14 309	6 759	83 836

SOURCE: Forestry Commission, 1988.

As the data in Table 1 show, conifers occupy 62% of planted areas; gum and wattle 7% and 14% respectively.

Figure 1

LOCATION OF MAJOR FOREST PLANTATIONS IN MANICALAND



Current production volumes for these plantations are shown in Table 2. The volumes are based on a sawlog production regime shown in Table 3.

Table 2

CURRENT PRODUCTION FIGURES 1987/88 (cu.m)

Producer	Conifers	Wattle	Gum	Total
Forestry Commission	528 787	-	64 880	593 677
MAI^3/ha/yr	17.5	-	20	27.5
RP(yrs)	30	-	10	NA
Border Timbers	455 848	-	46 544	502 392
MAI^3/ha/yr	19.0	-	20.0	39.0
RP(yrs)	25	-	10	NA
Wattle Company	99 280	113 158	14 400	127 558
$MAIm^3$/ha/yr	17.0	8.6	25	50.6
RP(yrs)	25	10	10	NA
Mutare Board and Paper	59 818	-	-	59 818
$MAIm^3$/ha/yr	22	-	-	-
RP(yrs)	14	-	-	-

Notes: RP = Rotation Period; MAI = Mean Annual Increase

Source: Forestry Companies

Table 3

CURRENT SAWLOG MANAGEMENT REGIMES

	1st Thinning			2nd Thinning			3rd Thinning			CLEAR FELLING		
	AGE	UV	WV	AGE	UV	WV	AGE	UV	WV	AGE	UV	WV
FC	5	0	30	9	0	50	16	60	40	30	224	100
BT	8	50	25	13	30-45	15-20	18	50-70	25-35	25	150-235	75
WC	8	20	5	12	52	8	16	120	10	25	195	15

Notes:UV = Utilizable Volume m^3/ha; WV = Waste Volume m^3/ha.

FC = Forestry Commission; BT = Border Timbers; WC = Wattle Company

Data not available for Mutare Board and Paper Mills.

Source: Maya; Zieroth; Zimbabwe Charcoal Utilization: Marketing Study, ZIDS Consultancy Report No. 8, 1988.

The current production regimes are not optimum and could be improved significantly if other production and market factors permitted. Under the present conditions, timber

production and utilization has remained relatively constant in the past few years as shown in Table 4.

Table 4

ROUNDWOOD SALES (PLANTATION WOOD)

1982-1987/(cu.m)

Year	Veneer Sawlogs	Veneer logs	Pulpwood	Poles	Matchwood	Mining Timber	Total
1982	453 329	9 442	108 594	17 873	2 688	2 120	594 046
1983	279 083	8 082	104 358	28 604	3 508	11 389	435 084
1984	333 135	8 313	100 312	29 992	2 929	6 327	481 008
1985	305 438	6 147	103 183	32 379	2 912	4 946	455 005
1986	251 487	6 390	100 440	33 183	3 751	11 876	407 127
1987	414 990	14 270	109 235	29 108	3 824	11 903	583 330

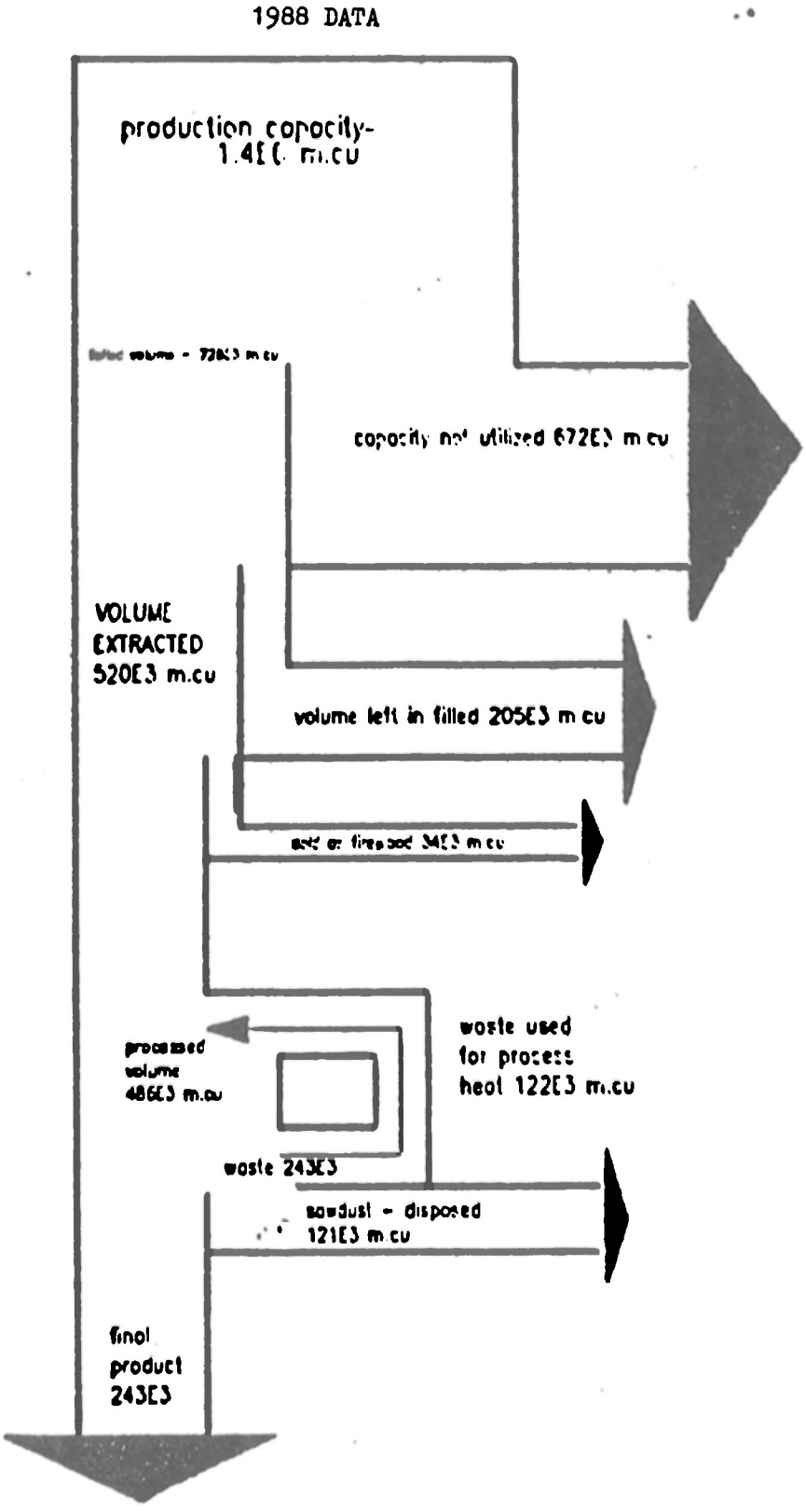
Source: Forestry Commission

A major feature of this timber production and utilization regime is the high level of wastes in all thinning stages and at clear-felling. Combining data on wastes, production and utilization gives a forestry product balance of the form shown in Figure 2.

This current excess volumes should, however, be eliminated if current expansion plans in the forestry products industry materialize. These plans aim first to improve the recovery of timber from the current rate of 45-50% to a higher rate. The Department of Energy has just produced a consultancy report on this subject. According to the report, wood products applications through the production of charcoal, for industrial gas, activated carbon and possibly for use as a reducing agent in ferrochrome smelters can absorb the present plantation wood surpluses and waste. The current waste product, which stands at 277000 cubic metres a year can be convertted to over 42 000 tonnes of charcoal a year, four times the present charcoal production leves.

Figure 2

FOREST PRODUCT BALANCE - EASTERN DISTRICTS



Industrial gas production from charcoal is already being undertaken by a few companies using locally produced industrial gasifiers. Applications for this gas are in the areas of painting (motor vehicle assembly plants), bakeries, and ore drying in the lithium industry. Applications in the form of activated carbon and ferrochrome reduction have not yet been realized. If all these applications come on stream, including planned expansions in the pulp and paper sector, all the current timber wastes will be fully utilized and plantation expansion will be necessary.

Already there are plans for production expansion as shown in Table 5 below. These expansions are meant mainly for the pulp and paper industry. Novel products would depend on waste volumes.

Table 5

PLANNED PLANTATION EXPANSIONS: 1989-1995 (ha)

Producer	Conifers	Wattle	Gum	Total
Forestry Commission	9 380	-1 104	1 250	9 526
Border Timbers	-	-	-	-
Wattle Company	800	300	1 500	2 600
TOTAL	10 180	-804	2 750	12 126

Source: Forestry Industry.

