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OVERVIEW OF AGRICULTURE SECTOR IN MYANMAR

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SUMMARY

Myanmar economy is predominantly agricultural country; it is endowed with rich natural resources. The country has a great potential for doubling its current sown area. Irrigated area reached a record level of 1.7 million ha; under multiple cropping irrigated area covers about 0.36 million ha. Tillage operation has been significantly improved through mechanization. However, mechanization in sowing, harvesting, threshing, and drying are still in its developing stages. The use of chemical fertilizer has decreased and the volume of current use remains around 200 thousand metric tons. More than 60 per cent of the labor force is engaged in agriculture. To enhance agricultural production, loans are made available to farmers.

The Forestry Sector of Myanmar plays a key role for ensuring viable crop cultivation, since it stabilizes soil, water and environment. National forest cover amounted to about 49 per cent of the country. During 1990s, annual extraction of hard wood doubled and amounted to 860 thousand MT, while teak extraction was stable around 250 thousand MT.

Livestock and Fisheries Sector is important for the production of meat, egg, fish and for raising draught cattle as well. The livestock population has increased; the production of meat, fish, egg and milk shows upward trend. Egg and fisheries production reveals the higher growth rate than meat and milk production.

Agricultural export in 1999/2000 registered about 51 per cent of total export. Among export commodities, peas and beans have been taking its leading role while rice export faced up and down trends. Exports of livestock and fishery products improved during last ten years especially in prawns export. Forestry products like teak and hard wood shows the upward trend in export.

In 1999/2000, agriculture sector's contribution to the national GDP registered about 43 per cent in real terms with a growth rate of 12.8 per cent. For Myanmar, in a foreseeable future, agriculture would remain holding its leading role in national economy. More statistics, reliable, consistent statistics with transparency and in timely manner becomes important prerequisite for the development of the agriculture sector.

I. INTRODUCTION

Myanmar is traditionally an agricultural country and agriculture sector remains as a major contributor to GDP, and its share of export earnings is about 40%. At the same time, agriculture sector provides employment to more than 60 per cent of work force. In addition, food security for the people and raw material production for domestic agro-based industries are heavily dependent on the agricultural sector.

Myanmar agriculture had been transformed from a subsistence to a commercial agriculture since colonial days and the country emerged as a major exporter of rice in the world. However, Myanmar could not maintain its leading role in rice export, though it still exports surplus rice over domestic consumption from its paddy production. Since 1988 when the economic system of the country shifted from a centrally planned economy to a market-oriented economy, agricultural production was revitalized again. At present, Myanmar leads in the export of pulses among ASEAN countries.

The Government considers agriculture "*as the base for all-round development of other economic sectors*". The three major objectives of the agriculture sector are: (i) to achieve surplus in paddy production; (ii) to achieve self-sufficiency in edible oil; and (iii) to step up the production and export of pulses and industrial crops. At the same time, within the context of market-oriented economic system, freedom in agricultural production, and participation of private sector have become the major policies in the agriculture sector.

Agriculture sector during the First Four Year Short-Term Plan (1992/93 to 1995/96) showed 7.3 per cent growth for crop sector, 4.6 per cent for livestock and fisheries sector, and (-) 5.5 per cent for forestry sector. Improvement in livestock and forestry sector can be seen during the Second Five Year Short-Term Plan (1996/97 to 2000/2001). At the end of the Fourth Year of the Short-Term Five Year Plan, agriculture sector registered an annual average growth rate of about 12.8%.

The objective of this paper is to provide an overview of the agricultural sector, particularly with the three sub-sectors viz. crop, forestry and livestock and fisheries. Then a reviews of investment in agriculture was made; it was followed by agricultural export, and finally with an annual performance analysis of the primary sector.

II. MYANMAR AGRICULTURE (CROP SECTOR)

Being endowed with rich land, water and forest resources, supplemented by regular rainfall are prerequisites for Myanmar to be an agricultural country. Variation in the geographical conditions of the country supports the country to produce several varieties of crops grown in tropical as well as in temperate zones. Strategic geographical location of the country favours access to world markets, particularly to the world's largest markets – China and India.

1. Land

Myanmar's total land area amounts to 67,658 thousand ha. and about 14 per cent of the area is under crop cultivation while about 49 per cent of the area is under reserved forests and other forests. According to current land utilization status (Table-1), about 9.67 million ha. are under cultivation. More than 8 million ha. can be brought under crop cultivation from culturable wasteland and fallow land if demand for agriculture produce increases.

Table 1. Land Utilization, FY1999/2000

Type of Land	Area (mil. ha.)	per cent
Net area sown*	9.67	14%
Fallow land	0.78	1%
Culturable wasteland	7.25	11%
Reserved forest	12.57	19%
Other forest area	20.24	30%
Other land	17.15	25%
Total:	67.66	100%

* area cultivated within the demarcated cultivation areas only

Source: Settlement and Land Records Department (SLRD)

Major land potential of Myanmar for agricultural purposes lies in Shan, Kachin and Chin States (Table-2). The said three States are rugged, mountainous, sparsely populated, and development is rather slow particularly due to transportation and communication difficulties. Regarding fallow land, Shan State, Mandalay Division and Sagaing Division are at the top of the list.

Table 2. Land Potential by State and Division (1999/2000)

	State/Division	Land Area	Population (000)	Net Sown	Fallow Land	Culturable Waste Land
1	Kachin	8904	1281	210	8	2009
2	Kayah	1173	269	50	8	50
3	Kayin	3038	1481	234	50	139
4	Chin	3602	473	84	1	1499
5	Sagaing	9463	5503	1598	76	211
6	Tanintharyi	4335	1356	225	25	342
7	Bago	3941	5059	1295	15	139
8	Magway	4482	4578	1110	25	96
9	Mandalay	3702	6585	1255	149	77
10	Mon	1230	2488	439	12	81
11	Rakhine	3678	2761	419	57	114
12	Yangon	1017	5677	596	28	7
13	Shan	15581	4828	735	257	2356
14	Ayeyarwady	3514	6794	1852	66	135
	Union	67659	49133	10102	778	7255

Source: NPED; SLRD; MOAI (2000), "Report on Performance of Agri. Sector", pp.31.

According to land utilization in terms of net area sown by primary land type (classified by the Settlement and Land Records Department), it is dominated by Paddy land followed by *Ya* land and Garden land (Table 3).

Table 3. Land Utilization of Net Area Sown, FY 1999/2000

Primary Land Type	Area (mil. ha.)	per cent
Paddy land	5.73	57
Ya land	2.89	29
Kaing land	0.49	5
Garden land	0.75	7
Dani land	0.04	0.4
Taungya land	0.20	2
Total:	10.10	100%

Source: Settlement and Land Records Department (SLRD)

1.1 Crop Area

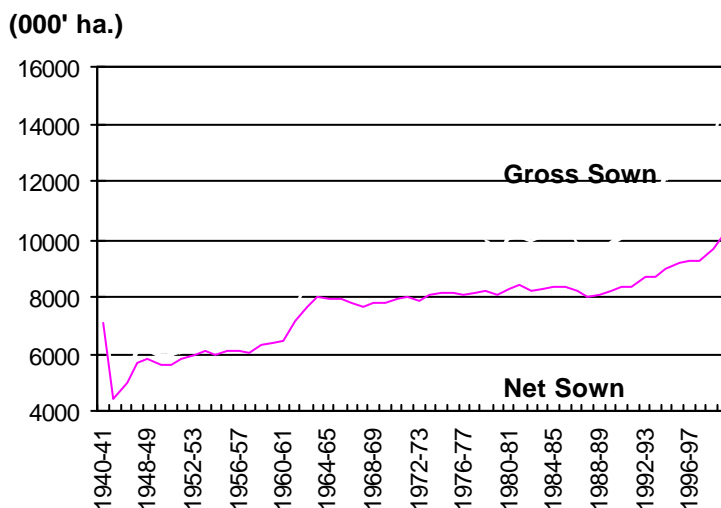
Expansion of crop area not only horizontally but also vertically makes gross sown area larger. As a result of development in variety, mechanization and irrigation facilities, cropping intensity increased up to 47 per cent in FY 1999/ 2000 compared to 20 per cent in FY 1989/90.

Table 4 Progress in Crop Area

Year	Gross Sown (mil. ha.)	Net Sown (mil. ha.)	Cropping Intensity (%)
1991-92	10.29	8.34	123
1992-93	11.01	8.71	126
1993-94	11.39	8.74	130
1994-95	12.14	8.95	136
1995-96	12.88	9.17	141
1996-97	12.31	9.28	133
1997-98	12.28	9.28	132
1998-99	13.31	9.67	138
1999-2000	14.80	10.10	147

Source: Settlement and Land Records Department (SLRD)

Figure 1. Gross Sown and Net Sown Area



Variation in topography, soil types and climatic conditions allow the country to grow a variety of crops. Major crops cultivated include cereals (paddy, wheat, maize), oilseeds (sesame, groundnut, sunflower), culinary crops (chillies, onion, garlic,

potato), industrial crops (sugarcane, cotton, jute, rubber), and plantation crops (fruit trees, coconut, banana). In FY 1999/ 2000, Cereal group covered 48 per cent of total sown area. Pulses took second place with 18 per cent followed by oilseeds with 17 per cent.

Table 5. Sown Area by Major Crop Groups, FY 1995/96 – 1999/2000

	(000' ha.)				
	1995/96	1996/97	1997/98	1998/99	1999/2000
Cereal	6742	6475	6399	6442	7032
Oilseed	2099	1824	1685	2143	2550
Pulses	2046	1963	2092	2459	2674
Industrial Crops	612	594	559	652	696
Culinary	133	147	148	161	203
Plantation	447	456	482	487	558
Others	805	853	912	963	1091
Total:	12884	12312	12277	13307	14804

Source: Settlement and Land Records Department (SLRD)

Of the total sown area, about one million ha. or 7 per cent is under perennial crops like rubber, tea, fruit trees, etc. and the rests are under seasonal crops. It is estimated that about 65 per cent are cultivated during the rainy season, while 25 per cent and 10 per cent are grown during winter season and summer season respectively.

Table 6. Sown Area of Major Crops, FY 1995/ 96 – 1999/ 2000

	(000' ha.)				
	1995/96	1996/97	1997/98	1998/99	1999/2000
Paddy	6138	5876	5785	5759	6284
Wheat	93	91	88	99	105
Maize (seed)	167	167	162	188	210
Pulses	2046	1963	2092	2459	2680
Groundnut	527	479	450	503	567
Sesame	1276	1145	1035	1199	1357
Sunflower	221	125	120	343	487
Cotton	379	333	267	325	341
Jute	50	47	38	40	38
Sugarcane (Indus)	66	82	108	126	135
Virginia Tobacco	4	4	4	4	4
Rubber	105	119	135	149	170

Source: Settlement and Land Records Department (SLRD)

1.1.1 Crop Production

Production in terms of weight, paddy, sugarcane and pulses belonged to major crops. Production generally changes either upward or downward; sugarcane is an exception, which showed a continuous positive trend for the last five years.

Table 7. Output of Major Crops, FY 1995/ 96 – 1999/ 2000

	1995/96	1996/97	1997/98	1998/99	1999/2000
Paddy	17953	17677	16655	17078	20126
Wheat	78	87	92	93	126
Maize (seed)	275	286	308	303	349
Pulses	1385	1370	1598	1685	1882
Groundnut	593	597	540	562	634
Sesame	304	345	296	210	296
Sunflower	164	170	90	189	160
Cotton	165	163	164	158	176
Jute	43	39	33	33	33
Sugarcane (indust.)	3250	4042	5137	5429	5449
Virginia Tobacco	3	3	5	4	5
Rubber	26	26	27	23	27

Source: Settlement and Land Records Department (SLRD)

Regarding yield trend of major crops, yield levels do not remain stable, and yield improvements did not show any progress except in paddy. Hence, vertical expansion is very important for the development of Myanmar agriculture.

Table 8. Yield per Hectare of Major Crops, FY 1995/ 96 – 1999/ 2000

	1995/96	1996/97	1997/98	1998/99	1999/2000
Paddy	2976	3064	3080	3129	3241
Wheat	856	961	1047	973	1196
Maize (seed)	1701	1732	1920	1651	1716
Pulses	699	723	797	724	729
Groundnut	1151	1170	1211	1145	1132
Sesame	336	339	382	298	286
Sunflower	759	758	787	593	355
Cotton	509	563	666	545	545
Jute	914	915	973	898	912
Sugarcane (indust.)	51165	49421	49709	44215	43467
Virginia Tobacco	869	947	1167	1169	1169
Rubber	528	566	566	484	507

Source: Settlement and Land Records Department (SLRD)

1.2 Holding Size

Majority of peasants engaged in agricultural production are small farmers. Although more and more waste land and fallow land are being brought under crop cultivation, size of holding has not changed significantly and most of the farm families are working on land less than 5 acres or 2 hectares.

Table 9. Size of Land Holding, FY 1999/2000

(in Thousand)

Size of Holding	Number		Percentage	
	Peasant Families and Societies	Area (ha)	Peasant Families and Societies	Area
Under 5 acres	2840	7096	62	27
5 to 10 acres	1164	8482	25	32
10 to 20 acres	497	7056	11	27
20 to 50 acres	107	2929	2	11
50 to 100 acres	2	157	0.05	0
Over 100 acres	2	875	0.04	3
Total	4612	26595	100	100

Note: Area includes both agricultural land and fallow land.

Source: Settlement and Land Records Department (SLRD)

2. Irrigation

Myanmar has an abundant supply of water resources such as rainfall, rivers, streams, lakes, and dams and reservoirs. The geographical location of the country is a gift from nature; it gives an opportunity to have regular rainfall from southeast monsoon. The four major river systems of the country - *Ayeyarwady*, *Chindwin*, *Sittaung*, *Thanlwin* and their tributaries, and lakes like *Inle*, *Inndawgyi* are valuable water assets of the country. Dams and reservoirs are other important sources for irrigation.

With a view to utilize rainfall, most of the crops are grown during the rainy season, and some crops are grown after the rainy season with residual moisture. Annual precipitation shows a large range; from a minimum of 600 mm. in central dry zone to a maximum of 5,400 mm. in coastal strips depending on topography, altitude, vegetation and forest cover. In addition, the distribution of rainfall is not even. Consequently, in most cases, rainy season crops require supplementary irrigation, and winter or summer crops, on the other hand, could be successful only with irrigation.

To enlarge the irrigated area, it could be safely said that Myanmar is gifted with rich water resources. According to the World Bank study made in 1956, total annual inflow of water is estimated to be about 870 million acre-feet. Of the total inflow, only about 6 per cent have been utilized currently for irrigation purposes. To enhance crop production, the magnitude as well as the pace of construction of new dams and reservoirs, have been accelerated especially in the 1990s. By the end of November 2000, 115 irrigation works have been built to irrigate additional 577 thousand ha.

Table 10. Accomplishment of Irrigation Works, FY 1990/ 91 – 2000/ 2001

Year	Number of Works	Beneficial Area (000' ha.)	Cost (mil. Ks)
1990-91	9	160	2119.96
1991-92	8	3	190.00
1992-93	7	2	113.80
1993-94	9	59	506.50
1994-95	16	38	1435.27
1995-96	16	101	4457.05
1996-97	12	84	3515.96
1997-98	10	23	2900.20
1998-99	8	49	4854.73
1999-2000	12	36	3433.51
2000-2001 (Nov.)	8	23	3106.15
Total:	115	577	26633.13

Source: Irrigation Department (ID)

As a result of establishing new dams and reservoirs, net irrigated area reached record a level of 1.7 million ha. Irrigated area amounted to about 17 per cent of net sown area in FY 1999/ 2000. Multiple cropping irrigated areas amounted to 31 per cent of the total irrigated area.

Table 11. Progress Made in Irrigated Area, FY 1991/ 92 – 1999/ 2000

Year	Net Sown Area	Irrigated Area		Irrig. Multiple Cropping	
		Area	per cent (Net Sown)	Area	per cent (Irrig. Area)
1991-92	8,339	998	12.0	165	16.5
1992-93	8,714	1,110	12.7	197	17.8
1993-94	8,738	1,337	15.3	285	21.3
1994-95	8,951	1,555	17.4	356	22.9
1995-96	9,168	1,757	19.2	385	21.9
1996-97	9,277	1,556	16.8	309	19.9
1997-98	9,278	1,592	17.2	331	20.8
1998-99	9,580	1,692	17.5	388	22.9
1999-2000	10,102	1,748	17.3	355	30.7

Source: Settlement and Land Records Department (SLRD)

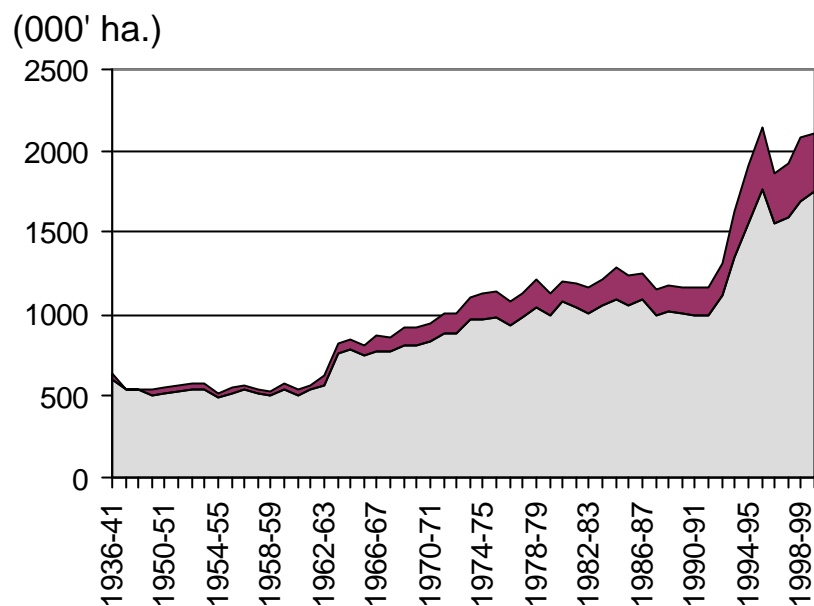


Figure 2. Gross and Net Irrigated Area

Pump irrigation is seen as the leading means of irrigation; it has increased significantly since FY 1993/94.

Table 12. Irrigated Area by Means of Irrigation, FY 1991/92 – 1999/2000
(000' ha.)

	Canals	Tank	Wells	Pumps	Other	Total
1991-92	503	186	26	131	152	998
1992-93	519	207	28	190	166	1110
1993-94	507	197	31	425	177	1337
1994-95	534	193	37	628	163	1555
1995-96	524	180	40	832	181	1757
1996-97	528	214	50	611	153	1556
1997-98	551	214	55	625	147	1592
1998-99	551	183	66	755	137	1692
1999-2000	594	178	68	768	140	1748

Source: Settlement and Land Records Department (SLRD)

Irrigated area by crop shows that paddy occupies the largest share and sesame and chickpea take second and third places respectively.

Table 13. Irrigated Area by Crop, FY 1999/2000

Crop	Irrigated Area (000' ha.)	per cent
Paddy	1788	78
Sesame	104	5
Onion	45	2
Chick pea	39	2
Other	309	13
Total:	2285	100

Source: Settlement and Land Records Department (SLRD)

On the other hand area protected against flood by Irrigation Department had become larger especially between FY 1994/ 95 and 1998/99.

Table 14. Flood Protected Area, FY 1991/ 92 – 1999/ 2000

	Embankments	Drainage Works	Total (000' ha.)
1991-92	1079	194	1273
1992-93	1079	194	1273
1993-94	1079	194	1273
1994-95	1112	194	1306
1995-96	1114	206	1320
1996-97	1115	206	1321
1997-98	1115	206	1321
1998-99	1247	200	1447
1999-2000	1247	200	1447

3. Mechanization

When multiple cropping was introduced, land preparation and other farm works traditionally done by draught cattle were to be supplemented by the mechanical power. By using mechanical power, most of the farm operations could be done efficiently in time. Mechanization in agriculture has been accelerated since the introduction of summer rice on a large scale in FY 1992/93. First tillage operation was mechanized and later, harvesting, threshing, drying and transportation became important fields of mechanization.

Since the policy of the Government is to provide support for agricultural mechanization, provision of farm machinery has been stepped up through importation and local assembly. Importation of farm machinery and other agricultural inputs is highly encouraged by allowing tax exemption to import these items. Local production of machinery by governmental departments, co-operatives and private sector is also promoted by the arrangement of the *Myanmar Industrial Development Committee* (MIDC) formed in July 1995. Under the guidance of the Committee, industrial zones were established for the production of agro-related machinery.

Government organizations not only import but also produce agricultural machinery such as power tillers, threshers, dryers, inter-cultivators, seeders, etc., and then distribute these to farmers. The number of farm implements distributed to farmers by public sector is given in the following table.

Table 15. Sale of Tractors, Water Pumps and Farm Implements,
FY 1991/ 92 – 1999/ 2000 (Number)

Year	Tractors	Power Tiller	Water Pumps	Thresher
1991-92	238	117	1305	58
1992-93	246	153	2936	1426
1993-94	1573	1977	2797	1461
1994-95	1381	7186	5821	472
1995-96	144	2431	2337	271
1996-97	385	4952	3773	583
1997-98	585	4481	1764	268
1998-99	716	1678	1340	495
1999-2000	815	4700	2200	455

Source: Agriculture Mechanization Department (AMD)

Although the performance of mechanization in tillage operation is found to be significantly improved, average area turn by a tractor is too low particularly for tractors owned by farmers. To raise the efficiency, supply of fuel, and provision of necessary spare parts and repair services are urgently needed.

Table 16. Mechanized Tillage by Tractors & Power Tillers, FY 1995/96 – 1999/ 2000

Source	Particular	Owner	1995-96	1996-97	1997-98	1998-99	1999-2000
Tractor	Number	Total:	7948	7548	8047	8465	8656
		AMD	2820	3148	3450	3366	3188
		Farmers	5128	4400	4597	5099	5468
	Tillage (000' ha)	Total:	2341	1703	1824	2269	2110
		AMD	1516	1015	1005	1309	1043
		Farmers	825	688	819	960	1067
Avg. turn /tractor	Total:	295	226	227	268	244	
	AMD	537	322	291	389	327	
	Farmers	161	156	178	188	195	
	Power	Number	Farmers	17000	25350	26130	31529
Tiller	Tillage (000' ha)	"	826	1541	1058	1362	1791
	Avg. turn/tiller	"	49	61	41	43	45
	Total tillage	A&F	3166	3244	2883	3631	3901

Source: Agriculture Mechanization Department (AMD)

Most of the mechanized tillage operation is done for pulses and monsoon paddy while mechanized tillage is limited in other crops.

Table 17. Mechanized Tillage by Crop, FY 1999/2000

Crop	(per cent)	
	AMD	Farmers
Pulses	46	70
Monsoon Paddy	36	15
Other Crops	18	15
Total:	100	100

Source: Agriculture Mechanization Department (AMD)

4. Fertilizer

Within the context of market-oriented economic system, State subsidies in agricultural inputs are gradually reduced to a level of almost no subsidy. Among agricultural inputs, fertilizer is the most important input since the introduction of high yielding varieties (HYVs) of paddy in FY 1974/75. Price reform in fertilizer has led to the current trend of price policy for other agricultural inputs like pesticides, seeds, diesel, farm machinery, etc.

Myanmar has produced Urea locally from its three Urea Plants at *Sale*, *Kyun-gyaung* and *Kyawzwa*. Other fertilizers, and Urea are imported. In FY 1997/98 domestic production of Urea available for agriculture was 124 thousand metric tons, and imported fertilizers amounted to 260 thousand metric tons. In Myanmar, extensive use of chemical fertilizer started since FY 1962/63. Annual utilization of different fertilizers reached more than 100 thousand metric tons after FY 1973/74, reached a peak level of more than 400 thousand metric tons in FY 1985/86 and then declined. Currently, the level of fertilizer utilization registers about 200 thousand metric tons.

Table 18 Utilization of Chemical Fertilizer, FY 1991/ 92- 1999/ 2000
(000' MT)

	Urea	TSP	MOP	Others	Total
1991-92	108	15	2	17	143
1992-93	145	24	4	5	179
1993-94	205	49	7	-	261
1994-95	241	71	4	-	315
1995-96	235	100	18	17	369
1996-97	200	64	29	29	321
1997-98	146	31	8	5	189
1998-99	217	11	10	*	210
1999-2000	155	34	9	1	199

* = less than 500 mt.

Source: Myanma Agriculture Service (MAS)

Table -19 shows that fertilizer distribution is centered about paddy and industrial crops.

Table 19. Fertilizer Utilization by Crops, FY 1996/ 97- 1999/ 2000
(000' MT)

	1996-97	1997-98	1998-99	1999-2000	
				Qty.	(per cent)
Paddy	262.5	149.9	182.0	168.9	(84.9)
- Summer	66.3	32.6	49.5	92.2	(46.3)
- Monsoon	196.2	117.3	132.5	76.7	(38.6)
Cotton	16.1	9.3	9.8	10.5	(5.3)
Jute	7.9	5.3	3.9	4.0	(2.0)
Sugarcane	14.0	6.8	7.0	3.7	(1.9)
Sesame	2.4	1.3	2.4	2.0	(1.0)
Pulses	1.9	2.6	1.6	1.9	(0.9)
Rubber	2.1	0.9	0.8	1.1	(0.6)
Sunflower	1.8	0.8	1.2	1.1	(0.6)
Others	12.5	11.9	1.4	5.7	(2.9)
Total:	321.3	189.0	210.0	198.8	(100.0)

As the price of imported fertilizer price became higher, and availability went down, the use of bio-fertilizers had been encouraged by developing several bio-fertilizers. These fertilizers like Effective Micro-Organism (EM), EM-Bocashi, Zepher, Bio-Composer, Bio-Super, Rhizobium, Gypsum, etc. are locally produced and distributed to farmers.

5. Work Force in Agriculture

Myanmar's population in 1999/2000 is estimated to be about 49.13 millions with an annual growth rate of 2.0. Of the total population, about 40 per cent of the labor force are engaged in economic activities including agriculture. Work force by sector reveals that the agriculture sector is the largest sector in terms of employment; it employs more than 60 per cent of the total labor force.

Table 20. Work Force in Agriculture, FY 1991/ 92- 1997/ 98 (million)

Year	Population	Total Work Force	Work Force in Agriculture				Agri %
			Crop	Livestock	Forestry	Agri Total	
1991-92	41.55	16.01	10.52	0.37	0.18	11.08	69
1992-93	42.33	16.47	10.78	0.38	0.19	11.35	69
1993-94	43.12	16.82	10.97	0.39	0.19	11.55	69
1994-95	43.92	17.23	11.12	0.39	0.19	11.69	68
1995-96	44.74	17.59	11.27	0.39	0.19	11.85	67
1996-97	45.57	17.96	11.38	0.39	0.19	11.96	67
1997-98	46.40	18.36	11.51	0.40	0.19	12.09	66

Source: NPED, "Report on Financial, Economic and Social Conditions of the Union of Myanmar", various issues.

Training of manpower in agriculture takes place at several levels: graduate, diploma, and high school. The number of graduates trained in veterinary improved significantly since FY 1996/ 97.

Table 21 Manpower Development/ Training in Agriculture, FY 1995/ 96- 1998/ 99

(Number)

	1995-96	1996-97	1997-98	1998-99
Graduate				
- Agriculture	213	217	-	-
- Forestry	35	39	53	46
- Veterinary	110	667	544	706
Diploma				
- Agri. Institute	381	545	784	1937
High Schools				
- Agri. High Schools	497	498	645	-
- Forestry Training Schools	1086	918	1145	925

Source: Department of Labour (1999), *Handbook on Human Resources Development Indicators, 1999* (& Draft for 2000), Yangon.

With an objective to assist farmers, the appointment of Deputy Assistant Supervisors has been increased. However, net sown area on the average per Supervisor remained around 1400 ha.

Table 22. Deputy Assistant Supervisors, FY 1995/ 96- 1999/ 2000

	Net Sown Area (000' ha)	Deputy Assistant Supervisor (No.)	Average Area (ha.) for a Supervisor
1995-96	9168	6432	1425
1996-97	9277	6682	1388
1997-98	9278	6932	1338
1998-99	9673	7182	1347
1999-2000	10104	7232	1397

Source: Myanmar Agriculture Service (MAS)

6. Draught Cattle and Farm Implements

Mechanization of agriculture is still in its early stages; agricultural production in Myanmar mainly depends on human labor and draught power of cattle. On an average, each farm family owns one pair of draught cattle and several farm implements. Bullock cart is also an essential vehicle for farmers to transport agricultural produce. Farmyard manure from draught cattle also serves as a good source of manure for crop production.

Table 23. Draught Cattle and Farm Implements, FY 1995/ 96 - 1999/ 2000

(000' Number)

	Draught Cattle	Plough	Harrow	Cart
1995-96	6808	2758	2834	1674
1996-97	6922	2774	2841	1684
1997-98	6986	2780	2850	1689
1998-99	7258	2801	2904	1720
1999-2000	7615	2795	3092	1696

Source: Settlement and Land Records Department (SLRD)

7. Credit

To lessen the capital burden on farmers and to assist in the development of agriculture, the government practices cheap rural credit policy through *Myanma Agricultural Development Bank* (MADB), one and only specialized farm credit institution. The main objective of MADB is to disburse necessary amount of loan to cover production costs at favorable interest rates in time. The Bank tries to educate farmers to change the concept of credit from privileged money (*Amadaw*) to borrowed money (loans). At the same time, loan rates and kinds of crops loaned are reviewed and changed if necessary.

MADB has disbursed different loans as: annual loans, short-term loans, long-term loans and development loans. According to statistics from MADB, in FY 1999/2000 loans other than the annual loan amounted to 5,430 million Kyats for farm development, and 59.64 million Kyats for border area development. However, the most important loan is crop loan and the amount of annual loan disbursed to the farmers shows an increasing trend. Collection of loan reveals favorable percentage, for example, average recovery rate for crop loan from 1989 to 2000 is 99.35 percent.

Table 24. Annual Agricultural Credit Disbursement and Recovery, FY 1991/ 92 - 1999/ 2000 (mil. Kyats)

Year	Amount Disbursed	Amount Repaid	Recovery Rate
1991-92	1533	1533	100.0
1992-93	1759	1759	100.0
1993-94	2609	2609	100.0
1994-95	2781	2781	100.0
1995-96	9014	9014	100.0
1996-97	9919	9919	100.0
1997-98	10245	10245	100.0
1998-99	10359	10358	99.99
1999-2000	11186	10783	96.39

Source: Myanmar Agricultural Development Bank (2000), "Agricultural Credit Policy and Operations", Yangon, Annexure (4).

In addition, advance payment for industrial crops (jute, sugarcane, Virginia tobacco) are made by State Economic Enterprises (SEEs). Payment for sugarcane excels other crop payments.

Table 25. Advance Payment for Industrial Crops, FY 1988/ 89 - 1997/ 98 (Million Kyats)

	Jute	Sugarcane	Virginia tobacco	Total
1988-89	7.6	12.7	-	20.3
1989-90	7.7	12.7	0.6	21.0
1990-91	12.7	23.0	-	35.7
1991-92	15.6	72.9	6.0	94.5
1992-93	27.1	66.3	4.2	97.6
1993-94	19.6	-	5.1	24.7
1994-95	126.8	289.9	28.1	444.8
1995-96	181.3	254.6	44.6	480.5
1996-97	160.2	530.1	102.5	792.8
1997-98	200.0	518.7	159.5	878.2

Note: Before 1987-88, there were advance payments for cotton

Source: NPED, "Report on Financial, Economic and Social Conditions of the Union of Myanmar", Yangon, various issues,

MADB has also launched a rural saving program since October 1993 to mobilize rural savings. It renders mobile services in order to facilitate rural savings. As of July 2000, about 2 million farmers have opened saving accounts with the Bank, and 2,404 million Kyats have been deposited.

III. MYANMAR FORESTRY SECTOR

The forestry sector of Myanmar plays a key role for ensuring viable crop cultivation for it stabilizes soil, water and the environment. About 49 per cent of the total land area is still covered by forests, it supports the livelihood of rural people. In addition, forests maintain and promote biodiversity of the country.

According to 1989 Forest Cover Appraisal, it is estimated that the coverage includes 43.3 per cent of closed forests and 7.5 per cent of degraded forests; about 22.8 per cent of forest area was affected by shifting cultivation. Within the last decade, the area of reserved forests has increased from 10,169 sq-km. to 12,570 sq-km.

Table 26. Extension of Reserved Forest Area, FY 1991/ 92 - 1999/ 2000

	Reserved Forest Area (sq.-km.)	Percent of Total Land Area (%)	Annual Increase (sq.-km.)
1991-92	10169	15	-
1992-93	10191	15	22
1993-94	10241	15	50
1994-95	10309	15	68
1995-96	10321	15	12
1996-97	10396	15	75
1997-98	10476	15	80
1998-99	11618	17	1143
1999-2000	12570	19	951

Source: National Planning and Economic Development (NPED)

During the 1990's, the production of forestry sector was found to increase. Annual extraction of hard wood doubled and amounted to 860 thousand MT, while teak extraction remained stable around 250 thousand MT.

Table 27. Extraction of Teak and Hard Wood, FY 1991/ 92 - 1999/ 2000

	Teak	Hard Wood	Total
1991-92	265	401	666
1992-93	284	419	703
1993-94	258	404	662
1994-95	267	486	753
1995-96	234	633	867
1996-97	206	746	952
1997-98	243	842	1085
1998-99	256	879	1135
1999-00	265	864	1129

Source: Ministry of Forestry

IV. LIVESTOCK & FISHERIES SECTOR

Livestock and Fisheries Sector is an important sector for the production of meat, egg, and fish. Draught cattle plays major role in Myanmar agriculture so efforts are being made in raising the population of draught animals in line with agricultural expansion activities. Regarding fisheries, Myanmar is endowed with both marine and inland fisheries resources with a production potential of about 1.05 million metric tons per year from marine sources alone. Current production by marine fishery is estimated to be about 69 per cent of the potential or maximum sustainable yield (MSY). On the other hand, inland and marine aquacultures are encouraged to enhance fishery production.