REVIEW OF ZIMBABWE'S COMMODITY TRADE POSITION

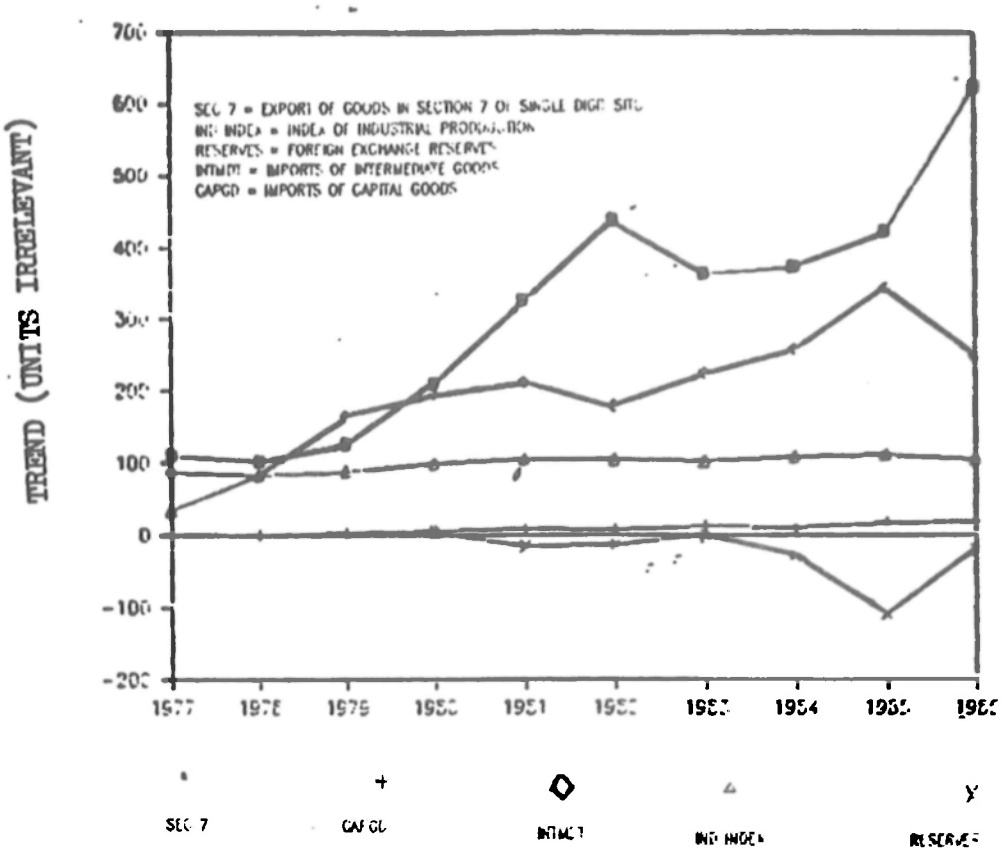
In this section we review Zimbabwe's position in international trade. Emphasis is placed on trade as it affects the country's ability to acquire technology and on trade in forestry products.

General External Trade Capability

Zimbabwe has had positive growth in the export of manufactured goods, indicating a relatively strong capability to acquire foreign currency on the basis of secondary goods exports rather than exports of primary high- volume low-value products. This position, as shown in Figure 3 below, is offset by imports of intermediate and capital goods. This results in a negative balance of payments position, again shown in Figure 3.

Figure 3

TRENDS IN SELECTED ECONOMIC INDICATORS



The schedule of capital goods imports is relatively flat and has a low volume of activity showing the difficulty the country has in importing technology necessary to match the increasing volume of industrial activity as indicated by the upward tendency in the index of industrial production (Figure 3).

Trade in Forestry Products

The bulk of the timber produced in Zimbabwe goes into products for domestic consumption. A significant amount is exported as shown in Table 6. Figures in Table 6 are offset by wood product imports shown in Table 7.

Table 6

DOMESTIC EXPORTS OF FORESTRY PRODUCTS 1980-87

YEAR	RAILWAY SLEEPERS (WOODEN)	POLES AND POSTS	PARQUET & OTHER LUMBER	WATTLE EXTRACT	PLYWOOD AND BOARDS	PAPER & PAPER BOARD
			CURRENCY DOLLARS (,OOO)			
1980	2 520	35	1 352	1 867	1 185	1 394
1981	029	78	1 077	2 992	807	1 120
1982	514	1 057	1 499	3 138	400	2 063
1983	1 674	454	2 368	2 200	734	4 606
1984	1 340	453	1 886	3 639	2 026	8 148
1985	1 481	615	1 514	5 704	931	7 682
1986	1 292	342	782	2 463	488	5 666
1987	1 602	854	4 217	6 126	1 059	9 844

Source: Central Statistics Office

Table 7

DOMESTIC IMPORTS OF FORESTRY PRODUCTS 1980-87

YEAR	RAILWAY SLEEPERS (WOODEN)	POLES & POSTS	PARQUET & OTHER LUMBER	WOOD PULP	PLYWOOD AND BOARDS	PAPER & PAPER BOARD
			CURRENCY DOLLARS (,000)			
1980	0.0	0.0	0.0	4 258	0.0	12 674
1981	0.0	0.0	0.0	5 233	0.0	16 645
1982	0.0	0.0	0.0	4 975	0.0	12 675
1983	0.0	0.0	0.0	3 867	0.0	12 571
1984	0.0	0.0	0.0	6 484	0.0	14 247
1985	0.0	0.0	0.0	8 219	0.0	18 435
1986	0.0	0.0	0.0	10 469	0.0	17 795
1987	0.0	0.0	0.0	12 195	0.0	22 338

Source: Central Statistical Office, Harare.

There are no imports of wattle products. Trade in forestry products is mainly with other states in the Southern African region as shown in Table 8. The table shows exports of forestry products by country by SITC category. As the table indicates, the greater part of trade is with Botswana and

Table 8

ZIMBABWE'S REGIONAL EXPORTS OF FORESTRY PRODUCTS

COUNTRY	COMMODITY	QUANTITITY	VALUE(ZWD)	YEAR
MOZAMBIQUE	-	-	-	1980
	247.9	181 cu.m	8 000	1984
	634.2	31 kg	496	
	245.02	140 172 cu.m	47 360	1985
	247.9	258 cu.m	15 534	
	248.31	4 cu.m	1 027	
	635.3	15 025 kg	31 368	
	635.919	0 kg	95	
	635.99	0 kg	1 253	
	247.9	59 cu.m	10 573	1987
	248.21	81 cu.m	17 445	
	248.31	181 cu.m	26 158	
	248.32	2 cu.m	797	
	634.2	40 kg	46	
	634.41	2 336 kg	7 394	
	634.42	4 259 kg	13 484	
	634.31	2 610 kg	2 481	
	247.11	1 cu.m	24	1988
	247.9	75 cu.m	3 208	
	248.21	17 cu.m	3 132	
	248.31	18 cu.m	16 509	
	248.1	3 316 cu.m	248 414	
	248.22	25 cu.m	7 770	
	248.32	19 cu.m	2 225	
	634.1	1 429 kg	5 264	
	634.2	4 kg	135	
	634.42	277 kg	1 985	
	634.31	6 002 kg	1 120	
	634.32	45 992 kg	15 603	

BOTSWANA	247.21	96 cu.m	4 295	1980
	247.9	1 732 cu.m	24 394	
	248.21	113 cu.m	8 891	
	248.1	93 cu.m	11 096	
	248.22	377 cu.m	37 896	
	248.32	11 cu.m	3 881	
	634.1	142 kg	229	
	634.2	26 070 kg	17 631	
	634.41	224 513 kg	118 089	
	63442	22 810 kg	14 015	
	634.32	93 980 kg	36 948	
	245.02	2 019 cu.m	1 000	1984
	247.11	355 cu.m	59 000	
	247.21	602 cu.m	13 000	
	247.9	3 364 cu.m	284 000	
	248.21	385 cu.m	59 000	
	248.31	3 041 cu.m	347 000	
	248.1	183 cu.m	44 000	
	248.22	3 112 cu.m	447 000	
	248.32	97 cu.m	4 000	
	634.1	88 kg	1 000	
	634.2	9 086 kg	18 000	
	634.41	203 074 kg	127 000	
	634.42	52 742 kg	42 000	
	634.43	100 kg	374	
	634.31	100 kg	111	
	634.32	130 758	53 000	
	247.9	2 235 cu.m	16 061	1985
	248.21	3 528 cu.m	490 507	
	248.31	1 096 cu.m	142 285	
	248.1	127 cu.m	21 243	
	248.22	14 cu.m	2 144	
	248.32	184 cu.m	4 544	
	634.1	642 kg	2 924	
	634.2	10 105 kg	18 917	
	634.41	81 811 kg	53 800	
	634.42	59 908 kg	30 657	
	634.32	44 893 kg	25 151	
	247.9	2 711 cu.m	327 538	1987
	248.21	8 534 cu.m	1 775 583	

	248.31	670 cu.m	104 768	
	248.1	112 cu.m	49 193	
	248.22	1 cu.m	265	
	248.32	52 cu.m	12 989	
	634.1	1 427 kg	1 918	
	634.2	62 724 kg	43 306	
	634.41	98 110 kg	87 180	
	634.42	87 590 kg	77 387	
	634.32	204 273 kg	128 658	
	247.9	1 772 cu.m	218 043	1988
	248.21	2 158 cu.m	509 908	
	248.31	67 cu.m	23 142	
	248.1	26 cu.m	40 448	
	248.22	4 082 cu.m	1 031 435	
	248.32	309 cu.m	87 550	
	634.1	1 353 kg	8 639	
	634.2	122 156 kg	151 893	
	634.32	330 505 kg	225 948	
MALAWI	248.32	66 cu.m	24 140	1980
	634.1	1 008 kg	1 965	
	634.2	20 255 kg	20 742	
	634.41	131 218 kg	71 558	
	634.1	400 kg	2 000	1984
	634.2	27 084 kg	24 000	
	634.41	248 006 kg	183 000	
	634.42	109 998 kg	80 000	
	634.32	18 795 kg	7 000	
	248.32	975 cu.m	1985	
	634.1	34 956 kg	16 862	
	634.2	47 507 kg	77 727	
	634.41	97 392 kg	71 907	
	634.42	85 386 kg	65 950	
	634.32	37 719 kg	18 868	
	248.32	12 cu.m	16 233	1987
	634.1	1 500 kg	17 204	
	634.2	20 500 kg	18 079	
	634.31	86 kg	472	
	634.32	6 kg	3	

	248.22	42 cu.m	8 671	1988
	634.1	6 289 kg	33 173	
	634.32	28 230 kg	10 989	
ZAMBIA	634.2	2 516 kg	1 083	1980
	634.41	4 136 kg	1 520	
	634.32	71 669 kg	28 136	
	248.22	41 cu.m	6 000	1984
	634.1	115 400 kg	77 000	
	634.2	87 807 kg	135 000	
	634.41	39 453 kg	31 000	
	634.32	13 093 kg	4 000	
	247.9	21 cu.m	104	1985
	248.31	4 cu.m	526	
	634.1	48 855 kg	40 512	
	634.2	50 kg	139	
	634.41	962 kg	1 208	
	634.32	384 kg	321	
	245.02	133 cu.m	134	1987
	248.22	5 cu.m	3 055	
	248.32	9 cu.m	5 959	

Source : 1986 Yearbook of International Trade Statistics Vol. 1

South Africa. Zimbabwe exports mostly unprocessed timber and imports mostly value-added products. This is typical of the country's foreign trade pattern across the rest of the economy.

Planned expansions, particularly in the pulp and paper subsector, have a more regional outlook and should enable Zimbabwe to exceed its own demand for paper and to export high-value forestry products to its neighbours.

REGIONAL OUTPUT OF FORESTRY PRODUCTS

The distribution of wood products activities in the region has a bearing on possible trade links in wood and wood products. Here we analyze the structure of such production for selected countries in Southern Africa.

The whole of Africa produces a wide variety of wood-based products including :

- wooden railway sleepers
- coniferous sawnwood
- Broad-leaved sawnwood
- Veneer sheets
- Plywood
- Particle board
- Wood pulp - dissolving grades
- Wood pulp - semi-chemical grades
- Newsprint
- Wood pulp - mechanical grades

Zimbabwe produces a small range of these products including particle board, plywood, veneer sheets, coniferous sawnwood, railway sleepers, wattle extracts, hardwood charcoal, industrial gas, pulp and paper. It does not produce broad-leaved sawnwood unless this refers to indigenous hardwoods such as teak and mahogany.

A regional picture on the distribution of forestry products activities is shown in Tables 9-1 through 9-9.

Table 9.1

PRODUCTION OF RAILWAY WOODEN SLEEPERS

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	344	360	312	305	288	349	340	330	330	330
N. America	388	306	530	564	731	663	566	474	474	474
EEC	570	502	540	544	574	562	475	409	361	351
Europe	1 747	1 751	1 606	1 624	1 699	1 460	1 336	1 324	1 266	1 229
Mozambique	80	80	11	11	11	14	6	4	4	4
S. Africa	9	14	19	10	13	13	17	17	17	17
Tanzania	1	0	0	0	0	0	0	0	0	0
Zimbabwe	14	20	18	20	24	20	15	7	7	7

Source: Industrial Year Book 1985 Vol. 11.
Commodity Production Statistics 1976-85
UN New York 1987

Table 9.2
PRODUCTION OF SAWNWOOD-CONIFEROUS

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	2000	1920	1855	1877	1919	2151	1903	1898	1921	1829
N. America	109135	120131	125338	124799	111754	100140	97499	119757	124377	127422
EEC	15783	16300	15881	16565	17088	16021	15595	16430	17198	17615
Europe	63070	64788	64846	69246	70374	65564	64838	67713	69 048	67629
Mozambique	0	0	0	0	3	4	4	5	12	8
S. Africa	1494	1395	1398	1385	1411	1581	1317	1363	1363	1276
Tanzania	20	2	2	2	1	0	0	0	0	0
Zimbabwe	80	128	106	112	148	164	164	110	123	123

Table 9.3
PRODUCTION OF VENEER SHEETS

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	292	358	391	435	525	514	488	517	522	543
N. America	488	486	507	497	489	497	493	487	483	483
EEC	828	805	822	854	854	824	667	774	812	789
Europe	1 553	1 515	1 463	1 470	1 501	1 532	1 481	1 566	1 631	1 606
Mozambique	1	1	1	1	1	1	1	1	1	1
S. Africa	22	41	53	75	72	73	70	70	70	70
Zimbabwe	0	0	1	3	1	3	4	4	3	3

Table 9.4
PRODUCTION OF PLYWOOD

Africa	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Total	404	424	462	478	514	525	569	569	573	593
N. America	19 382	20 897	20 123	19 933	17 833	18 758	15 369	19 497	20 177	21 157
EEC	1 613	1 548	1 461	1 566	1 614	1 531	1 346	1 259	1 323	1 333
Europe	3 779	3 899	3 567	3 676	3 589	3 441	3 271	3 071	3 183	3 462
Mozambique	6	3	1	1	1	3	2	1	0	0
S. Africa	23	18	21	29	28	29	27	27	27	27
Tanzania	2	3	4	4	3	3	2	2	2	2
Zimbabwe	5	15	15	16	12	12	13	10	9	9

Table 9.5
PRODUCTION OF PARTICLE BOARD

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	290	366	364	383	391	403	326	463	465	465
N. America	6 243	8 215	9 088	8 722	7 898	7 885	6 731	8 505	9 445	10 130
EEC	11 190	11 087	11 257	11 510	11 397	10 630	10 045	10 192	10 146	10 062
Europe	21 181	21 939	22 780	23 783	23 888	22 475	21 810	22 244	22 541	22 542
S. Africa	164	213	202	202	203	202	202	202	202	202
Tanzania	5	4	3	3	3	4	4	2	2	2
Zimbabwe	2	16	14	16	29	17	29	25	17	17

Table 9.6
PRODUCTION OF WOODPULP - MECHANICAL GRADES

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	209	201	188	171	220	272	335	297	170	276
N. America	11 276	11 355	11 869	11 509	11 730	12 510	11 513	12 448	13 865	13 678
EEC	2 267	2 303	2 425	2 525	2 512	2 401	2 285	2 322	2 576	2 535
Europe	7 702	7 850	8 435	9 102	9 234	9 190	8 695	9 124	10 322	10 437
S. Africa	194	185	170	152	200	250	313	273	148	255
Madagascar	3	4	4	4	4	4	4	5	5	4
Zimbabwe	12	12	14	15	16	18	18	19	17	17

Table 9.7
PRODUCTION OF WOODPULP-DISSOLVING GRADES

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	328	348	405	420	420	420	389	389	400	589
N. America	1 535	1 543	1 639	1 733	1 685	1 517	1 215	1 365	1 319	1 294
EEC	310	331	314	299	284	299	207	201	201	201
Europe	1 482	1 495	1 506	1 434	1 353	1 339	1 208	1 204	1 209	1 152
S. Africa	328	348	405	420	420	420	386	369	406	581

Table 9.8

WOODPULP-SEMI-CHEMICAL

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	77	128	117	93	94	92	114	93	129	137
N. America	3 513	3 525	3 949	4 549	3 994	3 894	3 608	3 799	4 051	3 940
EEC	637	559	505	500	493	445	421	445	446	488
Europe	1 666	1 591	1 603	1 631	1 631	1 524	1 456	1 483	1 528	1 619
S. Africa	71	122	108	82	82	82	105	84	117	126
Madagascar	2	2	2	2	2	2	2	2	2	1
Zimbawe	4	4	7	9	10	8	7	7	9	9

Table 9.9

PRODUCTION OF NEWSPRINT-PAPER JOURNAL

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Africa Total	229	271	230	245	247	249	322	260	320	345
N. America	11 229	11 411	12 064	12 248	12 923	13 780	12 767	13 286	14 132	14 020
EEC	1 558	1 552	1 605	1 749	1 785	1 576	1 455	1 463	1 713	1 795
Europe	4 916	5 094	5 574	6 092	6 267	6 392	5 680	5 884	6 784	6 839
S. Africa	212	251	212	226	226	226	300	240	301	325
Madagascar	4	4	4	4	4	4	4	1	1	1
Zimbabwe	12	12	13	14	16	18	17	18	17	18

Industrial Statistics Year Book 1985 Vol. 11.

Commodity Production Statistics 1976-85

UN. New York 1987

CURRENT STATE OF FORESTRY PRODUCTION TECHNOLOGY IN ZIMBABWE

All the four major forestry companies produce between them a narrow range of species: i.e wattle, pine and gum. Their production equipment tends to be relatively uniform for all stages of tree development from land preparation, planting, thinning, pruning and harvesting. Below we summarise some of these techniques and their applications.

Land Preparation and Planting Techniques

Land preparation in all the companies is at the moment restricted to replanting on previously cultivated land where initial land preparation was done many years ago for the previous crop. This activity is carried out mainly by the use of hoes for preparing holes for the seedlings.

Innovative thinking at this stage includes a departure from the traditional burning of slash which was believed to assist with the germination of seeds or was done for land clearing purposes. Two companies have already departed from the burning practice and now leave the slash on the ground to improve the humus condition of the soil.

The companies practising humus preservation against slash burning are aware of the germination advantages derived from the burning practice but they have consciously opted for humus preservation following observations in South Africa that the gains from humus preservation outweigh those associated with the better seed germination associated with slash burning. This change has also been accompanies by the development of better seedlings which develop satisfactorily on unburned soil. It appears that the rest of the major growers will adopt the humus preservation practice. It is worth noting here that the two companies taking the lead in this practice are the smaller members of the industry or they are those specialised in species which represent the minority contribution to the total volume of timber output. This is a passing observation which may have little statistical or inferential significance in terms of analyzing technological development in the forestry industry.

Those companies which do not practise humus preservation, as described above, do not hold any strong views against the practice. They only find themselves satisfied with the traditional practice.

On another aspect of land preparation, the inducement of mycorrhiza, all the four companies use the "soil transfer" method to bring in mycorrhiza from previously cropped areas to new sites which may be lacking in this bacterium.

The industry in general does not apply chemicals or fertilizers as part of land preparation. The environment is basically disease free at this and virtually all the other stages of tree development except for bugs which are a significant problem for wattle.

Conclusion

The industry uses no mechanized equipment at the land preparation stage. It does not need to use fertilizers or chemicals. Notable changes in the land preparation practice are in the sphere of biotechnology. The changes take the rudimentary but satisfactory form of soil transfers for mycorrhiza inducement and the abandonment of slash burning in favour of humus preservation. The latter innovation is borrowed mostly form experience in South Africa with respect to both humus preservation and improved seedlings.