It can be observed that all livestock population increased during 1990s. The highest rate of increase is seen in poultry population.

Table 28 Livestock Population, FY 1990/ 91 - 1999/ 2000

	(Million)				
	Cattle	Buffalo	Sheep/Goat	Pig	Poultry
1990-91	9.4	2.1	1.3	2.4	28.6
1991-92	9.5	2.1	1.4	2.6	31.2
1992-93	9.6	2.1	1.4	2.6	31.4
1993-94	9.7	2.1	1.4	2.7	31.6
1994-95	8.9	2.2	1.5	3.0	34.4
1995-96	10.1	2.3	1.6	3.3	38.1
1996-97	10.3	2.3	1.6	3.5	39.9
1997-98	10.3	2.3	1.6	3.5	38.7
1998-99	10.1	2.3	1.7	3.5	42.0
1999-2000	10.7	2.4	1.7	3.9	49.6

Source: Ministry of Livestock Breeding & Fisheries

As the livestock population increases, the production of meat, fish, egg and milk has also steadily increased. Egg and fisheries production reveals higher growth rates than the output of meat and milk.

Table 29. Production of Livestock & Fisheries Products, FY 1995/96 - 1999/2000

	Unit	1995-96	1996-97	1997-98	1998-99	1999-2000
MEAT	MT(000)	<u>244.3</u>	<u>265.4</u>	<u>295.9</u>	<u>313.8</u>	<u>378.9</u>
- Beef	"	50.5	51.3	52.3	53.9	61.2
- Mutton	"	7.7	7.8	8.3	8.8	10.1
- Pork	"	66.5	72.7	76.2	82.5	101.7
- Fowl	"	119.6	133.6	159.1	168.6	205.9
FISHERIES	"	673.0	853.0	922.0	1011.0	1171.0
EGG	No.(mil)	<u>1101.7</u>	<u>1231.4</u>	<u>1394.4</u>	<u>1487.6</u>	<u>1907.9</u>
- Fowl Egg	"	951.3	1070.1	1226.0	1310.2	1688.8
- Duck Egg	"	150.4	161.3	168.4	177.4	219.1
FRESH MILK	"	548.7	563.4	577.8	580.8	652.6

Source: Ministry of Livestock Breeding & Fisheries

V. AGRICULTURAL EXPORT

Myanmar has shifted its economy from a planned economy to a market-oriented economic system since 1988. Accordingly, farmers are free to produce, to process, to transport and to market their produces. Increase in price levels of agricultural commodities becomes a good incentive for farmers. Open door policy of the Government brought normalization of border trades with China, Thailand, India and Bangladesh. It enhanced the participating of the private sector in agricultural trade with bordering countries. However, Government exercises some external trade control particularly on rice and rice products.

Agricultural products such as: pulses, rice, corn, sesame, rubber play a vital role in export; however, export volume fluctuated from year to year. To maintain export markets, and to raise the quality of the export items are the challenging tasks for Myanmar.

Table 30. Export by Commodity Group, FY 1995/ 96- 1999/ 2000

(Million Kyats)

	1995-96	1996-97	1997-98	1998-99	1999-2000	
					Value	Per Cent
Agriculture	4211	4171	4053	4175	4801	51
- Crop	2321	1981	1952	1890	2176	23
- Fishery	615	887	945	941	954	10
- Forestry	1275	1303	1156	1344	1671	18
Industry	607	1042	1993	2544	2068	22
Mining	201	259	222	945	2503	27
Other	25	16	22	36	21	*
Total:	5044	5488	6290	7700	9393	100

* = less than 0.5%

Source: Ministry of National Planning and Economic Development (NPED)

Changes in pattern of exports by type of commodity reveal that peas and beans are taking leading roles while rice export fluctuated considerably over the last five years.

Table 31. Agricultural Export, FY 1995/96 – 1999/2000

(000' MT.)

	1995-96	1996-97	1997-98	1998-99	1999-2000
Rice	354.0	93.1	28.3	120.4	59.7
Maize	62.0	102.5	50.0	174.3	88.8
Peas and beans	609.6	594.8	768.9	621.5	650.7
Sesame seeds	50.3	52.5	51.7	42.2	21.5
Rubber	24.8	25.8	22.0	29.7	24.4

Source: Central Statistical Organization, (2000), "Selected Monthly Economic Indicators (July-August 2000)", Yangon, Table-5, pp-8-10.

Exports of livestock and fishery products improved during the last ten year period especially in prawn export.

Table 32. Livestock and Fisheries Export, FY 1995/ 96- 1999/ 2000

(000' MT.)

	1995-96	1996-97	1997-98	1998-99	1999-2000
Fresh & dried prawns	9.0	12.8	13.5	13.5	14.2
Fish & fish products	34.5	33.7	41.2	46.6	31.3
Hide & skin	0.4	0.8	0.3	7.5	5.7

Source: Central Statistical Organization, (2000), "Selected Monthly Economic Indicators (July-August 2000)", Yangon, Table-5, pp-10-11.

In the export list of Myanmar, a continued growth can be observed in the export of forestry products like teak, and hardwood.

Table 33. Forestry Export, FY 1995/ 96- 1999/ 2000

	1995-96	1996-97	1997-98	1998-99	1999-2000
Teak (000' MT.)	117.3	138.7	138.0	172.2	227.6
Hardwood "	83.3	130.8	153.9	242.7	367.4
Plywood & Veneer (mil. Ks.)	0.4	0.8	0.3	7.5	5.7

Source: Central Statistical Organization, (2000), "*Selected Monthly Economic Indicators (July-August 2000)*", Yangon, Table-5, pp-11-12.

On the other hand, Myanmar has to import some agricultural commodities, which are neither produced nor meet local demand. Principal import items include palm oil (edible oil), wheat flour, spices, etc. In addition, agro-chemicals like fertilizers and pesticides and farm machinery, and spare parts are also imported. The Government encourages importers of agro-chemicals, farm machinery, fuel (diesel), seeds, etc. by allowing them to enjoy tax exemption for importation of these goods.

VI. AGRICULTURE GROWTH

In FY 1999/2000, agriculture sector's contribution to the national GDP registered about 43 per cent at 1985/86 constant price or about 50 per cent at current price. In other words, agriculture's share in national GDP outnumbered any other economic sector. The performance of agriculture sector deteriorated after FY 1980/81 and reached its minimum in FY 1988/89. It sustained after 1988; however, the performance of the agriculture sector is not stable due to unfavorable weather conditions and shortage of inputs. Growth rate of the sector registered at 12.8 per cent in FY 1999/2000.

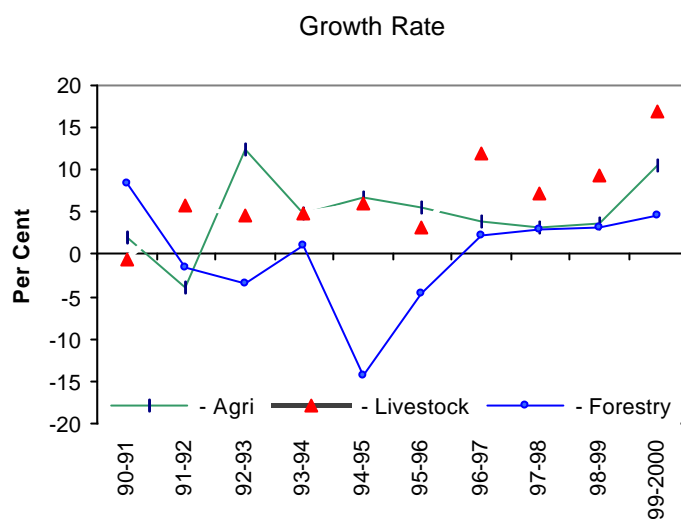
Table 34. Agri-GDP (at 1985-86 Constant Prices), FY 1991/92 - 1999/2000

Year	National GDP	Agri-GDP					Share in GDP (%)	Growth Rate
		Crop & Fisheries	Livestock	Forestry	Total			
1991-92	49.9	18.7	3.8	0.9	23.5	47	-2.4	
1992-93	54.8	21.0	4.0	0.9	25.9	47	10.5	
1993-94	58.1	22.0	4.2	0.9	27.1	47	4.6	
1994-95	62.4	23.5	4.4	0.8	28.7	46	5.9	
1995-96	66.7	24.8	4.6	0.7	30.1	45	4.8	
1996-97	71.0	25.7	5.1	0.8	31.6	44	5.0	
1997-98	75.1	26.5	5.5	0.8	32.7	44	3.7	
1998-99	78.8	27.2	5.7	0.8	33.6	43	2.8	
1999-2000	87.8	30.1	7.0	0.8	37.9	43	12.8	

Source: National Planning and Economic Development (NPED)

Performance of crop, livestock and forestry sub-sectors is shown in Figure - 3.

Figure 3. Performance of Agricultural Sub-Sectors



VII. CONCLUSION

For Myanmar, in a foreseeable future, agriculture would continue to remain as a leading sector in national economy. Myanmar's natural resources together with improvement in technology, increased investment and proper management would pave the way towards a modernized and developed agriculture. In this endeavor, efficient use of resources, transfer of technology to farmers, availability of loans, adaptation of quality seeds, international market situations, and environmental impact would be instrumental in the development of the agriculture sector. On the other hand, these situations would demand for statistics, which are both reliable as well as consistent.

OVERVIEW OF SYSTEM ON FOOD AND AGRICULTURE STATISTICS IN MYANMAR

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I. INTRODUCTION

This paper has been prepared to serve as a source document of statistics on food and agriculture in Myanmar. A general approach is adopted in collection, processing, analysing, monitoring and evaluation of the agricultural sector. These data are required to provide a quantitative basis for decision making processes in agriculture. Moreover, it is aimed at providing relevant information to both providers and users working within the public sector or within the private sector involved in economic activities associated with growing crops, raising livestock and fish farming.

The presentation is also concerned with an overview of the whole subject rather than an in-depth treatment of specific topics; the paper, therefore, is non-technical. Users of data on food and agricultural sector need to be aware of the problems usually encountered while collecting data, techniques used and classification systems widely used in Myanmar.

Myanmar is still a basically agricultural country, and the share of agricultural sector is about 40% in GDP and its share of export earning is about 25%. Cropping is the dominant sub-sector, it generates about 82% of sector output. The agricultural sector is the major source of employment for about 65% of the work force. Hence, the government has laid down five strategies for boosting agricultural production-reclamation of land for extended cultivation, adequacy of water supply, mechanization, employing advanced technical know-how and utilization of quality seeds. The time has come to make a careful analysis about the strengths and weaknesses that exist in the current system of collecting and disseminating data on agriculture in Myanmar.

II. ORGANIZATIONAL STRUCTURE

1. Nature of Agriculture

Organizational Structure for data collection in the agricultural sector is by nature quite different from the other productive sectors. A significant feature related to the productive activities depends on changes in the seasonal pattern or weather conditions. Seasonality can have serious impact on food production. The elongated shape of the map of Myanmar is a natural advantage; the northern most part of country experiences low temperature, and the temperature rises until it reaches the southern part. A major portion of country enjoys a tropical climate. A long coastline in the west and the south has a significant effect on the weather condition. The country is mountainous. River valleys and vast stretches of delta regions are fertile for growing rice. As the Ayeyarwady enters the sea, it forms a vast delta of 240 km by 210 km. The yield of crops is subject to changes in temperature and rainfall, dry and wet seasons. Farmers are widely distributed over wide geographical areas in different crop belts. Transportation is a problem to encourage output. Besides variation in weather

conditions, farmers face risks posed by fluctuating prices. Farmers are free to crops of their choice, yet market force plays an important role in raising either crops or livestock. Technological changes are always taking place in the agricultural sector. Essential mechanisms are in place for informing farmers about the new farming techniques and farm machineries. At the same time, the government needs to know to what extent new techniques are being used by farmers.

2. Sources Of Agricultural Statistics

Four main sources of agricultural data are censuses, surveys, administrative records and informal facts.

2.1. Censuses

An agricultural census is a large-scale data collection exercise undertaken at infrequent intervals. It is designed mainly to collect data on agriculture and other stock type data. In general, there are two main objectives of an agriculture census; (i) to collect data on agricultural structure which do not change rapidly from year to year, (ii) to provide a frame for conducting other surveys on the basis of agricultural holdings. Holdings are also used to generate sampling frames for collecting current statistics. Ideally, censuses use a method called complete enumeration; but in practice, this method is expensive and time consuming.

Myanmar's latest Agricultural Census was carried out by the Settlement and Land Records Department in 1993 with financial and technical assistance from UNDP/FAO. The primary objectives of the 1993 Myanmar Census of agriculture are: (i) to provide comprehensive and reliable data on food production and other agricultural activities required for planning purposes, and (ii) for strengthening the local capacity to formulate, implement and monitor various development programmes.

The 1993 Myanmar Census of Agriculture provides the users with a wide range of information on agriculture activities including average cropping intensity, temporary and permanent labour, livestock etc. The set of census reports by States and Divisions gives a comprehensive picture of agricultural situation.

2.2. Surveys

Ad hoc surveys are often conducted to collect data on agricultural production. Myanmar has carried out different sample surveys to meet the data requirements of various departments. Surveys conducted by Central Statistical Organization will be discussed in detail.

2.3. Administrative Records

Administrative records too provide agricultural statistics. Data on agricultural sector are obtained as a by-product from routine reporting system. Reports released by the Settlement and Land Records Department, Myanma Agriculture Service and by other publications of line ministries contained information on agriculture including livestock and fisheries.

2.4. Informal Data Sources

Informal data sources can be defined as those sources which collect data that are not based on formal statistical techniques. Even then, these sources are regarded as alternative sources for additional information on the subject under study.

Informal data sources are: -

1. Remote sensing
2. Early warning systems
3. Food insecurity and vulnerability information and mapping systems (FIVIMS)
4. Micro-surveys
5. Rapid rural appraisal

III. ROLE OF CENTRAL STATISTICAL ORGANIZATION FOR DATA COLLECTION

The statistical System of the Central Statistical Organization can be considered as decentralized . In Myanmar, Planning and Statistics Departments exist in almost all ministries and statistics are being compiled independently by each ministry to serve their own purposes. CSO collects data in accordance with the 1952 Central Statistical Authority Act, No.34 and plays a key role in the national system of statistical information as prescribed in Section (1):

1. To develop a comprehensive, efficient and reliable statistical system for social and economic policy, effective planning and administration;
2. Review and advise on all statistical operations of the Union Government whether performed for statistical, administrative or other purposes;
3. Coordinate and integrate statistics and statistical operations;
4. Establish, prescribe and maintain the highest Statistical Standards;
5. Organize and conduct social and economic censuses or surveys with reference to Burma's (Myanma's) economic needs and requirements either on a prepared planned basis or on short notice as may be required.

CSO is the only authoritative Organization in Myanmar that has the mandate to collect, process, organize and supply data for the use of planners, policy-makers and other users in the country as well as international bodies. It is one of the CSO's prime functions to provide timely and reliable data to those who are in need of statistical information.

CSO sometimes collects data by means of physical observation, personal interview, small enquiry, method of registration, transcription from official records and conducting surveys. All organized data in CSO are processed stage by stage before presenting final results. Data processing is done either manually or using computers.

Major statistical publications of CSO are as follows:

1. Selected Monthly Economic Indicators (bi-monthly)
2. Statistical Yearbook (bi-annually)
3. Agricultural Statistics (bi-annually)

4. Statistical Abstract (annually)
5. Bulletin of Exports (annually)
6. Bulletin of Imports (annually)
7. Statistical Profile of Children and Women (bi-annually)
8. Survey on Children and Women (ad hoc)
9. Vital Statistical Report (annually)
10. Household Income and Expenditure Survey (ad hoc)

IV. DATA DISSEMINATION

CSO has long been disseminating economic and social data by printing text and tables in book form. Electronic version print form has been attempted with a view to reach those who access to computers. Statistical Yearbook of Myanmar 1995, with Socio-economic time-series data, covering the decade 1985-86 to 1994-95 was first put on diskettes for use on IBM or IBM-compatible computers. CD-ROM versions of the 1997 and 1998 Statistical Yearbooks are now available to the public.

In capacity building, CSO organizes in-house training programme for the staff. Some junior statisticians have been training abroad at the Statistical Institute for Asia and the Pacific (SIAP) Tokyo, International Education Centre (ISEC), Calcutta, Bureau of Census, Washington, and Institute of Social studies The Hague.

V. AGRICULTURAL DATA COMPILED BY CSO

CSO has been compiling various data related to food and agriculture for many years. Food and agriculture involve a series complex relationships among physical, climatic, biological, environmental, economic and social processes. Data received from various sources are included in CSO publications such as Statistical Yearbook, Agricultural Statistics, Statistical Abstract, etc.