Seedling Development

Virtually every grower of timber gets their seedlings from the Forestry Commission. The Commission also holds the largest seedling R&D facility under the Forestry Research Centre in Highlands, Harare.

Individually, the rest of the industry produces small quantities of seedlings. There are, however, interesting developments under these individual company efforts. One company has adopted a process called SPEEDLING in which seeds are germinated in an inert medium, consisting of composted pine bark held in a copper-lined styrofoam board. The inert medium, pine bark, has larger root space in the cavities formed by bark

sections. This allows for better root development. The copper-lined styrofoam causes root burn-out when the roots, mainly the tap root, get into contact with the copper lining. This enables better development of lateral roots needed to feed the seedling after transplantation. Again the company leading the adoption of this process concentrates on a minority species. Its source of information on this technology is mainly South African counterparts in the industry.

Conclusion

There is continuous R&D in the area of seedlings development. The leading technology in this area is in the form of the development of better seedlings based on stronger lateral roots. The source of the technology is mainly casual contacts with the forestry industry in South Africa.

Thinning, Pruning, Clear-felling

All thinning is done by simple tools. First thinning is done mostly by axe; second and third thinnings involve chainsaws and bowsaws for felling.

Pruning is done by the same type of equipment: axes, bowsaws and chainsaws. There are no deviations among the producers in this activity. There are no major innovations, known or being considered for thinning and pruning.

Clear-felling is mostly done by chainsaws.

Extraction and Field Transport

Generally, the industry uses skidders for field extraction of timber. One organization uses mules and donkeys for this purpose alongside skidders. In all cases, tractors are used for in-field transport. This is between extraction and the loading point for transport to sawmills or to other processing centres.

In one case, field extraction is done by the use of skylines. This is a new piece of equipment in Zimbabwe's forestry operations. Its main advantage, besides speeding up the operations, is the reduction of soil compaction which is characteristic of the old methods. The company which has installed this equipment is again one of the smaller ones in the industry. According to the company's management, the company received satisfactory cooperation from Government on this acquisition and concurrence between technical staff and top company management on the decision was easily realized.

Conclusion

There are no major innovations in the area of field transport and timber extraction. The small improvements that have taken place were achieved without difficulty both internally in the company and externally with Government.

The advantages of the skyline system have been realized by one company. It is not clear whether these are of a sufficient magnitude to enable adoption of the technology by the rest of the industry.

Pests and Disease Control

Disease has not been a major problem in Zimbabwe's forestry industry. Therefore, no specific measures exist for disease control. The same is true for pests. In general, the operations are pest free for pine and gum species. Wattle is occasionally infested with bugs. The effect of these is to stunt growth and deform the structure of the tree thereby reducing slightly its workability in bark extraction alongside reducing the tree's commercial value.

Where cutworm problems are anticipated, dieldrin is applied for cutworm control. Bugs are controlled by spraying with carbaryl.

Members of the industry all indicate that there is no need for biotechnology in the control of both bugs and cutworm.

Conclusion

Disease and pests are not an overriding problem in Zimbabwe's forestry sector. In the few cases that disease and pests appear, the damage to the crop is of little financial significance. Present methods of control are based on proven chemicals and the need for biotechnological control is at present non-existent

CURRENT STATE OF TIMBER CONVERSION TECHNOLOGY IN ZIMBABWE

Primary Timber Conversion Technology

Primary timber conversion technology in the Zimbabwe forestry industry includes four types of activities, i.e.:

- Sawmilling to produce sawlogs, poles, roughsawn timber and to extract bark from wattle for the production of tannin.
- Production of particle board from plantation timber and from wood chips.
- Milling of plantation wood to pulp.
- Conversion of wood to charcoal.

Three of the timber producers run sawmill operations. The fourth one does not operate sawmills as its product is tannin and mining poles only. This company is, however, considering setting up a sawmill facility as it is expanding operations to produce timber and sawlogs for construction and for paper mill feedstock. No decision has yet been taken on the type of sawmill to be purchased for these future operations.

Those companies currently running sawmill operations have among them three types of sawmills, i.e:

- Kara mobile units
- Linkframe saws; and
- Circular saws

The Kara mobile units are used at smaller operations and have a production capacity of 10 m^3/day. One of these was supplied to a Government-affiliated timber producer under Finnish aid in 1986. The linkframe units run by the bigger producers are over 20 years old and have a capacity range of 60 m^3/day for the smallest unit to 500m3/day for the largest unit. Capacity estimates for the smaller units are affected by feedstock supply. It was not possible to determine design capacities.

All sawmill operations use manual log alignment and have a high labour intensity. None has computer-assisted operations. It was also not possible to determine either the design life or economic life for any of the sawmills. Industry experts, however, are convinced that most of the machines in the field can run for up to 40 years.

In all cases, there were no significant complaints related to unscheduled downtimes for the mills.

Conclusion

There is no present application of any of the ETs at the sawmill level. The industry appear cautious in advancing to ETs in this area of their operations mostly because:

- The present set-up enables them to meet market demand and does not expose their production to international price or technological shocks.

- The current set-up is considered robust and care is taken not tc upset it unduly.
- ETs may involve foreign inputs into the production system and may entail the production of goods for foreign market, which are difficult to secure..
- Excessive foreign composition of technology may lead to greater vulnerability to external shocks.
- Producing products for foreign markets, which the companies may be forced to do if they adopt ETs which are designed for precision products, may mean greater dependency on foreign markets for the precision products. In any case, these foreign markets may not be guaranteed particularly in the face of growing protectionism in Europe, the only reliable market for such products.
- There are known difficulties with the indigenization of imported technology, particularly high technology. In the absence of complete or effective indigenization, imported technology can easily become a constraining rather than an enhancing factor in production.

The industry is aware of these implications of ETs and, naturally, take a rather cautious approach to their adoption.

Secondary Timber Conversion Technology

Secondary timber conversion takes three major forms:

- Conversion of pulp to paper.
- The conversion of wattle bark into tannin.
- The conversion of charcoal into industrial gas.
- Production of household and industrial timber products.

Milling of Logs to Produce Pulp and Paper

There are two pulp and paper companies in Zimbabwe with a third one (Zimbabwe Pulp and Paper Company) at an advanced planning stage. The two current pulp and paper producing companies are Mutare Board and Paper Mills in Mutare, and Hunyani Pulp and Paper Company in Norton.

The study was only able to detail the operations of Mutare Board and Paper Mills. Only passing reference will be made on the Hunyani Pulp and Paper Company.

Operations of Mutare Board and Paper Mills

Mutare Board and Paper Mills produce mechanical pulp and paper. The company's grinders can take logs of 70 mm to 325 mm in diameter. The plant is currently running at 100% capacity and at this capacity factor it consumes some 60 000 m^3 per year of plantation timber. This feedstock can be supplied 100% by Mutare Board's own plantation wood. The company, however, buys thinnings from other producers, mostly Border Timbers and the Forestry Commission. Mutare Board and Paper Mills and

Zimboard, a particle board producer, are the only two companies capable of taking sawmill and plantation refuse from the sawlog producing industry. Zimboard does not run forestry operations. Its 30 000 m^3 a year timber intake is supplied mainly from thinnings and clear-felling products from Wattle Company, Border Timbers, and from the Forestry Commission.

Pulpwood specifications for the whole of the pulp and paper industry are shown in Table 10 below.

Table 10

PULPWOOD SPECIFICATIONS

	Top Diameter (cm)	Length (m)
Mutare Board	7.5	2.1
Hunyani Pulp and Paper	10.16 - 15.24	2.23
Zimbabwe Pulp & Paper	10	2.5

These specifications and the fact that Mutare Board and Paper Mills and Zimboard can take all sizes of refuse make timber specifications a non-constraint in the mill intake. For this reason, pulp and particle board producers do not concern themselves with the output quality of the timber producers and thus do not seek to liaise with them in this regard.

Pulp and paper producers could be more creative with respect to technology transitions. This creativeness is, however, limited by very complex market arrangements whose net effect is to deny the industry adequate returns from ET-related ventures.

Mutare Board, for example, currently sell paper products at below breakeven point. This is Z$929,44/tonne against a cost factor of Z$1 261/tonne. The company has to negotiate with Government for a price adjustment even in the face of current prices which are below cost. So far the company has failed to obtain the breakeven price from Government. Even if this were obtained, the company would still need to effect a 30% mark-up on the cost factor to realize a profit margin. This would bring the price/tonne of paper to Z$1 639,30.

The price CIF South Africa is Z$1 990/tonne and CIF Scandinavia is Z$2 293/tonne for the same or similar product imported into Zimbabwe.

Production costs plus mark-up, i.e. prices FOB for both South Africa and Scandinavia are, however, lower than the Zimbabwean (Mutare Board) price of Z$1 639,30/tonne.

Our comparison, of course, has to be based on landed prices.

The prices on the export market for Zimbabwean products are much better than the current local prices. The products can fetch US$560 - US$700/tonne, i.e. Z$1 250,00 to Z$1 562.50 at the present exchange rate of 1:0.448 USD : ZWD on the export market.

The prices currently obtained by the pulp and paper industry are thus much lower than international prices both for exports and for imports. This price suppression effect of Government's price control mechanism makes it difficult for companies to take risks with new production systems as they have neither the capital to invest in ETs nor the

guarantees on return on investment from such equipment or technology should they be adventurous enough to engage some.

Besides these constraints, companies have remained positive in their view toward technological advances in their industry and in some instances have attempted to engage some ETs.

Mutare Board and Paper Mills have, with these constraints, managed to take a creative approach to production systems development. They are currently on a plant refurbishing programme costing some Z$16 million. This is being done parallel with price negotiations between Government and Mutare Board in the hope that these developments will be paid for through price adjustments. Most of the work being done under this programme is to maintain current activity levels without expansion.

The company has also begun to slowly install a computerised system for controlling the fibre/water ratio in pulp. This system, which is a refurbishment of the current 30-year-old mechanical grinders, would in fact be a computer-controlled pulp consistency and quality control system in which pulp/water ratio sensors will send readouts to a computer which in turn will switch water jets on and off in accordance with pre-set parameters.

The company currently has IBM and Wang machines used mainly in management as data analysis and word processing systems.

COMPUTERS AND THE COMMERCIAL FORESTRY INDUSTRY IN ZIMBABWE

Computer Application in Production

Currently, there is no application of computer systems on production lines in the form of numerically controlled machine tools (NCMTs) or computer-assisted design (CAD) and computer-aided manufacturing (CAM). There is no electronic scanning, sorting and packaging or machine stress rating in the industry.

The furthest industry has come in this regard is represented by the Mutare Board and Paper Mills system described above.

The rest of the industry, particularly the timber producing section, has no need for computer-assisted design but may have applications for computer-aided manufacturing particularly at the sawmill level. The current operations are labour-intensive and basically manually controlled and the products from these operations seem to satisfy market requirements and specifications.

The advantages of better product sorting and higher recovery rates brought about by ETs do not particularly appeal to the industry since sawmill wastes (except for sawdust) are absorbed by the pulp and particle board factories. Moreover, the industry at the moment is saturated with timber even in the face of a very active construction sector. Investment in timber optimization equipment is, at the moment, not very appealing to industry even in the face of large planned expansion in the pulp and paper industry. This expansion is already catered for by complementing expansions in timber plantations.

The industry, despite these constraints to transition into ET-assisted production, keeps very much abreast of technology mainly through journals and inter-industry contacts.

High-speed sanders have had application in a factory for board products run by Border Timbers. Their application is, however, not widespread.

Laminated beams are produced by Gluelam, a company jointly owned by Border Timbers and Plate Glass Industries (through its PG Timbers subsidiary).

There should be room, however, for the use of NCMTs in the high-speed kilns particularly to ensure product consistency which at the moment is difficult to ensure.

The current drying system across the sector uses low-speed kilns which require 48 hours to dry a batch of timber. The Forestry Commission has installed one high-speed kiln which reduces drying time by a maximum of 24 hours. This is a relatively more sophisticated type of kiln capable of temperature programming and automatic temperature adjustment. The Commission, however, has to date not managed to fully utilise this German-supplied kiln due mainly to lack of operating experience.

Use of Computers in Management

All four major timber producers have computer facilities in the form of mainframes or personal computers. In three companies, the major application of computers is in data base management for financial and operations planning and management.

Operations data bases basically contain information on block histories of plantations, output, cost, and sales activities. These data are used mainly for stock control, harvesting and thinning schedules and annual planning.

The other applications are mostly in financial planning, budget control, and personnel administration including salaries and wages. Word processing is a minor application of computers in all the companies. Typewriters are still widely used although, in general, most secretaries are conversant with some word processing packages.

The most common machines in the industry are IBMs and Wangs.

Software development is mainly in-house, with the assistance of computer and software houses.

The Forestry Commission currently has a major computerisation project to include the installation of two IBM minis each with about six terminals. Initially these machines will be used primarily for financial management at the head office and at the Mutare regional management office. Other applications are expected to develop once the financial application has been successfully installed and resources permit. The Commission is aware of the advantages of the use of computers in its operations. The decision to install a financial management system first was just a matter of prioritization.

Generally, companies have a high degree of computer literacy albeit vested in very few members of staff. Staff with computer capability are mostly those with formal training in older generation systems now converted to work with fourth generation systems. There appears to be very close cooperation under consultancy arrangements between the forestry industry and the computer industry, particularly in the area of software training and software development with the computer industry providing its services mostly on a consultancy basis.

Among members of the industry, this cooperation is very minimal in formal terms, but because of the small size of the industry members end up basically informed about the activities and advancements of their counterparts. There is also significant collaboration with South African producers among some members of the industry.

In all cases, data computerisation is done at head office. Plantation centres send in hard copy entries to head office for capturing. The results of computer analysis are basically for use at head office. The set-up would differ in the case of the Forestry Commission which will have two independent systems installed, one at head office and the other at the commercial forestry headquarters in Mutare. Even in this case there will be no computerisation at plantation level. This will still be restricted to top management operations.

PART II

REVIEW OF THE COMMERCIAL FORESTRY INDUSTRY IN BOTSWANA

Organisation

Botswana does not have a timber growing industry based, as is the case in Zimbabwe, on commercial silvicultural activities. The country's forestry industry is based on commercial felling of indigenous wood which is left to natural regeneration.

Botswana is basically a very low rainfall country (see Figure 4) and as such has very poor forest resources. The distribution of these reserves is shown in Figure 5. Major commercial tree felling activities are limited to the north- eastern regions of Chobe and Kasane.

Fig. 4

RAINFALL PATTERNS OF BOTSWANA

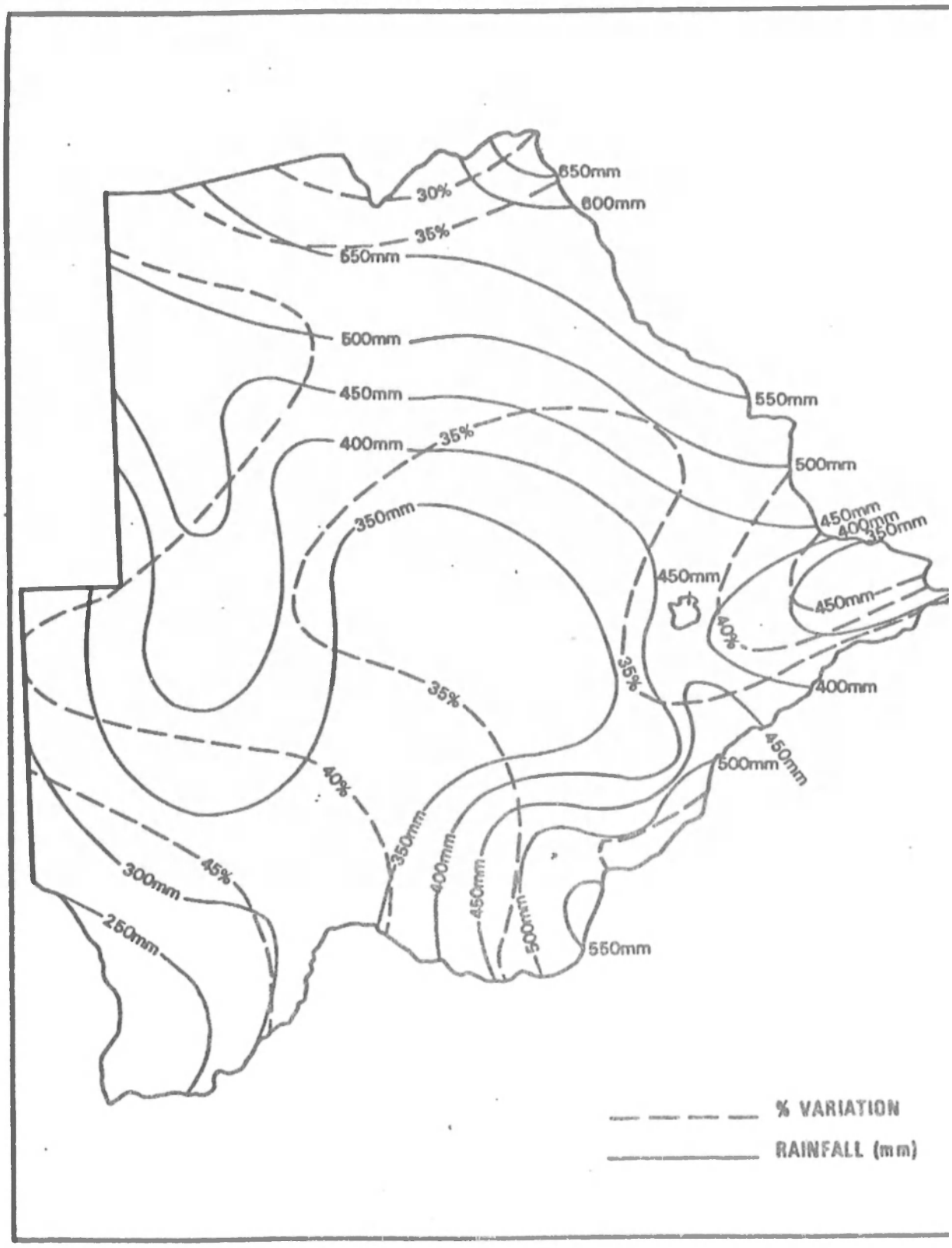
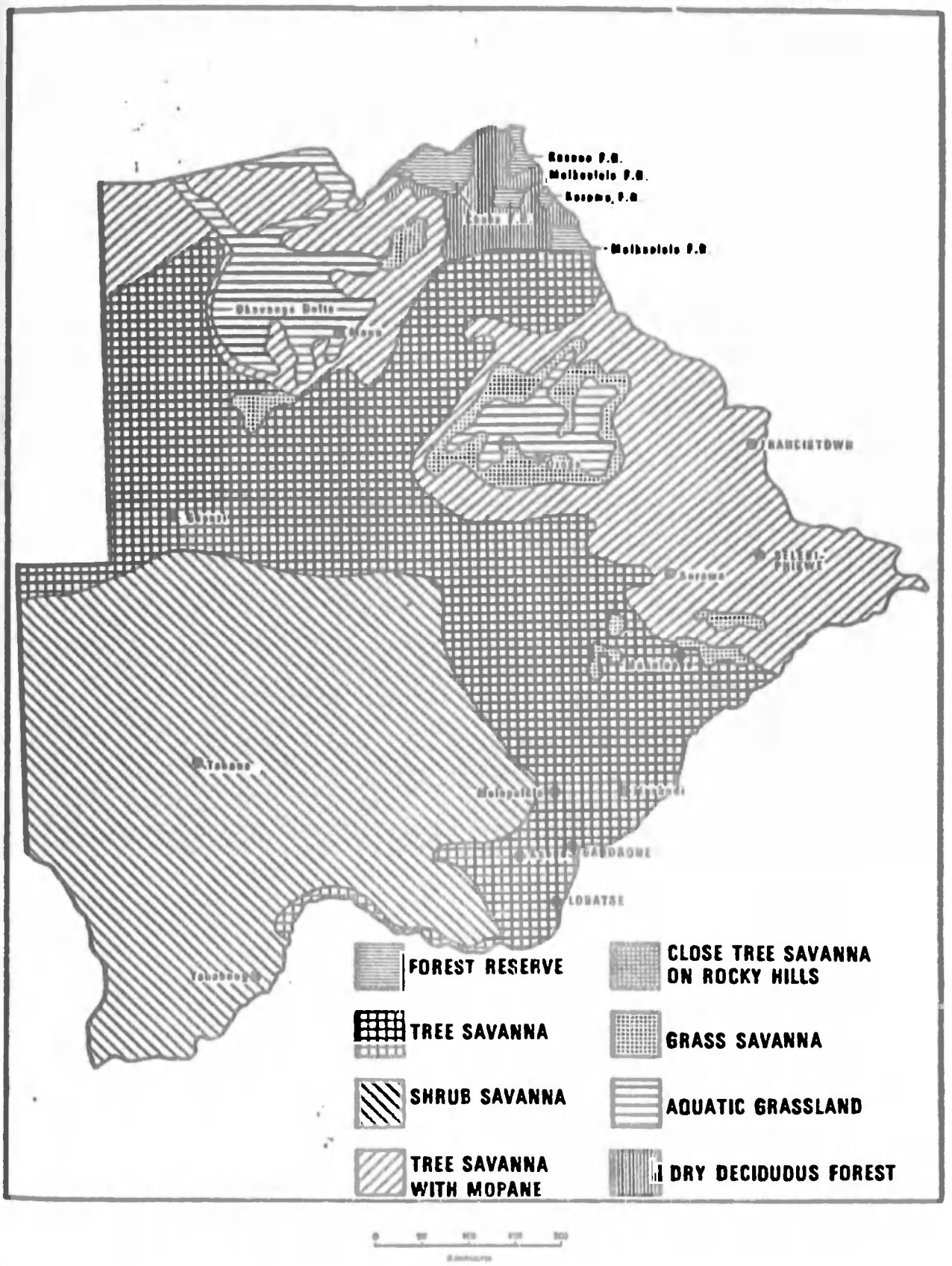