Data on agriculture can be classified into the following groups: (1) weather and land utilization, (2) Agricultural Inputs, (3) Agricultural Production, (4) Livestock and Fishery, (5) Prices and share of Agricultural in GDP, (6) Food and Non-food Expenditure Per Month at Household Level, (7) Export and import of agricultural commodities etc. These items are organized into 252 tables and published by CSO in Collaboration with Department of Agricultural Planning, the ministry of Agriculture and irrigation.

The United Nations' International Standard Industrial Classification (ISIC) provides a framework for classifying all economic production activities into 9 Major Divisions. They are in turn subdivided into Divisions and Major groups. Major Division I is for the agricultural sector which is again subdivided into 3 Divisions and 5 Major Groups. They include agriculture, livestock, fishery, hunting, logging, trapping which belong to the agriculture sector.

CSO compiles agriculture data according to ISIC definition. Major sources include departments like Settlement and Land Records Agricultural Planning, Agriculture Service under MOAI. Other sources include such Ministries as Defence, Home Affairs, Forestry, Fishery, Cooperatives, and Transport. Yangon City Development Committee is also an important source of Agricultural sector.

Based on the resource endowment of the country, Myanmar has laid down the following economic objective.

Development of agricultural as the base and all-round development of other sectors of the economy as well.

VI. SCOPE OF AGRICULTURAL DATA

1. **Reference :** Agriculture Statistics for the agricultural sector.
2. **Importance of the sector:** Economic development of Myanmar depends on the agricultural sector. Reliable agriculture statistics is a means to the implementation of the four economic objectives of the country and the successful achievement of the goals by coordination with related economic sectors.
3. **Characters of the topic:** Crops are sown by farmers to provide people with food, shelter, clothing and other essential needs. Crops are of two types: food and non-food. Agriculture produce covers crops like - cereals, oilseeds, pulses, spices and condiments, tobacco and betel, beverages, vegetables and fruits, fibre and miscellaneous. Forestry, Fishery and Livestock also belong to the agricultural sector. Agricultural statistics is concerned with weather and rainfall, land use, irrigation, agricultural implements, draught bulls and bullocks, farm machinery, fertilizers and pesticides etc.
4. **Uses and Application:** In Myanmar, the economic structure is based on Agriculture. Achievements of goals in various sectors depend on systematic coordination of agricultural statistics between the agriculture sector and the other economic sectors. For example, the need for raw materials by agro-based industries, agriculture surplus for export by trade sector. Agriculture Statistics is useful for those who are engaged in trading agricultural produce. Various organizations are interested in agriculture statistics. Since World Bank, Foreign missions, University Students and private business community use agricultural statistics, it is important to make available timely and reliable data on agriculture.
5. **Reliability of Statistics :** Agricultural Statistics for the public sector is valid and reliable. So too for the Cooperative sector. Privatisation following the adoption of the market oriented economic system, the quality of data for the private sector suffers from incomplete coverage. The holdings of agricultural land are occupied either by owners or tenants. Since a large majority of farming was done by the private sector, it is difficult to get reliable data over vast stretches of cultivated land in time. Coordination among line ministries and co-operation between business communities and peasants is to be encouraged in collecting information regarding agricultural activities.

VII. THE SURVEYS CONDUCTED BY CSO

The Central Statistical Organization (CSO) conducts various sample surveys to fill the gaps in the existing statistics to provide users with data, which they require from time to time. CSO uses proper sampling designs in order to get multipurpose data related to economic, social and population conditions with limited resources accompanied by statements on the precision of estimates made on sample observations.

Surveys conducted in recent years as well as in the past by the CSO are Household Income and Expenditure Survey (1997), National Mortality Survey (1997), Sample Survey on Evaluation of Vital Registration System (1995) Groundnut Survey (1978), Agriculture Survey (1972-73, 1981-82, 1983-84), Industry Survey (1975-76, 1977-78, 1978-79, 1980-81), Transportation Survey (1965-66), Water Craft Survey (1970-71), Livestock Survey (1973-74) etc.

The Sample design used in conducting the Agriculture Surveys was three-stage sampling. The method was essentially with implicit stratification using Probability Proportional to Size and Systematic Sampling in selecting ultimate sampling units. It needs some explanation as to why and how this method was chosen in conducting Agriculture Survey by CSO beginning 1978. The sample selection procedure for Groundnut Survey (1978) in Ayeyarwady Division is given as an illustration in appendix-1.

CSO conducted a survey on Groundnut Seed Programme in 1978 with assistance from World Bank. In January 1978, a meeting was held at CSO with heads of divisions and senior members from CSO, representatives from the departments of Myanmar Agriculture Service and the Settlement and Land Records Department. The director-general of CSO discussed among others the following points-

1. objectives of the survey
2. sampling design
3. questionnaire design
4. construction of frame
5. cost of survey
6. date of starting survey

Regarding sampling design, stratified three-stage sampling was accepted but it was modified to use Probability Proportional to Size Systematic Sampling (PPSSS). From this time onward, CSO used the same method in conducting Agriculture Surveys.

The questionnaire design was to meet the requirements of the objectives laid down for the crop under study. In general, the questionnaire consists of the area sown, harvested, production, yield, method of cultivation, loan for crop, utilization of seeds, fertilizers and pesticides used, cost of cultivation by stage, capital expenditure, buying and selling prices, agricultural equipment, depreciation, maintenance, market and transportation, investment for the crop, Labour force and wages etc.

The following computations were also made using the formula expressed below-

$$\frac{K}{Y} = \text{Average Capital - Output Ratio (ACOR)}$$

$$\frac{\Delta K}{\Delta Y} = \text{Incremental Capital - Output Ratio (ICOR)}$$

$$\frac{\Delta K}{Y} = \text{Rate of Return}$$

Where,

K = Capital Investment

Y = Value of Output in real terms during the year

ΔK = Investment during the year under survey

ΔY = Increased value of output over that of previous year

XIII. CONDUCT OF AGRICULTURE SURVEYS

Conducting Agriculture Survey by CSO involves three main stages, namely (1) planning stage, execution stage and analysis and reporting stage. Based on these stages, the following steps are taken to implement various survey operation-

1. Setting objectives of the survey
2. Choosing of the survey design
3. Designing the questionnaires
4. Determining the data to be collected
5. Deciding the method to be used for collecting data
6. Choosing sampling units
7. Coding Raw Information collected and processing data
8. Scrutinizing data for inconsistencies
9. Doing statistical analysis and reporting
10. Drawing plans for the Dissemination of survey results

CSO usually takes about 30 days to collect the data required. Operational programmes are divided into two phases (I) (sample) frame construction and (II) field operation.

Phase .I Frame Construction (7days)

1. previsit to selected townships
2. selection of the required townships
3. preparation of list of villages from which sample selection is to be made
4. preparation of estimated number of crop-growers in each village of selected townships.
5. selection of villages for the survey
6. listing of frames in each selected village
7. building frames for the survey
8. discussion about the problems, such as security, transport, training, volunteer service etc with local authorities concerned
9. report back to the head office about the experiences and general situations

Phase . II Field Operation (23days)

1. choice of temporary office
2. recruitment of enumerators for the survey
3. training supervisors and enumerators
4. demonstration for the questionnaire
5. exchange of experiences
6. checking and editing the questionnaires already filled
7. coding at the main office
8. computer runs
9. organizing tables
10. report writing

IX. REVIEW ON AGRICULTURE SURVEY

CSO stopped conducting Agricultural Surveys in 1984-85, and continued to conduct the other surveys. Myanmar being an agricultural country, it is really necessary to conduct Agriculture Surveys at national level; Previous Surveys were conducted only at the regional level. With a steady growth in the world population, there is a rising demand for food for the people. Myanmar, on its part, is tackling the global problem by applying practical measures in order to boost food production. Agriculture Surveys are closely related to food security data and analysis. And so Agriculture Surveys should be conducted at regular intervals to investigate issues on food security.

X. PROBLEM ON CONDUCTING AGRICULTURE SURVEY

CSO has limited staff to conduct surveys. Resources will be required to conduct Agriculture Survey at the national level; demands will be great in terms of money and manpower. Moreover, CSO has been conducting other regular and adhoc surveys to produce data that meet the pressing needs of the country. Surveys in the future should be conducted with the cooperation of the Ministries concerned. This is the only reasonable solution for the problems faced by people engaged in development planning.

XI. SOME IMPERATIVES OF AGRICULTURAL INFORMATION

There are many striking features on food and agricultural information of which some imperatives, sown acreage of crops, production and irrigation systems are analyzed below.

1. Sown Acreage of Crops

Myanmar is still a country with an agro-based economy. Development programmes of the State depends to a great deal upon the progress of the agricultural sector. Over 25% of Myanmar's exports become from agricultural production, and over 65% of the working population of the country is engaged in agricultural pursuits. Since Myanmar's potential for development is solidly based on the effective use of natural resources viz agriculture information; reliable statistics on agriculture is a key factor in the development process.

The country is systematically reclaiming fallow and virgin land for cultivation of crops viz paddy, various oil-seed, beans and pulses, sugarcane, cotton etc. The practice of multiple and mixed cropping has been encouraged on all arable land in increasing cultivated acreage, especially extending cultivation of summer paddy through irrigation systems. In Myanmar, paddy, the staple food occupies about 50 percent of total sown area under various crops.

Statistics on area sown for about 60 crops has been systematically collected for monitoring agricultural development. For statistical purposes crops are classified into two types, permanent crops and temporary crops, Permanent crops refer to those which occupy the land for a long period of time and do not have to be replanted. Temporary crops are the ones with a growing season of less than a year which need to be replanted after each year. For permanent crops, changes in area will indicate the extent to which future production may

increase or decrease. For temporary crops, particularly staple food crops, knowledge of the area under cultivation is needed for management of the food system and ensuring that national supplies are sufficient to meet national demand. Reliable estimates of land classification, the area sown, harvested for different crops are required for different purposes.

At national level, the government needs to know the area under crops in order to estimate levels of production which is the most important factor for making decisions related to national food security.

Area Classified by Type of Land is shown in the table (1), expressing the situation of the land use in Myanmar. Net area sown in Myanmar is increasing at a steady rate of growth and at the same time, there is nearly about 20 million acres of cultivable waste land. See table 1.

Statistics on Area Sown, Harvested and Destroyed are shown in the table (2) for over six decades from the year 1936-41 to 1995-96, followed by the next two years, 1996-97 and 1997-98. Gross area sown in the years 1950/51, 1955/56 and 1960/61 could not reach the pre-war level; it even registered a decline of 3.9, 2.5 and 1.5 million acres each year below the area of pre-war average. However, gross area sown began to rise in 1970-71, exceeding that of pre-war average and continued to rise up to 1997-98, registering the highest level in 1995-96, an increase of 70.51 percent over that of pre-war average.

Data on Sown Acreage of Selected food crops are given in table (3) from 1936-41 to 1997-98 in terms of unequal intervals. Sown area of paddy in 1936-41 was 12.4 million acres. Sown area of paddy is about 50 percent of total sown area of all crops. The sown acreage of paddy in the post-war years failed to meet the 1936-41 level. Sown acreage of paddy in 1975-76 rose by nearly 0.4 percent over 1936-41, and exceeded the sown acreage of paddy in 1936-41 (average), for the first time, registered an increase of 12.9 million acres. But the sown area of paddy declined during 1980s. However, the sown area of paddy reached the peak in 1995-96 and, registered 15.2 million acres Table (3).

Utilization of Agricultural land for ASEAN countries is described in the table 4. Myanmar's total land area was 65.8 million hectares, occupying the third position, after Indonesia and Thailand. But Myanmar's agricultural land in 1989 was 10.0 million hectares and, in 1998, was 10.1 million hectares, an increase of 0.1 million hectares more than 1989 (from 20.1% to 23.1%). No other country shown in the table was as progressive as Myanmar.

2. Agricultural Production

Agricultural Statistics is an important part of the system of food and agricultural information in Myanmar. Agriculture is still the predominant economic activity. The government has recognised the importance of the agricultural sectors. Growth in production is essential to ensure overall economic and social development, and in particular, to deal with problems of poverty and malnutrition. Increases in output are needed just to keep pace with the need for food and other items of the growing population. As data on agricultural production are important, the provision of reliable and up-date information on the level of agricultural production is given top priority.

A majority of the rural poor in Myanmar depends on agriculture for employment and income. Agricultural growth thus holds the key to a sustained reduction in rural poverty and promotes quality of life in rural areas. In general, the measurement of agricultural production is closely associated in estimating the following social and economic indicators.

- to perform as a major component of measures of overall economic growth ,
- especially measuring GDP;
- to monitor the production of food in the country in order to make an assessment of the national food security;
- to investigate trends in production and incomes of farmers;
- to identify requirements for inputs such as fertilizers, pesticides; seeds ;
- to identify priorities for agricultural research;
- there are still other items to be identified based on activities of agricultural production.

Figures on production of some important food crops are shown in table-5 from 1936-41 (average) to 1997-98. The production of paddy in 1936-41 (average) was 7426 thousand tons, and in 1997-98, it was 16391 thousand tons. From 1965-66 to 1997-98, the production of paddy continued increase. See the table(5)

Food production and population growth is a related question. A spot check is made below.

The debate over" how many people the Earth's limited land and water can support" has been going on since Malthus discovered his population theory. According to his theory, increases in human numbers would eventually outstrip food supply and precipitate the collapse of society.

In 1941, Myanmar population was 16.8 million, and in 1997-98, the population stood at 46.4 million, increasing about 30.4 million, nearly 3 times within 57 years.

The production of paddy in 1940-41 was about 7.4 million ton, in 1997-98, it was 17.0 million ton, registering an increase of 9.6 million ton.

Can Malthus' theory be overtaken by quantum leaps in Myanmar agricultural technology? Myanmar agricultural system could keep food production ahead of population growth?

A solid conclusion can be drawn that the production of agricultural sector has been on increase, not because the area sown has been developing, but because yield per acre has been increasing significantly due to agricultural technology that is being applied in all operational sectors of food production.

For example, according to table 6, sown acreage of paddy in 1931-40 (average) was 12.21 million acres and the production was 7.11 million metric tons. After over 50 years, in 1990-91, sown acreage was 12.20 (Less than 0.01 million acres) million acres and production was 14.00 million metric tons. Area sown remained nearly the same, but production increased twice that of the pre-war average.

Adoption of new technologies and commercialization of agriculture will continue to be the key criteria in enhancing agricultural growth. In Myanmar, advances in irrigation, pesticide and fertilizers , genetically superiors, disease –resistant , high – yielding crops and improved farming techniques have allowed farmers to increase both the acreage under food crops and the yield from a given amount of land.

For further information , the area sown, production and export of paddy are given in table 6. Similarly, the situations of paddy production and cereals production of ASEAN countries are shown in table 7 and 8 respectively.

XII. IRRIGATION SYSTEMS

Myanmar still has vast water resources to be developed. Of the annual total volume, ie 876 million acre-feet of water flowing into all rivers and streams of the country, less than 5% has been put to use at present.

Irrigation systems play a vital role in the development of agriculture. The Ministry of Agriculture and Irrigation (MOAI) is implementing irrigation projects for systematic utilization of water resources.

The area of crop production under irrigation had stood at only about 12% of net area sown for many years. Irrigated area is shown in table 9. Total irrigated area from 1970-71 to 1992-93 was at only around 12% of the total net area sown. A significant increase of 2.6 million acres (15.3%) is observed between 1992-93 and 1993-94. Irrigated area under various crops had also increased continuously from 1993-94 to 1997-98

Information on irrigation systems; Irrigated Area by Type of Irrigation and Area Irrigated is given in tables 10 and 11.

According to the table 11 , total irrigated area remained unchanged onward from 1936-41 to 1962/63. During these two decades , the total irrigated area failed to meet the 1936-41 record. Season and Crop Report figures show that the total irrigated area in 1965/66 had increased by 357 thousand acres. Between 1965-66 and 1985-86, the average irrigated area increased by about 100 thousand acres , compared with 1936-41(average).

As the availability of adequate water is crucial for the agriculture sector , attention has been paid to all resources of water. Water resources play a key role for multiple cropping. To achieve the export target of three million tons of paddy it needs to be cultivated 18 million acres ; 14 million acres under monsoon paddy, and 4 million acres under summer paddy.

Annual Water Use and Future Projections by River Basin are given in table 12. Success in agriculture means greater sufficiency in food production and self –reliance in agri-inputs. Stored water , pumped river water and underground water provide better chances for irrigating crops grown in arid zones as well as crops grown during the dry seasons.

In Myanmar , altogether 138 dams were built during the 900-year period. A total of 111 dams have been built in the country within ten years after the SPDC Government has taken over the affairs of State in 1988. A total of 249 dams provide irrigation water in Myanmar.

Myanmar's position for cultivation by using irrigation systems is shown in table (13) and (14) along with other ASEAN countries.

XIII. LIVESTOCK AND FISHERY STATISTICS

Myanmar is striving to produce enough food so as to be able to feed her population. Producing sufficient food is the key among the three basic needs-food, clothing and shelter. The Livestock and Fishery Sector is one of the most important productive sectors. This sector has a vast potential for further expansion and for export. Now programmes are being made for the improvements in the method of raising Livestock, animal husbandry and fish breeding.