Fig. 5

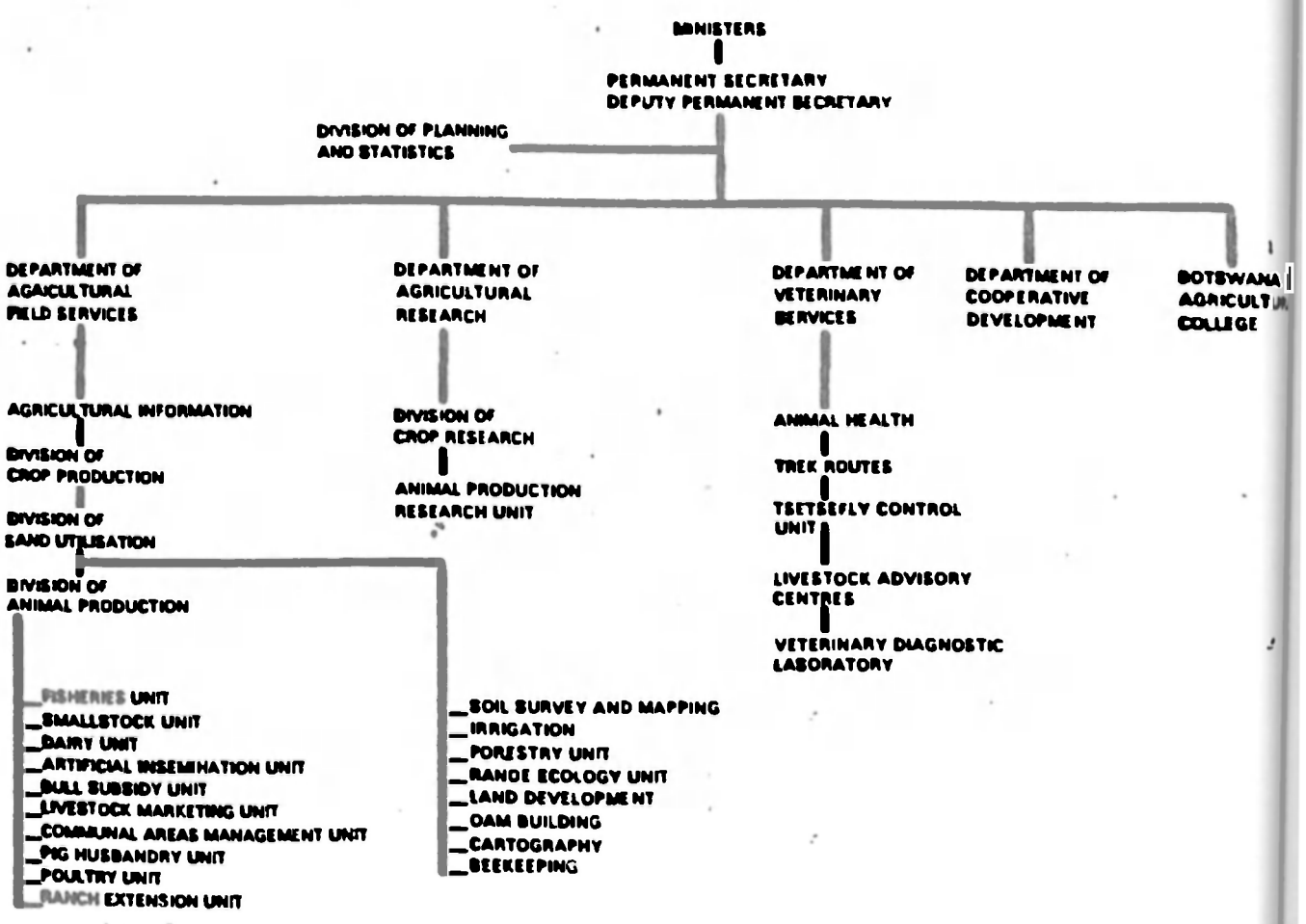
BOTSWANA'S FOREST RESERVES AND VEGETATION PATTERNS



Here two private companies, The Chobe Forest Industries and Exotic Timber, conduct harvesting and sawmilling activities under concessions obtained from government through the Ministry of Agriculture, the department of government responsible for forestry resources. (The general structure of this ministry is shown in Figure 6.) The management of forestry activities is limited to a small unit in this ministry.

Fig. 6

STRUCTURE OF MINISTRY OF AGRICULTURE : BOTSWANA GOVERNMENT



Source: Government of Botswana, National Development Plan 1985-91. December 1985, Government Printers, Gaborone.

This unit is concerned mainly with rural woodlot development activities. (No major large-scale commercial forestry plantations are planned). Its role, however, includes the monitoring of felling activities in Chobe and Kasane.

The CFI concession, which was granted in 1983, stipulates a minimum and maximum mill output of 7 500 m^3 and 20 000 m^3 per year respectively.

The Exotic Timber concession started operating in 1985 and is much smaller at (2 500 m^3 per year only) compared to the operations of CFI.

Both these operations take place in the Chobe and Kasane forest reserves. Logging rights were granted for 10 years only. In the opinion of CFI, extending the concessions would not be difficul of input timbert.

The present concession agreements for these areas require that only timber of a minimum diameter of 35 cm for Makusi, and 30 cm for Mukwa be felled. Thirty centimetres is thus the minimum input diameter for the sawmill. The maximum is 60 cm. In these operations only the stem of the tree is used as sawmill feedstock. The rest of the tree sections are left in the forest. This allows recovery rates of 50% for Mukwa and 45% for Mukusi and Teak. These rates are further reduced by sawmill losses which are as high as 55% of input timber.

Resource Estimates for Botswana

Woodland in Botswana is classified into nine classes with "dense woodland" holding the largest volumes per unit area and "salt pans" holding very little or no woody vegetation.

Dense woodland is restricted to the extreme north of the country, mainly in Chobe and Ngamiland and extends over some 33 360 km^2 or 5,73% of Botswana's land area.

The Chobe and Ngamiland districts together hold 42% of growing stock and 32% of MAI volumes of dense woodland timber. Chobe forests alone comprise some 188 000 ha.

Review of Botswana's Commodity Trade Position

Botswana's external trade position is at the moment very strong. Selected indicators on trade: balance of payments, terms of trade and exchange rate (Table 11) show a very healthy situation for Botswana.

Table 11

SELECTED EXTERNAL TRADE INDICATORS - BOTSWANA

	1978	1980	1982	1984	1990
BOP (P million)	33.00	72.00	57.00	161.00	NA
Exchange Rate - Rand	1.05	1.02	1.05	1.10	NA
Exchange Rate - USD	1.20	1.25	1.10	0.90	NA

Source: Botswana Fourth Five-Year National Development Plan.

The BOP position was strong in 1984 and is even stronger now with Botswana holding foreign reserves in excess of $4 billion. The pula has remained quite stable over the years despite Botswana's almost total dependence on South Africa for consumer goods and equipment.

This is also in the face of Botswana's very heavy reliance on primary commodities: beef, diamonds and copper-nickel for exports. The country's terms of trade have, contrary to this positive economic atmosphere, deteriorated from 100 in 1977 to 65,5 in 1983. More recent figures on terms of trade were not available. It is unlikely, however, that the terms of trade position would have increased meaningfully in the few years after 1983 as Botswana's economic activity continues to be led by the extractive and agricultural industries. Table 12 below gives data on sectoral contributions to GDP for 1985 and estimates for 1990.

Table 12

GDP CONTRIBUTION BY SECTOR - BOTSWANA

Sector	1985	1990 Projections
	Share of GDP %	
Agriculture	6.9	7.4
Mining	31.3	29.5
Manufacturing	7.4	8.8
Electricity & Water	3.4	3.9
Construction	4.4	4.2
Transport & Comms	2.8	2.8
Finance	4.2	4.3
Services	3.6	3.7
Government	15.5	15.8

Source: Central Statistical Office - Botswana

While Botswana is heavily dependent on primary commodities for export earnings and is suffering negative terms of trade, the country is in an excellent position to import equipment and capital goods as well as to finance major development projects. It is unlikely, however, that any such projects would be in forestry as the rainfall regimes and climate are quite restrictive in this regard.

Botswana's Trade in Forestry Products

Botswana does not export industrial wood products beyond the few thousand tonnes of Mukwa and Teak exported to Zimbabwe and South Africa (see "Review of CFI Operations" below). Its role in the forestry industrial products trade is mainly as an importer. Its major trading partners in this regard are Zimbabwe and South Africa. The two countries supply the bulk of Botswana's requirements in timber and timber products. Its imports from Zimbabwe are listed in Table 13 by SITC. Data were not available for imports from South Africa.

Table 13

LISTING OF BOTSWANA'S TIMBER PRODUCTS IMPORTS FROM ZIMBABWE

Year	Commodity (by SITC)	Quantity	Value (Z$)
1980	247.21	96 cu.m	4 295
	247.90	1 732 cu.m	24 394
	248.21	113 cu.m	8 891
	248.10	93 cu.m	11 096
	248.22	377 cu.m	37 896
	248.32	11 cu.m	3 881
	634.10	142 kg	229
	634.20	26 070 kg	17 631
	634.41	224 513 kg	118 089
	634.42	22 810 kg	14 015
	634.32	93 980 kg	36 948
1984	245.02	2 019 cu.m	1 000
	247.11	355 cu.m	59 000
	247.21	602 cu.m	13 000
	247.90	3 364 cu.m	284 000
	248.21	385 cu.m	59 000
	248.31	3 041 cu.m	347 000
	248.10	183 cu.m	44 000
	248.22	3 112 cu.m	447 000
	248.32	97 cu.m	4 000
	634.10	88 kg	1 000
	634.20	9 086 kg	18 000
	634.41	203 074 kg	127 000
	634.42	52 742 kg	42 000
	634.43	100 kg	374
	634.31	100 kg	111
	634.32	130 758 kg	53 000
1985	247.90	2 235 cu.m	16 061
	248.21	3 528 cu.m	490 507
	248.31	1 096 cu.m	142 200
	248.10	127 cu.m	21 243
	248.22	14 cu.m	2 144
	248.32	184 cu.m	4 544
	634.1	642 kg	2 924
	634.2	10 105 kg	18 917

	634.41	81 811 kg	53 800
	634.42	59 908 kg	30 657
	634.32	44 893 kg	25 151
1987	247.90	2 711 cu.m	327 538
	248.21	8 534 cu.m	1 775 583
	248.31	670 cu.m	104 768
	248.10	112 cu.m	49 193
	248.22	1 cu.m	265
	248.32	52 cu.m	12 989
	634.10	1 427 kg	1 918
	634.20	62 724 kg	43 306
	634.41	98 110 kg	87 180
	634.42	87 590 kg	77 387
	634.32	204 273 kg	128 658
1988	248.90	1 772 cu.m	218 043
	248.21	2 158 cu.m	509 908
	248.31	67 cu.m	23 142
	248.10	26 cu.m	40 448
	248.22	4 082 cu.m	1 031 435
	248.32	309 cu.m	87 550
	634.10	1 353 kg	8 639
	634.20	122 156 kg	151 893
	634.32	330 505 kg	225 948

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It is likely that the South African portion of trade is greater than the Zimbabwe share and consists more of finished high-value products than those included in trade with Zimbabwe.

REVIEW OF CFI OPERATIONS

Chobe Forest Industries (CFI) fells mainly Mukwa, which represents 55% of their product, and Teak which is about 43% of total product. About 2% comprises other species, mainly Mukusi and Ngongo.

As stated earlier, CFI has a stipulated 30 cm minimum felling diameter. Its sawmills have a 60 cm maximum log diameter. Almost all of CFI products are milled on site at Chobe. These products include sawlogs, railway sleepers, slices, pillars and roughsawn timber.

Mukwa products are used mainly for furniture and are shipped 60% to Zimbabwe, 20% to South Africa, and 20% to Botswana.

Teak products are used mainly for railway sleepers as teak wood is considered too hard for furniture. These products are shipped 80% to South Africa and 20% to Zimbabwe.

Future Plans for CFI

CFI strongly wish to expand their activities in the production of pillars and slices. In this venture they would seek the cooperation of companies currently producing slices and pillars from CFI sawlogs. The production of pillars and slices will represent an expansion in the present activities and therefore an expansion of timber harvesting volumes. There are no exact figures on the expected volume required for this expansion.

Review of CFI Equipment

The current CFI sawmill has a capacity of 80 m^3 a day. The mill was built by CFI themselves in 1982. The plant currently runs at a capacity of 60% with forced downtimes constituting 40% of total time. These stoppages are mainly due to delays in bringing in spares as Chobe is located in a remote area. There are no computer applications or any other sophisticated technology at CFI. Whatever improvement they may institute, CFI are cautious not to become too sophisticated but to remain simple. This caution is mainly due to the remoteness of their operations and the perceived difficulty associated with bringing in foreign experts to repair equipment of a sophisticated nature.

Field equipment is limited to chainsaws, tractors and trucks for felling and transporting logs to the mill. CFI feel that their present technology is adequate.

With respect to forest management technology, both CFI and the government of Botswana do not apply any management system on the Chobe concession. Trees are felled and left to natural regeneration. There is no disease control even in the face of "Mukwa Decline". This disease, in any case, has no control even at the international level.

General Awareness of ETs at CFI

The management of CFI have a strong appreciation of ETs. Their particular interest is in wood products gasification to produce fuel for a sawmill engine and for power generation. Such a system would have effective application in remote sawmilling operations located far from power grids. A pilot project in Tanzania under CARMATEC has shown plausible technical feasibility for a similar technology. The technical economics of the system have, however, yet to be proved. CFI have kept close contact with developments in this technology.

They have also attempted to produce charcoal from sawmill wastes but have since discontinued the effort after a cooperating partner had abandoned the charcoal project. The arrangement had been for CFI to supply sawmill wastes to a third party for charcoal production. The trials went well in technical terms and the product was competitive in its physical parameters with charcoal from South Africa.

CFI are generally aware of most of the ET's introduced to them. They are, however, satisfied with their present technological set-up for both production and information systems. They have, however, kept an eye open for the producer gas and technology. Conditions pemitting, it would also be possible to rekindle CFI interest in charcoal

production for the Zimbabwean market. This interest would, of course, have to be sustained by market interest.

This aspect of the problem was the subject of a recent World Bank study conducted with respect to charcoal utilization in the ferrochrome, gasification, and food and drink industries in Zimbabwe. The findings of this report were that a market existed for hardwood charcoal but that it required formalization through a pilot project in the ferrochrome industry and in the utility of wood-based activated carbon as a filtering agent for juices and for liquid sugar.

Successful use of hardwood charcoal in these areas would very much reduce field and sawmill wastes for CFI and perhaps open them up to related ETs.

As it stands, the situation indicates little scope for ETs in general. Application could, however, be found in disease control and in improving the regeneration management method for indigenous trees. This may be an area for biotechnology, particularly the use of microbial insecticides and mycorrhizal fungi.

At the sawmill level, ETs in the form of high-speed sanders, machine matching of lumber, finger-jointing and lamination should find application and reduce losses at this point.

Of course, all these are identified as possible areas of ET application. Actual application will require a detailed assessment of field operations and of the market for the improved products.

Doing this may not be overly difficult except that the small-scale operations of CFI and Exotic Timber may not lend themselves effectively to such improvements. It must be possible, however, to view such developments in a global perspective for Zimbabwe and Botswana indigenous timber operations in order to benefit from economies of scale.

PART III

TECHNOLOGICAL INNOVATIVENESS - BOTSWANA AND ZIMBABWE

The general situation in technological innovativeness is not very bright. In both countries R&D activities are very low despite positive government pronouncements on local R&D activities. In Zimbabwe R&D is concentrated more on agriculture and medical research. There is very little activity in industrial research. Botswana has very limited R&D facilities. The little work it is doing concentrates more on solar energy systems and rural technology.

A review of patent records held at ARIPO (African Regional Industrial Property Organization) indicated that there were only seven applications to patent technology in the area of forestry, while the field of mechanical engineering received 243 applications, and biochemestry received 238 in the same period. In these three categories, foreign applications were much greater than local ones. In the paper industry technology category, only two of the seven applications received were local. Biochemistry and mechanical engineering had 18 and 58 local applications respectively.

This low level activity in local patent filings indicates limited creative activity in S&T areas which bear upon technological innovativeness in the timber and timber products industry.

If this trend continues, it would be fair to say that most of the S&T innovations to benefit forestry would be expected to come from outside Zimbabwe, Botswana and perhaps the SADCC region as a whole. Hence the linkage between foreign exchange capabilities and adaptation or acquisition of forestry-related S&T becomes even more paramount. Alternatively, the option of setting up production facilities in SADCC for forestry technology assumes greater significance.

Environmental Considerations

In all cases there were no major environmental degradation problems associated with the use of current technology or with the current production systems at the plantation, primary conversion, and secondary conversion levels. There was consideration, of the industry however, with regard to the fact that most of the indigenous trees are leguminous species and have habitat and forage relevance to indigenous game. This attribute is generally absent in plantation species. Hence plantation expansion on the basis of current exotic species would carry with it this environmental drawback.