1. Characteristics of the Sector

Livestock Statistics deal with livestock breeding and production of meat, milk, eggs and animal fats etc. Raising of Livestock forms an important part of rural economy.

Fishery Statistics are concerned with fish breeding and total catches from fresh and marine water.

2. Sources of Statistics

The data on Livestock and Fishery are presented with 11 tables in the Statistical Yearbook , giving proper headings for each table. Data on fish production are obtained from the Department of Fisheries , Myanma Fishery Enterprise , Fishery Co-operatives and private wholesalers. Livestock statistics are received from the Yangon City Development Committee , the Livestock Breeding and Veterinary Department , Myanma Farms Enterprise , the Cooperative Department , the prison Department, the office of the Ministry of Defence and the Livestock Feedstuff and Milk Products Enterprise.

3. Importance of Fishery Sector

Myanmar has a long coastline ; 2832 kilometers in all. The continental shelf covers 228, 781 sq. kilometers and Myanmar's exclusive economic zone is 486,000 sq. kilometers wide. The Fishery Sector has a Large Potential for development . There are plans for expansion and increasing the production of the sector and a separate Ministry has already been formed for this purpose.

4. Reliability and Improvement

Livestock and Fishery Statistics for the private sector is not as reliable as those in the public sector and co-operative sector. The reasons are that private sectors are very wide and their economic activities are scattered all over the country. And it is very difficult to get adequate staff or facilities to collect data from each and every farm, or from individuals. Improvements should have to be made to collect data in the private sector by taking periodic surveys.

XIV. PROPOSAL FOR IMPROVING THE AGRICULTURAL SECTOR

Myanmar, being an agricultural country, needs to carry out three imperative tasks for the agricultural sector. They are agricultural accounts, food balance and food accounting matrix.

The first one describes how sets of economic accounts can be put together for the agricultural sector. The agricultural sector accounts are the most important component of the national accounts. It is, however, essential that the accounts should be prepared in a standard way.

The second one deals with food balance sheets. A food balance sheet is a set of accounts which describe the supply and utilization of food commodities in a country, usually taken as of one year. In reality, a food balance shows where the supply of food commodities comes from and how they are used. Preparation of food balance will be very useful to Myanmar in considering food security issues.

A food accounting matrix is an extension of a food balance sheet which is a part of the food system. This system indicates how food commodities move from producers to consumers. A food accounting matrix is described how the marketing and distribution system for food commodities work. On the other hand, the matrix is just a way of representing commodity flows between agents.

Myanmar should compute those three items for the benefits of the country. The programmes should be implemented in collaboration with the Ministries concerned.

XV. CONCLUSION

This paper is simply a general expression. It proves very difficult to describe the national statistical systems in a such way which conveys a clear and accurate picture. This type of Seminars should be held frequently in the country with all interest and responsible organization including the NGOs to promote an integrated national agricultural statistical system. It would be the only way to have the attainment of a higher quality of data through concerted efforts of all Ministries concerned.

Since agricultural statistics are prerequisites for effective development for national economy, it is of vital importance to collect series of reliable and comprehensive data. Timeliness is an important factor because timelag would decrease the utility of data. It would be only an evidence of historical facts to those who are in need of urgent information for a set of data on particular subject. Now the time has come to solve these problems by means of cooperation and coordination among the departments concerned as they may be confusion and inconsistency if information are available from different sources.

METHODOLOGICAL REVIEW OF STATISTICAL ACTIVITIES FOR CROP STATISTICS IN MYANMAR

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INTRODUCTION

The Union of Myanmar is geographically situated in Southeast Asia between latitudes 09° 32' N and 28° 31' N and longitudes 92° 10' E and 101° 11'E. The total land area is 261, 228 square miles (676,577 sq. km). It stretches for 582 miles (936 kilometres) from east to west and 1275 miles (2051 kilometres) from north to south. The length of contiguous frontier is 3828 miles (6129 Kilometres), sharing 1370 miles with China, 1310 miles with Thailand, 832 miles with India, 1687 miles with Bangladesh and 148 miles with Laos respectively.

Union of Myanmar is basically an agricultural country with about 75 percent of the population residing in rural areas. The agriculture sector provides about 63 percent of the total labour force and contributes 36 percent of GDP and 35 percent of total foreign export earnings.

LAND UTILIZATION

Myanmar has net sown area of crops about 23.9 million acres and much of the fallow and culturable waste land are gradually brought under cultivation. During the period 1996/97 to 2000/2001, Ministry of Agriculture and Irrigation has laid down plans for reclaiming 0.7 million Acres of fallow land and 0.5 million acres of waste land. Total gross sown area is also targeted to reach about 39.37 million acres. Present status of land utilization is shown in Table-1.

Table-1 **Land Type by Area in 1999/2000.**

	Type of land	1999 – 2000	
		Million acres	million hectares
1	Net sown acreage of crop land	23.90	9.67
2	Fallow land	1.90	0.76
3	Waste land	18.10	7.32
4	Reserve forest	28.71	11.62
5	other forest	51.92	21.02
6	other land	42.66	17.27
	Total	167.19	67.66

ADMINISTRATIVE DIVISION

At the province level, Myanmar is divided into seven states and seven Divisions. The states/Divisions are sub-divided into 64 districts which are further divided into 324 townships. The townships are again subdivided into 13,759 village-tracts. The basic administrative unit in Myanmar is the village-tract. Each village tract is administered by a committee which is directly supervised by township Peace and Development Council.

DISTINCT FEATURES IN MYANMAR

Since the lowest administrative unit is the village tract, statistics are collected usually on that basis. The village tract Peace and Development Council is an integral part of the agricultural statistics system and it has to give necessary assistance to SLRD staff in the collection and compilation phases of information and in keeping records for the village tract. Myanmar has therefore a very closely knit structure of local administrative system. This network helps in coordinating statistical activities at the local level and ensures close cooperation between farmers and government agencies.

The distinctive feature of the statistical base is the large scale cadastral maps that is 1:3690. The mapping system has almost a nation-wide geographical coverage. They are updated continuously and are used as basis for compiling statistics by area. Information on agriculture sector is collected on a complete enumeration basis.

Myanmar also has the government statistical agencies which have field staffs who have thorough knowledge of local climate, topography, local crop technology and familiar with the local people and their customs.

STATISTICAL SYSTEM OF THE COUNTRY

The Statistical system of Myanmar is a decentralized system. Each ministry has its own statistical unit to serve its own needs either through the survey method or as a by-product of administration. The principle agency for the collection and compilation of crop statistics and land utilization statistics is SLRD under ministry of Agriculture and Irrigation.

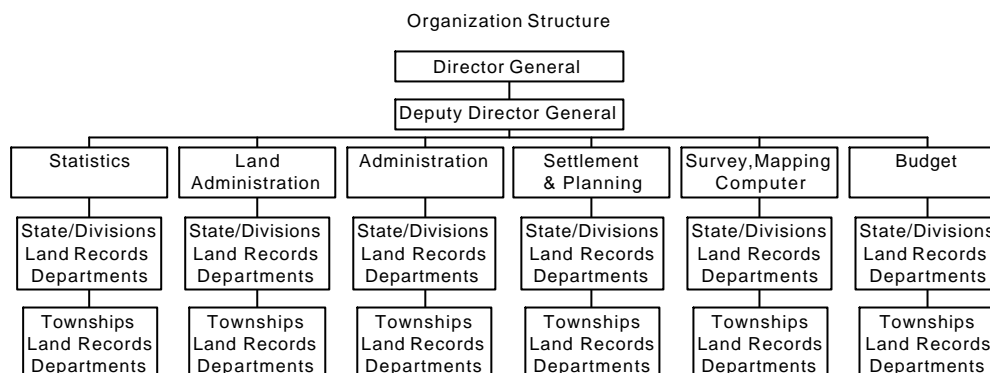
STATISTICAL PROCEDURES

The Settlements and Land Records Department (SLRD) is the only government agency whose predominant activity is the collection and dissemination of Land Utilization and Crop statistics. The SLRD's statistical activities include; (i) monitoring the progress of land preparation and cropping, condition of weather and crops, (ii) making crop forecasts, (iii) carrying out periodic crop surveys, (iv) compiling data on farmer and farm size distribution, (v) taking annual inventory of agricultural machinery and implements, and (vi) compiling the annual Season and Crop Report. This report provides statistics on rainfall; land use; irrigation and flood protection; crop acreage, yield per acre and production; multiple cropping; inventory of agricultural machinery and implements. Agricultural statistics is collected through the network of 14 state/ divisions and 286 township Land Records offices.

ORGANIZATION OF SLRD

In 1999, the State Law and Order Restoration Council Government reorganized SLRD and sanctioned a staff strength to 12870 personnel and the director general is the head of the department. The organizational structure is shown in chart 1.

Chart-1 : Organization Structure of SLRD



METHOD OF DATA COLLECTION AND PROCESSING

The Settlement and Land Records Department collects area statistics and production statistics primarily through its Crop Forecasts and Survey Operations.

a) Basic Unit

The basic unit in collecting agricultural statistics in Myanmar is the 'Kwin' . A "kwin" is a survey unit that covers about 500 acres and usually has natural and man-made features such as streams, rivers, roads, etc., as its boundaries to facilitate on ground recognition. A "Kwin" indicates a farmer's plot and its utilization (whether it is utilized for agricultural purposes or non-agricultural purposes). It is surveyed cadastrally in the scale of 1: 3960. These cadastral "kwin" maps are updated continuously. The surveyor is expected to bring every 'Kwin" map and its registers at the time of his visit to the field. Up till now 77459 kwins and 7578 blocks are surveyed cadastrally and maps produced.

b) Basic Registers

The following registers are kept for each kwin map:

1. Register of areas

Register of areas record the area of each field in the kwin up to two decimal places of an acre.

2. Register of fields

Register of fields includes (i) area of all separate fields which are grouped under each parcel of land held by one holder; (ii) soil classes according to fertility and by main kinds.

3. Register of holdings

In the register of holdings, the same entries as in the register of fields, except those related to non- agricultural lands, are entered parcel wise omitting the details for each field. In addition, the name of the holder, his status and tenure are also recorded.

The term "holding", as it is used in connection with the above registers does not have the same sense as the concept of holding use elsewhere. Here it is referred to as a parcel of land worked by a farmer and not necessarily his total land

4. Register of crops

Working from the information contained in these registers and the seasonal crops marking operation on maps, the revenue assessment and statistics register (Register of Crops) is compiled.

This register is a single basic frame upon which all of the area statistics and crop production statistics are based. It gives the following information:

- Name and residence of farmer
- Main kind and soil classes of land
- Area of all separate plots grouped under each holding held by one farmer
- Actual area of all crops planted during the year
- Area of damaged (failed) crops
- Harvested area of all crops
- Fallow land area
- Assessed area
- Land revenue and water tax assessed
- Gross planted area, net planted area of the kwin
- Name of crop and area planted more than once
- Name of mixed crops and its area

CROP FORECASTING

The object of crop forecasting is to provide statistical information on area under various crops, their probable production and the possibility of agricultural distress primarily for general information and secondarily for the benefit of trade. The crops for which forecasts are required are specified by the Ministry of agriculture. Periodical forecasts for planted area, harvested area, probable production per acre and total production are required at present for 14 important crops. These are: (1) Monsoon Rice, (2) Summer Rice (3) Monsoon Groundnut, (4) Winter Groundnut, (5) Early-monsoon Sesame, (6) Late-monsoon and winter Sesame. (7) Summer Sesame (8) Wagyi Cotton, (9) Mahlaing 5/6 Cotton, (10) Long Staple Cotton, (11) Jute, (12) Sugarcane, (13) Wheat, and (14) Rubber.

Usually three forecasts are made for each crop. The fourth forecast which is only required for rice and long duration cotton crops. The First Forecast is scheduled to coincide with the usual seeding time and the Last Forecast with the usual harvesting time of a particular crop. The figures for the forecasts are framed by surveyors visiting the field for about a week each time, assessing the extent of area cropped, condition of standing crops and interviewing key farmers and other knowledgeable persons. Planned production target for the year, prevailing weather conditions, crop prices, labour availability, sufficiency of draught power and implement, agricultural financing and input situation, land disputes allocation of lands by government performance in last five years as reflecting the recent trends, are taken into account in preparing and editing the forecasts.

Assistant staff officers and Head of Township Land Records Offices also visit the fields to supervise and inspect the work of surveyors and to arrive at independent estimates for the forecasts.

◆ Details of the Crop Forecasts

The following information on crops are included in the forecasts:

- **PLANTED AREA:** The planted area or sown area is estimated on the basis of actual seeded area and the prospect for the whole season, taking into consideration, the view of cultivators, the planned target for the year,
 - prevailing weather condition, crop prices, availability of labour, sufficiency of draught animals and implements, agricultural financing and input situation, previous years sown acreage and recent trends , land disputes, allocation of agricultural lands by the government, sufficiency of water resources, etc.
- **HARVESTED AREA:**The harvested area is estimated as much the same manner as for the sown area. In addition, germination rate of seeds, actual failure of crops due to draught, flood and pests at the time of forecast and replanting of damage area if any are taken into account. To arrive at the realistic figure for harvested area, average harvested area for preceding 5 years (omitting the exceptionally bad years or good years) is calculated and use as a base. As the season progresses, up to date information on actual situation is incorporated to produce successively improved forecast of harvested area.
- **YIELD PER ACRE:**The basis for forecasting yield of crops is five years average similar to that of harvested area mentioned above. The rate of yield is also based on the weather, especially rainfall, sufficiency of water from irrigation, method of cultivation used, crop diseases, pests, use of organic and chemical fertilizers, use of certified seeds, germination rates and weeding conditions. Aggregate weight, average yield is obtained by calculating yield by crop variety and by season of cropping.
- **TOTAL PRODUCTION:** Total production is estimated by using harvested area and yield per acre obtained as shown above. Five years average is also used to gauge plausibility of the total production.

◆ Editing of forecast figures

Assistant staff officers of the Township Land Records Department prepare the forecast by processing the data obtained from the surveyors. Particularly at the township level, staff officers of the township Land Records Department, relying on the independent estimation framed on his field visits and supplementing it with the information obtained from his assistant staff officers and other knowledgeable persons edited the forecast. The township forecasts are transmitted through the State and Divisional Land Records Offices to the Head Office.

◆ Forecast for all crops

Forecast for all crops have to be submitted twice annually. The agricultural year, which is identical with financial, begins on 1st April and ends on 31st March. The first forecast deals with period ending 30th September. The second forecast deals with period ending 31st March. Sixty of main crops are grown in Myanmar. Planted area, harvested area, rate of probable yield per acre and probable production of all sixty main crops are shown in the forecasts. In the first forecast actual planted area of pre-monsoon crops such as

rice, jute, cotton, sesamum (early rain), groundnut (rain), maize(rain), chilies (early rain) and certain pulses are obtained. At that time only winter crops and mayin (winter rice) remain uncultivated. In preparing the forecast of

these crops, previous years' achievements, weather condition, planned figures are also considered. By the end of March the second forecast is prepared. By this time, all crops grown during the agricultural year have been harvested. The production of all crops have been determined finally.

CROP SURVEYS

Crop Surveys are carried out to get reliable data on crop acreage and production. Field organization of SLRD consists of revenue surveyors whose duties comprise maintenance of records, crop marking, crop surveys, collection and compilation of agricultural statistics, assessment, survey, mapping, compilation and other miscellaneous work. As field work has to be done as far as possible while the crops of different seasons are on ground, the surveyors take the field trips mostly throughout the year.

◆ **Method of Enumeration**

Area figures are based on field to field and plot to plot visit and all crops (varieties of crops) are marked on each respective plot of the kwin maps and then entered in the registers of crops. The crop surveys are meant to cover all the crops grown in an agricultural year, therefore three crop surveys, each timed to coincide with the major growing seasons, are carried out annually.

At the schedule time for a crop survey the surveyors visit the kwins and record the crop information on the maps by each field using prescribed symbols.

There are three main crop surveys. They are:

- Monsoon crops survey
- Rice Survey and
- Winter crops survey.

(a) **Monsoon Crops Survey**

The Monsoon Crop Survey covers all the pre-monsoon and early-monsoon crops. Major crops are cotton, Jute, oilseeds, maize, and sugarcane. While surveying the monsoon crops, 34 kinds of other mid rain crops are also surveyed. At the same time, yield and production are estimated by subjective methods.

(b) **Rice Survey**

Rice survey is the most important because over 12 million acres are grown with rice in Myanmar. Rice survey consists of high yielding varieties, local high yielding varieties and others. Seasonally it consists of (i) pre-monsoon rice (ii) monsoon rice (iii) late monsoon rice and (iv) Mayin and Summer rice. Myanmar rice is divided into 5 types (1) A type (Emata) (2) B type (LetYwayZin) (3) C type (NgaSein) (4) D type (MEdon) and (5) E type (Byat).

Rice surveys are undertaken twice a year. The first survey covers the period ending 30th September. By the end of September, planting or transplanting of rice are almost complete. The degree of reliability of area statistics is quite high. Yield per acre is obtained by subjective methods. The second rice survey covers the period ending 31st December. The report on second survey represents the position of rice at the end of December. By this time almost all various varieties of rice have been harvested, extensive crop cutting of sample plots are carried out. The total production is calculated by the product of harvested area and yield per acre.

◆ **Procedure for estimating yield**

Sample plots are to be chosen in the following manners:-

- For every kwin, main type and species of rice to be sorted and
- For each main type, number of sample plots are selected according to quantity of the harvested area as follows:

Area	Number of plots
Area up to 100 acres	1
From 101 to 200 Acres	2
from 201 to 300 Acres	3
from 301 to 400 acres	4

◆ **Size of sample plots**

The size practiced at present is 0.001 acre or (6.6x6.6ft) square plot.

◆ **How to choose the sample plot**

In a Kwin at least two or three main types of rice are grown. At the harvest period, every field is classified in classes for good, fair and poor by species of the crops with taking into account of the opinion of a surveyor, farmers, knowledgeable persons in the village. For every 100 acres of a class three small sample plots are chosen.

◆ **Process of crop cutting**

For the size of 6.6x6.6ft sample plot, at least 2 farmers or farm labours are needed. With the help of these persons the cutting process is carried out. The paddy obtained from each plot is dried, weighted and yield per acre is calculated.

◆ **Inspection**

Inspections are carried out throughout the period of crop cutting season. The inspection teams use the same size of plot to check the yield.

Another method used for inspection is yield component method, using the formula shown below:

$$Y = \frac{a \times b \times c \times d \times e}{454 \times 46 \times 100 \times 1000}$$

where

- Y = yield per acre
- a = number of hills per acre
- b = average number of matured panicles per hill
- c = average number of grains per panicle
- d = average percentage number of ripen grains
- e = weight of per matured (1000) grains in gram

◆ **Farmer's Admitted produce**

In a kwin for each type of rice grown, enquiry for admitted outturns is made from 15% of the farmers that grow rice in that kwin. If 15% is not available at least 5 farmers are interviewed.

◆ **Determination of Production**

Based on the yield per acre and the harvested area of each type and variety of paddy the total produce is calculated and estimated. The calculations are made from plots to kwins, kwins to village tracts level and then to townships, states & Divisions level and then to national level.

◆ **Sampling for other crops**

In addition to rice, sample reaping is carried out for sesamum, groundnut and jute. For the rest of crops estimation is done by subjective method.

(c) **Winter crops survey**

Winter crops consists of groundnut, wheat, pulses, maize, tobacco, chilies, onion, garlic, potatoes, long staple cotton and jute. The total production of groundnut and wheat are obtained through sample cutting and the rest through inquiry.

For Un-surveyed Areas

The Land Records System as described above only covers the main agricultural areas of the country. In other areas, tax assessment and collection of statistics are done differently. There are three types of un-surveyed area.

- ❖ **Non-agricultural areas** in surveyed village tracts. In many village tracts, there are areas considered non-agricultural, such as forests or wasteland, which have not been surveyed. There may be some cultivation in these areas (such as Shifting Cultivation) and surveyors are meant to establish this from their visits to cultivators. They should then visit the area concerned to make estimates of the area of cultivated land and complete crop areas in the Assessment and Crop Reports in the usual way.
- ❖ **Unsurveyed Village Tracts.** Some village tracts have not been surveyed at all because there is little or no cultivation or because they have only recently come under cultivation. No Land Registers, cadastral records or Kwin maps exist. Surveyors are required to keep field books for these areas. In the field books, they draw sketch maps of all cultivated land and estimate areas based on quick survey work. The crop area collection and tax assessment are done.
- ❖ **Remote Areas.** Surveyors can not visit these areas for surveying or to collect crop data. Instead, they are asked to make contact with each village head and get information provided by him on cultivated land. Crop statistics are based on office estimates.

DATA PROCESSING

Currently, all statistical compilation work on SLRD crop statistics is done manually, most of it in the township offices. Data on crop sown in each field are added to form totals for the kwin, which are then transcribed to a separate form where they are aggregated to form village tract and township figures. For crop cutting, average yield and estimated production are first calculated for each kwin and aggregated as for the crop area statistics. Other data are compiled in a similar way.

STATISTICAL REPORTS PREPARED BY SLRD

The following reports are prepared at the end of each agricultural year.

- (a) Season and Crop Report (Year Book of Agricultural Statistics) covering; Rainfall; Areas under different categories of land use; Irrigated areas by source of irrigation and by crops; Flood protected areas by crops; Planted area, harvested area, yield per acre and production estimates by crops; Agricultural machineries and implements.
- (b) Crop outlook (covering 60 types of crops)
- (c) Numbers of farmers and farm size Distribution

PROBLEMS IN THE EXISTING SYSTEM

The main responsibility for the collection and compilation of statistics rests with Settlement and Land Records (SLRD) as stated before. The existing system is based on land records information. Crop data are recorded for each field in the country and this is also used for land tax assessment and the generation of crop area statistics. Crop cutting surveys are conducted to estimate crop yield and production.

One of the advantages of the current system is to be suitable to the management needs of the different levels of the government. Another is helpful to use the data in accordance with the administrative township level.

But, there are still existing many problems. The main problems with the existing system are:

- (a) The data collection is a very large operation and as a result, field procedures are not always strictly followed and control over field work is difficult to maintain.
- (b) Estimation of areas by using cadastral maps has the problem in updating of the maps.
- (c) There are a number of significant data gaps, especially agricultural holding and household level data, prices, farm costs, labour, farm income and consumption.
- (d) Crop forecasting procedures are inadequate.
- (e) The data are not widely disseminated and few statistical publications are issued.
- (f) The collection of statistics as a by-product of the land taxation system may affect the reliability of data.
- (g) The whole land records system and its associated registers are manual operations, records being kept in register books, maps and other documents.

POLICY PRIORITY IN AGRICULTURE AND RURAL DEVELOPMENT IN MYANMAR

Myanmar is rich in natural resources including land, water and forests and it is still self-sufficient in food production. The government of Myanmar embarked on a program of structural adjustments of the economy in the late 1980s with a view to building a modern state within the context of a market oriented economic system. With the introduction of market economy, the role of national plan was also changed.

1. Objectives in Agriculture

As Agriculture plays a crucial role in the economy of Myanmar, the present plan sets priorities for promoting economic development which increase the income of rural people. The four economic objectives are as follows:

- development of agriculture as the base together with all round development of other sectors of the economy
- proper evolution of market oriented economic system
- development of the economy with participation in terms of technical know-how and investments
- to shape the national economy be kept in the hands of the state and national peoples.

2. Strategies for the National Development

The agriculture sector provides about 63% of the total labour force and contributes 36% of GDP and 35 % of total foreign export earnings. To further enhance agricultural development, the following five strategies have been adopted:

- Development of new agricultural land
- provision of adequate irrigation water supply
- increased agricultural mechanization
- application of modern agricultural technologies
- development of agro-based industries

The Ministry of Agriculture and Irrigation also has laid down the following guidelines for agricultural development:

- to permit agriculture production freely;
- to expand the area under agriculture while safeguarding the rights of farmers;
- to permit the private sector to engage in the production of industrial crops, fruit trees and perennial crops;
- to encourage the participation of the private sector in the production of agricultural machinery and inputs.

3. Data Needs:

As agricultural development is the basis for the development of other sectors in Myanmar, all agricultural statistics have become ever more important. With the country's transition from planned to market economy, the reporting system will not be able to adequately support data requirements for development planning and policy formulation. An also, the introduction of market economy makes the data collection a more difficult work. Therefore, statistical agencies should prepare to resolve these challenges in the next few years.

RECOMMENDATIONS

- Currently, it is necessary to record crop data for each field for assessment purposes and crop area statistics should continue to be based on the existing crop recording system. To get reliable data, current reporting system need to be strengthening.
- It should be considered to expand survey items such as horticulture and perennial crops.
- A systematic programme for re-surveying and updating of cadastral maps with the help of modern field survey equipment should be introduced.
- Work on the establishment of computerized data base of agricultural and related statistics should be accelerated.
- Study and develop statistical methodologies and introduce sampling techniques on crops output/production statistics.
- Educate the field staff with statistical concepts and sampling techniques
- Study photo-interpretation and remote sensing for Agricultural statistics
- Study the data need, demand and supply and their constraints in an integrated manner
- Investigate and formalize the concepts, definitions and procedures used
- Link and share data with the Ministries concerned
- Needs organizational coordination to avoid duplication of work and complement each other

CONCLUSION

In the transition from a planned to a market economy, the continuous provision of accurate and reliable statistics is indispensable for policy makers to promote agricultural development programmes. Myanmar with a long traditional of strong statistical organizations does not use advanced statistical techniques in land and crop statistics. The introduction of sample surveys can supply objective and reliable statistics with the ability to define error margins.

The Settlement and Land Records Department has the resources in the area of data collection and data processing but less in terms of analytical capacity and need assistance for providing training to the staff in such fields of statistical techniques such as survey planning, survey methodology and data base management system.

REVIEW OF STATISTICAL ACTIVITIES FOR LIVESTOCK SECTOR

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SUMMARY

Livestock Breeding and Veterinary Department (LBVD) is responsible for the livestock sector development of the Union of Myanmar. Animal census was taken by LBVD from the year 1983-84 to 1993-94. From 1994-95 till now, animal population in each household is counted by veterinary staff with the assistance of trained personnel and village headman in respective villages on 3 month interval basis. The data for livestock products i.e. working draft cattle, milk, meat and eggs are obtained from townships every month. Some basic data on landing of livestock for meat, eggs, registered slaughtered numbers are obtained from city Municipality. Data for cattle/ buffalo and sheep/goat market, animal moved over the township, animal feed mills, shops and stores of animal feed, drugs and medicine, commercial livestock farms, production of livestock farms are collected by LBVD staff. Data for livestock and livestock products are also obtained from Myanmar Livestock Federation. Data for informal slaughter, some of non-commercial slaughter, illegal slaughter and traditional home consumption slaughter are estimates. Data for animal population and livestock products are assessed by compilation of base line data and estimated data for dissemination.

I. Organizations responsible

- Livestock Breeding and Veterinary Department (LBVD) is responsible for livestock census, data collection, compilation of statistics on livestock numbers, livestock products and Animal feed.
- Prior to 1983-84, LBVD was an organization under the Ministry of Agriculture.
- During that period LBVD staff took records of statistical data on livestock of the private sector such as: opening stock, multiplied numbers, numbers sold, numbers dead and closing stock of animals, meat, milk, egg and working draft cattle in all townships on a quarterly basis.
- After 1983-84, census and data collection on livestock of the Private sector, Government sector and Co-operative sector was undertaken by LBVD, under the newly created Ministry of Livestock and Fisheries.
- Livestock Breeding and Veterinary Department (LBVD), Livestock Feed-stuff and Milk Products Enterprise (LFME) and Directorate of Livestock and Fisheries (DLF) under the Ministry of Livestock and Fisheries (MLF) are the main institutions engaged in compilation, analysis and dissemination of livestock statistical data. Relevant livestock data are then submitted to the Ministry of National Planning and Economic Development for GDP assessment.
- National livestock statistical data covers all three sectors viz-Government, Cooperatives and Private.

II. COVERAGE OF LIVESTOCK STATISTICAL DATA

The following data on livestock and related fields are covered in compilation of data.

- (a) Animal census: current status of livestock population, i.e. cattle, buffalo, sheep/goat, pig, elephant, horse, mule, donkey, mython, poultry, duck, turkey, goose, muscovy etc.
- (b) Livestock products: draft-working animals, meat, milk, eggs, hide and skin, feather, etc.
- (c) Animal feed: animal feed resources and feed mills.
- (d) Producer's price: base data on the price of feed, building, labour, services etc.

III. ANIMAL CENSUS-TAKING

1. Organization structure and timing of census taking.

- Before fiscal year 1983-84, livestock census was undertaken in combination with agriculture census by SLRD. Annual census was taken during the month of March.
- Collected data was approved by departmental officials of SLRD, LBVD and General Administrative Department (GAD) who were members of the supervising committee for livestock census taking.
- From the year 1983-84 up to 1993-94 the activities for animal census was undertaken by LBVD.
- Livestock census was taken by Complete Enumeration Method. The period for census taken was from 1st March to 31st March. Census showed the data for closing stock of animal of current year or opening stock for coming year.
- Complete enumeration on a yearly basis for livestock census was carried out in the year 1983-84 to 1993- 94 continuously.

Forms used in livestock census taking.

Sr. No	Code of form	Livestock items
1.	001	Union total of livestock data
2.	002	State/ Division total of livestock data
3.	003	District total of livestock data
4.	004	enumerated data for cattle / mython
5.	005	enumerated data for buffalo
6.	006	enumerated data for sheep/goat
7.	007	enumerated data for horse/ ass
8.	008	enumerated data for mules/ elephant/ turkey
9.	009	enumerated data for pig/ duck
10.	010	enumerated data for poultry/ muscovy
11.	011	enumerated data for goose

2. Manpower status

Manpower was used during census period.

- Total number of 1199 veterinary staff participated as supervisors at the township level.
- Local youth was organized and 2405 youths participated as interviewers in field operation.

3. Financial status

- A total of 1.8 million kyats for transport allowance, daily allowance and stationary (paper) were spent every year for census operations.

4. Training

- Objectives of census-taking, census-taking approach, questionnaires, practice sessions for filling up data in the forms, ways of compilation and summarizing data, checking data relevancy and consistency etc. are included in the 3 day training package given to enumerator's multiplier training courses.
- Training was conducted at Central Training Centre of LBVD and at all Township - offices of LBVD. Veterinary staff and Local youths involved in census-taking are trained by trainers of LBVD.

5. Method of census-taking

- Complete enumeration.
- Enumerators take livestock census from each household by individual visit or group visit to all villages.

6. Compilation of data

- Enumerated data of individual household was compiled into village total.
- Livestock data of village total was then compiled into "village - tract total" and then into "township total". Township veterinary staff and township youth who participated in census taking help to get aggregate data for each township.
- The district LBVD compiled each "township total" into a "district total". State/Division LBVD then make further compilation by adding "district total" to get "state/division total".
- The supervision committee at various levels counter check all data before approving.
- All census data compiled by each state and division are then sent to Planning and Statistics Section of LBVD head office. Planning and Statistics Section again processes all provided data to acquire the "Union Data".
- Enumeration and compilation of census is accomplished according to the following implementation schedule:

- Census operation period	1st March to 31st March
- Compilation and summarizing of enumerated data from villages into townships	1st April to 20th April
- Compilation of data of townships into a district data	21st April to 30th April
- Compilation of data of districts into a state/division	1st May to 15th May
- Compilation, checking, processing and evaluation of the enumerated data from village level to national level at the head office	1st June to 30 th September
- Dissemination of National Livestock Census	1st October

7. Livestock Population

- The following data was disseminated as the national livestock population as per census.

Livestock Population, 1983-84, 1988-89, 1993-94

(numbers in million)

Year	cattle	Buffalo	sheep/ goat	pig	elephant	horse	ass & mule	mythun	poultry	duck	goose & muscovy
1983-84	9.33	2.05	1.31	2.72	0.002	0.12	0.005	0.04	30.87	5.68	0.69
1988-89	10.04	2.24	1.48	3.13	0.003	0.14	0.009	0.04	33.40	6.21	0.84
1993-94	9.59	2.11	1.40	2.55	0.002	0.12	0.01	0.05	25.85	4.21	0.84

source:(i)Annual report of Livestock census, 1983-84 to 1993-94 by LBVD.

IV. CURRENT ACTIVITIES IN DATA COLLECTION ON LIVESTOCK POPULATION

Improvement of commercial farming programme and data collection

- In 1997-98, the development programme for poultry farming was initiated because of its quick return.
- LBVD provided veterinary services and monitored the progress of livestock activities.
- Commercial production of poultry was in speedy development and needed physical assessment.
- Present status of semi -commercial and commercial livestock farms were recorded by on a monthly basis LBVD staff by interviewing farmers and counting animals.
- Recorded data were used as a base line data for national livestock population.
- Animal population State/Division is shown as table (1).
- Base line data on livestock holders is shown as (2) and (3).

Livestock population in Myanmar, during the last three years.

(numbers in million)

year	Cattle	buffalo	sheep\ goat	pig	poultry	duck	turkey, goose & muscovy
1995-96	9.86	2.20	1.49	2.94	27.98	4.99	0.86
1997-98	10.30	2.30	1.63	3.36	33.07	5.60	0.89
1999-2000	10.74	2.39	1.73	3.71	39.5	6.14	0.92

Source : (1) Annual report of livestock population 1995-96 to 1999-2000 by LBVD
(2) Annual report on Review of the Financial, Economic and Social Conditions (F, E & S) by Ministry of N P & E D.