In terms of industrial activities, waste and effluent do not appear to be of major environmental concern to either the industry or the respective governments. Chemical application in timber production is minimal. Chemical pollution is, therefore, not a significant problem.

The above assessments are based on the present production systems and technology. It is not clear how the use of ETs will affect the environment.

Employment Levels

The industry in total employs an estimated 7 712 people in Zimbabwe in timber production activities alone. This figure excludes people employed in the secondary timber conversion subsector. Typically, the timber production sector employs about half of its field labour as casuals working for periods of up to eight months in a year. The rest are employed as full-time labour or as company staff in the areas of management and administration. Typically, a company with about 1 500 full-time employees would have about 250 people categorized as staff.

CONCLUSIONS

The use of ETs in the forestry industry is non-existent at present. There is, however, significant use of computers in planning and management. Generally, the enthusiasm exists for ETs but this is constrained by caution and cost recovery limitations imposed by government. There is greater room for the expansion of computer applications in planning and management. The use of computers in NCMTs, scanning, or sorting will remain at bay for some time into the future.

Technology Acquisition Policies and Processes in the Industry

In general, all the four major timber producers have an open mind towards technological advancement. They keep an eye open for technological developments mostly by following journal publications, research findings, and through direct contacts with the rest of the forestry industry in the world.

The industry, despite this open-mindedness, is notably cautious in adopting new technologies. This is because of three basic reasons:

- The industry seeks to avoid dependency on foreign technology in their production systems, particularly if this technology is new and cannot be serviced locally.
- The industry is very careful to maintain the existing matching of its products to the local market and is cautious not to engage in products marketable only abroad, particularly if these foreign markets are difficult to maintain.
- The industry lacks foreign capital with which to acquire and maintain the ETs that they may use in production.

For these reasons, the positive attitude towards ETs has not been translated into a major drive for ETs except in one pulp and paper factory where NCMTs are gradually being introduced.

The technology acquisition process generally begins with technical staff initiative and gets the approval of management which in turn approaches Government for foreign currency to acquire the necessary equipment or technology.

In all these stages, this study has found no major drawbacks on decisions to adopt the required technology. Rapport is generally good between technical staff and

management and so far Government approval for essential technology has been forthcoming.

Problems and constraints have been experienced, however, in other areas of Government control of industry, particularly the instrument of price control. The price suppression or moderation effect of this instrument has created a situation where companies are not guaranteed a satisfactory return on new investment and have thus resorted to adopting only that equipment necessary to maintain present operations.

The purchase of equipment or new technology in all cases rests with the management of the company. No company refers to a foreign MNC or to a local mother company or to Government (in the case of parastatals) on decisions to adopt new technology.[3]

For the private sector companies and for the Forestry Commission, it does not help, as it were, to be a subsidiary of or to be associated with a major MNC or the Government on issues relating to access to technology or to the financing of technological acquisitions. In the case of Border Timbers, a subsidiary of Anglo American, and in the case of Wattle Company, a subsidiary of Lonrho, the mother company does not assist with such technological issues. In any case, the forestry companies here are the only forestry operators within the large conglomerates in Zimbabwe and thus have some monopoly on forestry know-how within the company. They can, therefore, not obtain any specialized help on forestry from parent MNCs.

The same applies to the Forestry Commission. For all the forestry operators, however, it is possible to benefit from aid protocols or loan protocols signed between the Zimbabwe government and foreign governments.

For example, the Kara Mobile Sawmill at the Zimbabwe College of Forestry was acquired through Finnish aid.

There was no evidence of large-scale utilization of this form of technology acquisition, however. Essentially, the companies rely on their own technology acquisition efforts.

3 Such references only occur on issues of major expansions of investments.

APPENDICES

Appendix 1

OVERVIEW OF EMERGING TECHNOLOGIES FOR THE FORESTRY INDUSTRY

New technologies for application in forestry production have been developed over the past few years. These are in the areas of:

- Feedstock Supply
- Mechanized Silviculture
- Computer Integrated Process Systems
- Solid Products
- Biotechnology Applications

Technologies in these categories are either novel, newly introduced or proven. Because of its financial limitations and its limited capacity to afford the risks of trying novel technologies, the forestry industry here is better off concentrating on those newly introduced technologies which are already commercially proven.

There are some commercially proven new technologies in the areas of:

- Timber Harvesting and Transportation
- Sawmilling
- Information Technology
- Biotechnology - genetic tree improvement

Relevant developments in these areas are discussed briefly below.

Sawmilling Technology

This is a broad category of technological advancement with application in the sawmilling process including log selection, bucking, sorting, packaging, drying, planning, timber grading, the enhancement of sawmill products by finger-jointing, lamination of veneer timber, and edge-gluing and resawing of otherwise low-grade timber sections.

All these new processes enable the optimization of timber value, the handling of smaller-sized and lower quality logs, the reduction of labour costs, and the improvement of timber recovery.

Specific advances in this area include:

- the use of electronic scanners to check timber length, tapper and straightness at the log-deck.
- computer automation of the barking process by making use of data acquired at the log-deck.
- the use of sensors to measure each log for computerised direction to appropriate batch sections before sawmilling by computer-controlled equipment to provide the optimum value of lumber.
- computer-controlled sorting and packaging of sawn products.

- the use of high-speed sanders instead of knives to ensure a better "planning finish".
- the grading of lumber on the basis of compression and strength instead of grading on the basis of visible characteristics and machine-stress rating of lumber which classifies products by stiffness and strength after rating for modules of elasticity and fibre stress in bending.
- machine-matching of pieces of lumber with defective sections removed, thus enabling utilization of otherwise defective lumber which would otherwise be wasted. New advances are in the finger-jointing of bad sections.
- lamination of reconstituted veneer sheets (laminated veneer lumber) and sawmilling to desired thickness. This allows recovery of veneer sheets which would otherwise be wasted.

All the above processes come under the general terms: Sawmill Automation.

Information Technology

The latest advances in information technology involve the use of computers in CAD/CAM (computer-assisted design/computer-aided manufacturing), NCMTs (numerically controlled machine tools) combined with CAD/CAM into FMS's (Flexible Manufacturing Systems) and computer application in management.

At the forestry products level the use of CAD/CAM and NCMTs or FMSs has greater potential at the sawmill level, particularly in the form of scanners, sensors and other micro-electronic CAM systems. At management and R&D levels, computer-based systems find wide application in the form of information processing, systems simulation, and communications.

Biotechnology

Biotechnology has wide-ranging applications in various areas of industry. Its applications in forestry include the following activities:

- cloning of superior tree varieties via tissue culture;
- improved nitrogen fixing via nitrogen-fixing bacteria including actinomycetes;
- greater use of microbial insecticides;
- improved nutrition and field hardiness via mycorrhiza fungus selection and management;
- rapid laboratory selection from cell cultures of trees with some superior traits such as resistance to disease, frost and drought;
- development of trees with properties outside the species limit, such as lignin content, increased fibre length, and high turpentine content;
- development of new species of trees with features ofseveral current species;
- development of new microbial insecticides;
- genetically improved mycorrhizal fungi and nitrogen-fixing bacteria;

- symbiotic nitrogen fixation in trees that do not naturally fix nitrogen;
- biopulping
- biobleaching
- biotechnical improvement of mechanical pulps;
- biological pre-treatment of wood for fermentation;
- biotechnical improvement of mechanical pulps;
- wood and pulp chip protection during outside storage.

Appendix II

COMPANY PROFILES

Forestry Commission

The Forestry Commission is the State forestry authority. It was established by an Act of Parliament. The Commission runs two distinct divisions: the State Forestry Division, which is responsible for the management of the indigenous forestry resources of the country; and the Commercial Forestry Division, which is responsible for the development and management of commercial forests on behalf of the State.

The Commission currently operates a total 34 565 ha of commercial forest in the Manicaland province alone. Its turnover per year is about Z$20 million.

The Commission also operates various other ventures including a Forestry Research Centre which is an up-to-date research facility and a regional seed supplier for SADCC and for the rest of the timber producers in the country; a forestry training college, the Zimbabwe College of Forestry, which provides training for nationals and for other countries in the SADCC region; cattle ranching and safaris. Recently, the Commission became a partner in the newly formed Zimbabwe Pulp and Paper Company.

The Commission has a total staff complement of about 3 500.

The Wattle Company

The Wattle Company is a subsidiary of Lonrho, an MNC with massive interests in Southern Africa. The Wattle Company, however, operates quite independently of the mother company in terms of investment and technology decisions. The company is also independent with respect to providing funds for technology acquisition and for the sourcing of such technology.

Wattle Company specialises in producing wattle bark for tannin and for poles. Its planted area in 1988 totalled 19 574 ha of which about 6 000 ha were conifers and gum.

The company employs about 2 600 people of whom about 1 300 are casuals, 130 are management staff and 400 are factory personnel.

Border Timbers

Border Timbers is jointly owned by the Anglo American Corporation and PG, formerly Plate Glass Industries. The company is the second largest producer of conifers after the Forestry Commission. It has a total plantation area of 26 901 ha of which only 3 000 ha are gum.

Border Timbers employs a total of about 2 500 people of whom about 250 are classified as management personnel.

The company, together with PG Timbers, also operates Gluelam, a laminated beam manufacturer.

Its annual turnover is about Z$32 million.

Mutare Board and Paper Mills

Mutare Board and Paper Mills is located in Mutare. It is owned 60% by Baringa and 40% by British Plaster Board. The company operates 3 000 ha of conifers. Output from these plantations, together with thinnings from other timber producers, provides adequate input timber for the company's pulp mill.

Mutare Board and Paper Mills employs 237 people in the forestry operations and 871 people in the mill section. Its annual turnover is about Z$35 million.