V. STATISTICAL DATA ON LIVESTOCK PRODUCTS

1. Working draft cattle/buffalo production

- Working draught animals are indicated as cattle and buffaloes for ploughing, harrowing, threshing, pulling and carting. A draught animal comes into the list of working draught when it reaches the age of 3 years.
- All male and female adult buffaloes are counted as draught/working animals. But for cattle, all adult male and some percentage of female are taken as working or draft animals
- Age estimation is identified by dentition process.
- Complete enumeration of adult cattle and buffaloes was taken during the census years of 1983-84 to 1993-94. Since then, monitoring and recording of livestock data was based on a 3-month interval practice.
- Base line data is shown in table (4).

Total working draught cattle /buffalo in Myanmar, during 1989-90 - 1999-2000.

(numbers in thousand)

Year	no. of working draught cattle and buffalo
1989-90	6115
1991-92	6281
1993-94	6427
1995-96	6808
1997-98	6986
1999-2000	7615

Source: 1. Annual report of LBVD.

2. Milk production

- Milk comes from dairy cattle/buffalo and some cross-bred draught cattle and buffalo.
- Local adaptable breed: Thari and Sindhi cross-bred are dairy type breed which are derived from Bos- indicus species. Jersey-cross and Friesian-cross are high milkers derived from Bos Taurus species.
- Murrah is a breed of high milk producing buffalo.
- Female cattle and buffaloes come into reproductive age and become the milkers at about 4 years of age.
- According to the technical study and survey: [Performance record of AI by LBVD, 1980-81; Record of performance on dairy cattle, 1986-87 by WUSC/ CIDA project; Reproduction performance, 1995-96 to 1997-98 by IAEA, MYA/8298/RB].
- Draught type Pyasein cattle and draught buffalo cow produced 80 viss (128 Kg) on the average in lactation period.
- Local dairy cows Sindhi and Thari and Murrah buffalo produced (540-900) 720 viss (1152 Kg) on the average.
- Cross-bred dairy cow Friesian, Jersey produced (1200-1800) 1500 viss (2400 Kg) on the average.
- Calving interval for local draught cow is (533) days and (499) days in cross-bred dairy on the average.
- Data for milk production from individual dairy farms are recorded by LBVD staff.
- Data for milk production in cross-bred draft cow are estimated.
- Base line data is shown in table (5).

Total milk production in Myanmar, during 1989/1990-1999/2000.

(Metric-Ton in thousand)

Year	Private	union total
1989-90	505.86	506.57
1991-92	519.24	520.03
1993-94	531.10	532.0
1995-97	547.71	548.16
1997-98	576.92	577.26
1999-2000	651.54	651.93

Source: 1. Annual report of LBVD.
2. Annual report on Review of F,E &S by Ministry of N P & E D.

3. Cattle and buffalo meat production

- Data for the number of slaughtered animals, live weight, dressed weight were obtained from the records of registered slaughterhouses.
- Data for non-commercial slaughter for religious feast, was obtained through administrative channels.
- Data for some animals supplied to market for meat production was estimated because of illegal or non-commercial or informal slaughters.
- Data for number of sold animals for slaughter purpose was recorded at live cattle market.
- Data for animal movement within township or transboundary was recorded by township veterinary officers.
- Base line data is shown in table (6), (7), (8).

Total beef production in Myanmar, during 1989/1990-1999/2000.

(Metric -Ton in thousand)

YEAR	private	union total
1989-90	37.61	37.87
1991-92	47.00	47.23
1993-94	48.07	48.45
1995-96	49.58	49.89
1997-98	51.95	52.23
1999-2000	60.81	61.13

Source : (1) Annual report of LBVD.
(2) Annual report on Review of F, E & S by Ministry of N P & E D

4. Sheep/goat meat production

- Data for the number of slaughtered animals, lived weight, dressed weights were obtained from the records of registered slaughterhouses.
- Data for religious feast was recorded by veterinary staff.
- Other slaughtered animals supplied to market were estimated because of illegal, informal and non-commercial.
- Data for animal moved over the township was recorded for animal health inspection.
- Base line data on sheep/goat meat products was collected from township slaughterhouses and City Development Committees (Municipality) Table (10).

Total sheep and goat meat production in Myanmar, during 1989/1990-1999/2000.

(Metric-Ton in thousand)

year	private	union total
1989-90	6.43	6.56
1991-92	6.50	6.60
1993-94	7.04	7.29
1995-97	7.52	7.62
1997-98	8.23	8.31
1999-2000	10.07	10.15

- Source :
1. Annual report of LBVD,
 2. Annual report on Review of F, E & S by Ministry of N P & E D.
 3. Record of City Municipality.

5. Pork production

- Pork production comes from local indigenous pigs and cross-bred pigs. Local indigenous pig is commonly in central Myanmar and Ayeyarwady division. Miniature local pig survives in some parts of Shan State, Chin State, Kayah State and Kayin State. Cross-bred pigs such as Berkshire cross, Large White cross, Landrace cross which are large size is widely seen throughout the country.
- Local pigs weigh 20-40 viss (32-64Kg) and cross-bred pigs were found to weigh 60-90 viss (96-144Kg).
- Slaughter numbers, live weight, dressed weight is obtained from registered slaughterhouses.
- Pigs passing through townships are inspected for animal health and recorded.
- Daily sale of pork and its price is collected by LBVD and Municipality.
- Base line data is shown in table (10).

Total pork production in Myanmar, during 1989/1990-1999/2000.

(Metric-Ton in thousand)

year	private	union total
1989-90	39.55	42.18
1991-92	39.52	41.80
1993-94	45.26	47.32
1995-96	63.98	65.05
1997-98	74.44	76.57
1999-2000	99.79	101.61

- Source :
1. Annual report of LBVD.
 2. Annual report on Review of F, E & S by Ministry of N P & E D.
 3. Record of City Municipality.

6. Poultry meat production

- Data on poultry, poultry meat landed in Yangon City and the Cities in State and Division was obtained from city markets.
- Data for number of poultry supplied to City markets in State/Division was obtained from poultry farms.
- Non-commercial of traditionally consumed chicken are estimates.
- Base line data is as shown in table (3), (9), (11).

Total poultry meat production in Myanmar, during 1989/1990-1999/2000.

(Metric-Ton in thousand)

year	private	union total
1989-90	68.87	70.17
1991-92	68.44	69.66
1993-94	78.65	79.83
1995-97	98.87	99.95
1997-98	135.86	138.39
1999-2000	177.40	180.01

- Source :
1. Annual report of LBVD.
 2. Annual report on Review of F, E & S by Ministry of N P & E D.
 3. Record of City Municipality.

7. Duck meat production

- Data on the number of duck and duck meat including turkey, goose, muscovy landed in Yangon City and the Cities in State/Division was obtained from City livestock markets.
- Data for the number of ducks supplied to market was obtained from commercial duck farms.

Total duck meat production in Myanmar, 1989/1990-1999/2000.

(Metric-Ton in thousand)

year	Duck meat	Turkey, Goose, Muscovy meat
	union total	union total
1989-90	11.85	1.478
1991-92	12.21	1.555
1993-94	14.06	1.737
1995-96	16.62	1.750
1997-98	18.72	1.768
1999-2000	23.64	1.989

- Source:
1. Annual report of LBVD.
 2. Annual report on Review of F,E & S by Ministry of N P & E D.

8. Poultry eggs production

- Eggs for human consumption come from local chicken and cross-bred layers.
- Rural farmers traditionally breed local chicken which constitutes 83% of total poultry population. A local hen produces 60-80 eggs per annum.
- According to the nature and habits of rural farmers, some 50% of total eggs goes into family food, and the rest into hatchery for next multiplication of chicken.
- Layers such as CP brown, ISA brown, Hi sex, Hi line etc produce 240-300 numbers per annum.
- Numbers of eggs landed in wholesale markets in Cities was recorded weekly by veterinary staff.
- Base line data is as given in table (2), (3), (9), (11).

Total poultry egg production in Myanmar, during 1989/1990-1999/2000.

(numbers in million)

year	Private	union total
1989-90	742.6	761.1
1991-92	736.6	756.6
1993-94	792.6	815.2
1995-96	923.4	940.2
1997-98	1201.8	1227.4
1999-2000	1656.0	1688.8

Source : 1. Annual report of LBVD.
2. Annual report on Review of F, E & S by Ministry of N P & E D.

9. Duck eggs production

- Most duck eggs are obtained from local indigenous duck. Commercial duck farms are found in Yangon, Bago and Ayeyarwady Divisions. Duck farming by rural farmers are on a small scale and is for subsistence.
- A duck produces 100-120 eggs per year; 80 percent of laid eggs goes into market for human consumption and 20 percent for hatching.
- Duck eggs landed in wholesale market in cities are recorded by veterinary staff.
- Production of duck eggs is calculated on the basis of eggs landed at market and female duck population.

Total duck eggs Production in Myanmar, during 1989/1990 - 1999/2000.

(numbers in million)

year	Private	union total
1989-90	107.3	107.6
1991-92	108.1	112.8
1993-94	124.8	126.7
1995-97	149.6	150.3
1997-98	167.6	168.4
1999-2000	218.3	219.1

Source : 1. Annual report of LBVD.
2. Annual report on Review of F, E & S by Ministry of N P & E D

10. Cow hide (cattle/buffalo) production

- Cattle / buffalo hide came from slaughtered animals and other dead animals.
- Raw hide is acquired for slaughtered animal.
- Some clinically dead animals (25 percent out of total dead) provides some cow hide.
- Production of cow hide weighs calculated on the basic data of registered slaughters and clinically dead animal, estimated data of semi-commercial, informal and illegal slaughters.
- The fresh salted cow hide weighs about 10 viss on the average.

Total cow hide Production in Myanmar, during 1989/1990-1999/2000.

(numbers in thousand)

year	union total
1989-90	401
1991-92	469
1993-94	477
1995-97	494
1997-98	523
1999-2000	593

Source : 1. Annual report of LBVD.
2. Annual report on Review of F, E & S by Ministry of N P & E D.

11. Sheep /goat hide and skin production

- Slaughtered sheep/goat provides raw hide and skin.
- Some percent of clinically dead carcass also provide some hide and skin (25 % hide and skin come from dead carcass).
- Fresh salted hide weighs about 4 viss on the average.

Total production of sheep/ goat hide and skin in Myanmar, during 1989/1990-1999/2000.

(numbers in thousand)

year	union total
1989-90	708
1991-92	716
1993-94	776
1995-96	828
1997-98	868
1999-2000	1044

Source : 1. Annual report of LBVD.
2. Annual report on Review of F, E & S by Ministry of N P & E D.

12. Feathers production

- Feathers from chicken and duck are used as dust-cleaners, decoration and pillows cushion etc.
- Feather acquired from a bird weighs about 0.005 lbs (0.14 tical).
- Data for feather production was calculated on the basis of poultry / duck supplied to market.

Total feather production in Myanmar, during 1989/1990-1999/2000.

(lb in thousand)

Year	union total
1989-90	330
1991-92	351
1993-94	402
1995-96	466
1996-97	663
1999-2000	727

Source : 1. Annual report of LBVD.
2. Annual report on Review of F, E & S by Ministry of N P & E D.

13. Producer's price, market price for livestock and livestock products.

- The production cost was calculated according to availability of animal feed resource, constructed material resource, farming pattern, communication, labour and services.
- Data on available animal feed such as straw, grass, soybean, gram husk, rice bran, broken rice, oil cake, fish meal etc. was collected in respective townships in every month by LBVD staff.
- Animal feed mills and animal feed production quantities, ex-farm price and market price of animal feed commodities are also recorded by LBVD staff.
- All data on ex-farm price, whole sale price and retail price are collected from livestock farms, livestock traders, whole sale sellers, retail sellers, and farmers.
- Base line data for animal feed mills are as shown in table (11).

Producer's price and market price in Myanmar, during 1985/86, 1995/96, 2000/2001.

(kyats)

Description	counting unit	1985-86		1995-96		2000-2001	
		producer's price	market price	producer's price	market price	Producer's price	market price
Working draught Cattle	per head	74.50	74.50	150	150	150	282.87
Milk	per viss	5.00	5.00	29.65	29.65	29.65	59.11
Beef	"	11.50	11.50	135.07	135.07	135.07	254.72
Mutton	"	16.41	16.41	157.36	157.36	157.36	293.74
Pork	"	13.5	13.5	126.20	126.20	126.20	237.99
Poultry meat	"	18.31	18.31	162.77	162.77	162.77	306.95
Duck meat	"	13.02	13.02	160.56	160.56	160.56	302.77
Poultry egg	per numbers.	0.51	0.51	4.41	4.41	4.41	7.56
Duck egg	"	0.48	0.48	4.20	4.20	4.20	7.13
Hide and skin (cattle & buffalo)	"	12.00	12.00	89.31	89.31	89.31	194.38
Hide and skin (sheep/goat)	"	3.75	3.75	38.36	38.36	38.36	84.57
Feather	per lb	2.5	2.5	14.58	14.58	14.58	32.14

Source: 1. LBVD
2. Dept of National Planning & Economic Development.

VI. REVIEW AND IDENTIFYING BASIC NORMS OF LIVESTOCK PRODUCTION.

In 1973, Review and Identification Committee was formed to review and identify the basic norms which act as a yard-stick for assessment of livestock and livestock products. The members of the Committee comprise of delegates from LBVD, University of Veterinary Science, Institute of Economics and Central Statistics and Economic Department. Survey programme is as follows:-

<u>Field of Survey</u>	<u>Method of Survey</u>
1. Government farms	Complete enumeration
2. Co-operative Farms	“
3. Private Commercial Farms	“
4. Local Farmers	Two stage stratified random sampling
Survey Team	14 teams of enumerators was formed and 14 townships were selected for survey.
Timing for survey	one month take in every survey and 3 times of survey in a year and continuation up to 3 years (1973-1975).
Enumerators	The students from University of Veterinary Science and Agriculture Institute. Veterinary staffs participate as supervisors.
Area selected to survey	14893 households at 153 Villages in 14 townships under 14 districts were selected.

The basic norms for livestock production was identified. The basic norms for individual livestock products were slightly changed for time scale and according to the physically improvement of individual livestock production. The production norms are as follows:-

The basic norms for reference

Sr. No	Description	opening stock (OS)	delivered rate	dead rate	supplied rate for market	closing stock(CS)
1.	cattle/ buffalo	1.00	0.104	0.052	0.032	1.020
2.	sheep/goat	1.00	0.70	0.161	0.515	1.024
3.	pig	1.00	0.832	0.274	0.496	1.062
4.	poultry	1.00	5.5079	1.737	3.6859	1.085
5.	duck	1.00	3.08	0.431	2.604	1.045
6.	turkey,goose,muscovy	1.00	2.25	1.1639	1.0521	1.034

Source: LBVD staff.

VI. CONSTRAINTS

1. Base line data for livestock population is the fundamental factor for justified assessment on planning, implementation, monitoring and evaluation for current and future livestock development. Ten years after last livestock census, data collected by veterinary staff on a 3 monthly interval is in use basic data provides reasonably acceptable data for determining livestock population. But more efforts using data collection systems are needed for accuracy and relevancy.

2. Data for individual livestock products, non-commercial slaughter, informal slaughter, family consumption, landing of milk, meat and eggs on market are needed for accurate and reliable information compilation.
3. Practice on compilation, assessment and dissemination of the livestock data are carried out in accordance with the manual of livestock statistics.

VI. RECOMMENDATIONS

- Census taking for livestock population should be encouraged. It should be conducted every 5 years. It should be in line with other countries' practices in the Asia Pacific region.
- Updated technologies and facilities such as computer, microcomputer etc should be strengthened for the purpose of data compilation, processing, security and dissemination.
- Survey on individual animal productivity, home consumable pattern, supply and demand of products, registered and non-registered products, non-commercially produced numbers should be programmed in line with the status of manpower, financial, transportation and communication.
- International or national training courses on methodology for planning and implementation of livestock surveys, censuses, data processing including biotechnology should be conducted with the assistance of donors.

VIII. CONCLUSION

In recent years livestock sub-sector has become more and more important in the economic development of many developing countries in Asia and the Pacific region. Timely and accurate livestock statistics are required for planning, monitoring and evaluation of livestock development. Methodology and technology for data collection, compilation, analyzing, processing and dissemination of information are still insufficient. It is recommended that FAO should coordinate and develop a standard methodology for the collection of livestock statistics. Technical assistance or consultancy services on data collection, processing and utilizing of livestock statistics should be encouraged, at least, within the ASEAN Region.

IX. List of Table

Table (1)

Animal population in State/ Division (1999-2000).

(numbers in thousand)

Sr No	State/Division	buffalo	cattle	sheep/goat	pig	chicken	duck
1	Kachin	149	229	21	313	1350	112
2	Kayah	25	65	2	58	597	9
3	Kayin	61	259	34	118	1030	145
4	Chin	30	99	44	136	828	14
5	Sagaing	355	1928	321	494	4430	131
6	Tanintharyi	118	121	17	86	1517	230
7	Bago	235	1166	29	340	4975	1558
8	Magwe	81	1603	430	247	4005	44
9	Mandalay	101	1695	582	305	3732	186
10	Mon	63	332	37	99	1141	304
11	Rakhine	242	632	103	113	1825	145
12	Yangon	106	475	47	288	5521	1255
13	Shan	531	1038	16	481	3208	169
14	Ayeyawaddy	294	1097	49	637	5369	1836
	Total	2391	10739	1732	3715	39528	6138

Source : 1. Annual report 1999-2000, LBVD

Base line data on livestock holders by State/Division in Myanmar (1999-2000)

(numbers in thousand)

Sr. No	State/Division	Cattle		Buffalo		Poultry	
		holders	numbers	holders	numbers	holders	numbers
1.	Kachin	46.7	229.4	34.6	148.6	61.9	1349.8
2.	Kayah	11.1	65.0	6.9	24.6	15.6	596.7
3.	Kayin	65.0	258.7	14.7	61.4	73.3	1030.5
4.	Chin	19.7	99.5	6.7	29.8	59.2	827.8
5.	Sagaing	392.3	1928.5	75.3	354.8	299.3	4430.8
6.	Tanintharyi	28.5	121.0	17.9	118.4	42.4	1517.0
7.	Bago	301.3	1166.2	52.0	235.5	285.8	4974.5
8.	Magwe	341.6	1603.2	19.8	81.1	285.5	4004.8
9.	Mandalay	428.3	1694.9	29.6	100.7	224.1	3731.6
10.	Mon	70.2	331.8	9.9	62.6	64.0	1141.2
11.	Rakhine	132.2	631.5	35.2	242.5	118.6	1824.6
12.	Yangon	95.1	474.6	29.3	106.1	106.3	5521.2
13.	Shan	183.6	1037.9	144.6	531.2	143.2	3208.4
14.	Ayeyawaddy	293.1	1097.3	81.2	293.7	302.4	5369.6
	Total	2408.7	10739.5	557.7	2391.0	2081.6	39528.5

Data collector: LBVD

Data collection: Quarterly basis

Method: Actual counting and interviewing to farmers and headman of village

Table (3)

Base line data on Poultry (layer and broiler) Livestock Farms (private sector)

State/Division	under 200		200-1000		1000-5000		above 5000	
	holders nos.	nos. of chick (000)	holders nos.	nos. of chick (000)	holders nos.	nos. of chick (000)	holders nos.	nos. of chick (000)
Kachin	39	7.10	148	64.05	1	1.25	2	28.65
Kayah	53	8.51	101	47.47	2	3.23	-	-
Kayin	61	11.40	56	38.38	5	8.00	-	-
Chin	7	1.00	-	-	-	-	-	-
Sagaing	811	120.01	745	307.41	17	37.65	-	-
Tanintharyi	25	3.66	242	125.34	56	117.8	7	70.30
Bago	369	64.48	281	137.28	45	105.45	9	118.10
Magwe	320	49.01	201	85.70	6	10.07	-	-
Mandalay	89	14.77	105	85.70	124	296.26	10	68.04
Mon	143	21.29	736	200.88	90	132.70	-	-
Rakhine	86	12.91	102	47.38	10	20.13	-	-
Yangon	241	33.27	486	237.90	108	278.34	36	406.30
Shan	51	7.27	404	283.28	119	241.90	20	265.60
Ayeyawaddy	110	18.13	196	92.26	27	56.75	1	6.00
Total	2402	359.30	3803	1829.76	494	1006.94	85	962.99

Data collector
Data collector
Method

LBVD staff
Monthly basis
Actual counting and interviewing to farmers.

Table (4)

Base line data on working draft animals in Myanmar, 1983/84 - 1998-1999, 1999-2000

(numbers in million)

Year	over 3 yr of age			union total			working draught
	male	female	total	male	female	total	nos
1983-84	5.04	3.01	8.05	6.66	4.699	11.38	6.27
Cattle	4.94	2.28	6.72	5.7	3.609	9.33	4.94
Buffalo	0.60	0.73	1.33	0.96	1.09	2.05	1.33
1993-94	5.11	3.10	8.21	6.86	4.84	11.70	6.43
Cattle	4.46	2.37	6.83	5.85	3.74	9.59	5.05
Buffalo	0.65	0.73	1.38	1.01	1.10	2.11	1.38
1999-2000	5.70	3.47	9.17	7.64	5.119	13.13	7.61
Cattle	4.96	2.67	7.63	6.52	4.22	10.74	6.07
Buffalo	0.74	0.80	1.54	1.12	1.27	2.39	1.54

Data collector LBVD staff
Data collection Quarterly basis
Method Actual counting and interviewing to farmers

Table (5)

**Base line data on adult female cattle and buffalo for milk production
in Myanmar 1983/84, 1993/94, 1999/2000**

(numbers in million)

Year	Female	under 1 year	under 3 years	over 3 years adult
1983-84	Draught Type	0.69	0.86	2.75
	Cattle	0.54	0.65	2.75
	Buffalo	0.15	0.21	0.70
	Dairy Type	0.089	0.076	0.238
	Cattle	0.068	0.069	0.233
	Buffalo	0.021	0.007	0.005
1993-94	Draught Type	0.73	0.89	2.91
	Cattle	0.57	0.69	2.19
	Buffalo	0.16	0.20	0.72
	Dairy Type	0.056	0.063	0.193
	Cattle	0.052	0.058	0.178
	Buffalo	0.004	0.005	0.015
1999-2000	Draught Type	0.73	0.88	4.01
	Cattle	0.55	0.65	3.20
	Buffalo	0.18	0.23	0.81
	Dairy Type	0.064	0.072	2.59
	Cattle	0.059	0.066	2.39
	Buffalo	0.005	0.006	0.20

Data collector	LBVD staff
Data collection	Quarterly basis
Method	Actual counting

Table (6)

Base line data on cattle/buffalo sold for slaughter in livestock Markets

(numbers)

Sr No	State/Division	nos of township holding cattle market		nos of cattle/ buffalo sold as working animals		nos of cattle/ buffalo sold for slaughter	
		1998-99	1999-2000	1998-99	1999-2000	1998-99	1999-2000
1	Kachin						
2	Kayah	1	1	2400	2400	1200	840
3	Kayin						
4	Chin						
5	Sagaing	2	3	547	664	1254	93
6	Tanintharyi						
7	Bago	7	11	25840	43128	12560	18472
8	Magwe	4	5	4929	19658	4319	4603
9	Mandalay	12	13	790366	33689	37529	22418
10	Mon						
11	Rakhine						
12	Yangon	2	2	8833	2015	18861	6953
13	Shan	2	2	420	768	3254	840
14	Ayeyawaddy	-					
	Total	30	37	127335	102322	76977	54219

Data collector
Data collection
Method

LBVD staff
On every day of cattle market which used to open once a week
Actual counting

Table (7)

Base line data on slaughtered animals in registered slaughter houses

(numbers)

State/Division	cattle/buffalo		sheep/goat		pig	
	1995-96	1999-2000	1995-96	1999-2000	1995-96	1999-2000
Kachin	1201	5259	2985	1856	8729	12021
Kayah	-	1342	270	87	2018	1781
Kayin	2812	1963	2653	3382	5417	7495
Chin	1463	1055	88	-	1736	1218
Sagaing	10306	34412	19608	12167	43409	64232
Tanintharyi	3445	1611	1212	163	22531	8467
Bago	14130	30445	-	16238	-	31704
Magwe	16497	19258	15051	24054	17924	24153
Mandalay	14599	33542	16709	27027	31340	32308
Mon	7770	9105	5819	4673	21311	24202
Rakhine	2564	11876	-	3742	-	8310
Yangon	25049	33491	83495	103084	154722	102968
Shan	12980	94643	8432	4341	23404	26685
Ayeyawaddy	17256	14465	1911	3425	31579	23854
Total	130572	207767	158253	204239	364120	369395

Data collector LBVD, Municipality
 Data collection Weekly basis
 Method Actual counting

Table (8)

Base line data on non-commercial slaughtered animals (religious feast)

(numbers)

Sr No	State/Division	cattle/ buffalo		sheep/goat	
		1995-96	1999-2000	1995-96	1999-2000
1	Kachin	261	248	-	-
2	Kayah	66	39	-	-
3	Kayin	514	731	-	-
4	Chin	-	-	-	-
5	Sagaing	182	604	-	-
6	Tanintharyi	157	351	81	-
7	Bago	183	1136	-	-
8	Magwe	147	185	-	16
9	Mandalay	977	892	-	53
10	Mon	1203	1404	105	-
11	Yakhine	2564	3180	-	-
12	Yangon	4980	2270	42	-
13	Shan	216	467	-	-
14	Ayeyawaddy	1602	1833	1	-
	Total	13052	13340	79	69

Data collector LBVD staff
 Data collection On occasional month of feast
 Method Actual counting

Table (9)

Base line data on poultry (meat and eggs) production in 1999-2000

(numbers in thousand)

State/Division	layer breed	broiler breed	local breed	total
Kachin	112777	-	1237044	1349821
Kayah	47600	-	549087	596687
Kayin	40778	19200	970548	1030526
Chin	920	9	826911	827831
Sagaing	453805	363000	3941006	4430811
Tanintharyi	256500	60140	1200310	1516950
Bago	111615	60498	4802417	4974530
Magwe	103502	67677	3833610	4004789
Mandalay	611400	71250	3048958	3731608
Mon	237267	79650	824298	1141215
Rakhine	56730	-	1767861	1824591
Yangon	769717	1072063	3679402	5521182
Shan	565885	63952	2578602	3208439
Ayeyawaddy	190617	17700	5161249	5369566
Total	3559113	1548130	34421123	39528546

Source : Data collector LBVD staff
 Data collection Monthly basis
 Method Actual counting and interviewing to farmer.

Table (10)

**Base line data on landing of livestock commodity in whole sale market
and commodity price in Citys of Myanmar**

Average commodity landed and whole sale price(wsp. kyats) on a day of September 2000.

State/ Division	City	Beef		Pork		Sheep/Goat		Chicken		Egg (Chicken Duck)	
		Viss	k.wsp	viss	k.wsp	viss	k.wsp	viss	k.wsp	viss	k.wsp
Kachin	Myitkyi na	467	575	467	750	67	900	500	690	1334	17
Kayah	Loikaw	167	500	107	550	5	1200	233	650	1684	19
Kayin	Pan	52	750	162	600	17	750	100	700	2053	15
Chin	Hakha	70	500	29	500	-	-	10	950	403	21
Sagaing	Sagaing	500	325	150	500	120	800	700	800	52500	19
Taninthar yi	Tawae	300	500	1200	700	90	800	600	700	1950	18
Pegu	Bago	150 0	440	1450	480	115	1150	1850	750	35000	15
Magwe	Magwe	138 0	390	1250	490	750	525	1450	525	19120	16
Mandalay	Mandala y	250 0	450	8500	550	900	550	7500	650	65000 0	15
Mon	Mawlam yaing	200	800	250	650	20	900	450	750	6000	16
Yakhine	Sittwe	700	600	500	600	100	700	400	700	15333	16
Yangon	Yangon	970 1	278	2106 1	320	2280	550	3218 5	485	28483 4	14
Shan	Taungyi	182 0	440	826	425	142	675	2188	460	39033	14
Ayeyawad dy	Pathein	300	450	214	700	10	970	114	850	757	18
Total/ avg.		196 57	500	3626 6	580	4616	748	4881 0	690	90800 1	17

Data collector
Data collection
Method

LBVD staff, Municipality staff
Weekly basis
Actual counting and interviewing to buyers and sellers.

Table (11)

Base line data on status of feed mills

(Metric .Ton)

Sr.no	Name of animal feed mill and locality	producing capacity/day
1	Thein Than Win, Yungon(private)	40 M Ton
2	MCP Group, Yangon(private)	100 M Ton
3	Makha, Yangon(private)	80 M Ton
4	Sein Pan, Yangon(private)	30 M Ton
5	Annawah mon, Yangon(private)	60 M Ton
6	Golden Flower, Yangon(private)	80 M Ton
7	Top , Yangon (private)	30 M Ton
8	LFME , Yangon(private)	133 M Ton
9	Maung Maung Than, Yangon(private)	2 M Ton
10	U Than Chaung, Yangon (private)	2 M Ton
11	Aung Naing Moe, Yangon(private)	2 M Ton
12	Aung Setana, Yangon(private)	2 M Ton
13	Ahtaparha , Yangon	2 M Ton
14	Nilar , Yangon	20 M Ton
15	B and B , Yangon	30 M Ton
16	Super power, Yangon	50 M Ton
17	Moon Light , Yangon	30 M Ton
18	Myo Myint Kyaw, Yangon	2 M Ton
19	Sanpya, Mandalay (private)	50 M Ton
20	Thein Kaba , Mandalay(private)	50 M Ton
21	CP Group , Mandalay (private)	40 M Ton
22	Makah, Mandalay (private)	32 M Ton
23	Shwe Lwin Oo (private)	60 M Ton
24	K T Shwebo (private)	100 M Ton
25	U Tat Chaung, Taungyi (private)	60 M Ton
26	Nyaing Chanye, Loikaw (private)	20 M Ton
	Total pricing capacity / day	1107 M Ton

Data collector LBVD cooperates with Myanmar Livestock Federation
 Data collection Quarterly basis
 Method Actual counting and interviewing to producers.

Table (12)

Livestock products of Myanmar, 1993/94, 1996/97, 1999/2000

(numbers in thousand)

Description	Counting Unit	1993-94		1996-97		1999-2000 provisional	
		private	total	private	Total	private	total
working draft cattle, buffalo	Nos of head	6496	6496	6922	6922	7615	7615
Milk	Viss	325706	326050	344836	345047	399650	399636
hide & skin (cattle&buffalo)	Nos	477	477	508	508	593	593
hide & skin (sheep/goat)	Nos	776	776	865	865	1044	1044
meat total	Viss	119567	121537	162751	164450	230376	232035
Beef	Viss	29503	29698	31214	31389	37326	37472
Mutton	Viss	4328	4446	4815	4871	6172	6219
Pork	Viss	27923	29019	43798	44508	61462	62287
Chicken	Viss	48292	48705	70983	71615	109862	110346
Duck	Viss	8457	8604	10868	10994	14335	14492
turkey, goose, muscovy	Viss	1064	1064	1073	1073	1219	1219
egg Total	Nos	921926	945196	1210668	1231786	1885816	1908585
fowl egg	Nos	795774	818116	1049616	1070039	1666117	1688793
duck egg	Nos	125750	126678	160528	161223	218342	219065
Feather	lb	402	402	524	524	727	727
increased population	Nos	408	333	2539	2375	4935	4911
Cattle	Nos	90	88	194	194	228	229
Buffalo	Nos	19	19	32	32	50	50
sheep/goat	Nos	11	1	74	75	50	53
Pig	Nos	65	51	131	130	208	218
Poultry	Nos	371	367	1856	1682	4083	4045
Duck	Nos	(-)150	(-)195	249	259	306	306
turkey, goose, muscovy	Nos	2	2	3	3	10	10

Source: 1. Annual report of LBVD

2. Annual report on Review of F, E & S by Ministry of NP&ED

Livestock Breeding and Veterinary Department

Livestock numbers in Semi commercial and Commercial Farms (Pig)

Township-----State/Division-----

Date of data collection	Farmer's Name	Address	Under 5 sow herd	5-10 sow -herd	10-20 sow- herd	20-50 sow-herd	Above 50 sow- herd

Signature-----

Name of enumerator-----

Rank-----

Livestock Breeding and Veterinary Department

Livestock numbers in Semi-commercial and Commercial Farms (Dairy Cattle)

Township-----State/Division-----

Date of data collection	Farmer's Name	Address	Under 3 cow- herd	3-8 cow-herd	8-12 cow-herd	12-20 cow-herd	Above 20 cow- herd

Signature-----

Name of enumerator-----

Rank-----

Form (1)

Livestock census (private/cooperative/Government)

Census form 004 for cattle / mythun 19----- 19 -----

Enumerator-----Township-----State/Division

Sr no	village name	owner name	draught type									Dairy type									Total			
			bull	Oxen	cow	under 3yrs			under 1 yr			bull	cow	under 3 yrs			under 1 yr							
						M	F	total	M	F	total			M	F	total	M	F	total					

Form (2)

Livestock census (private / cooperative/ Government)

Census form 005 for buffalo 19-----19-----

Enumerator----- Township-----State/ Division-----

Sr no	village name	owner name	draught type									Dairy type									Total				
			bull	Oxen	cow	under 3yrs			under 1 yr			bull	cow	under 3 yrs			under 1 yr								
						M	F	total	M	F	total			M	F	total	M	F	total						

METHODOLOGICAL REVIEW OF STATISTICAL ACTIVITIES IN FISHERIES SECTOR OF MYANMAR

Ma Ma Lay
Staff Officer
Department of Fisheries
Ministry of Livestock Breeding & Fisheries

1. BACKGROUND

People in Myanmar get their protein from fish and fish-products . Vast sea, abundant inland waters and appropriate climate have the combined effect of creating the most favorable natural conditions for the growth of varied aquatic fauna and flora. The fishery resources of Myanmar play a crucial role in increasing food production , over 2 million people, in terms of income and employment, benefit directly from the fishery sector . Per capita consumption of fish fluctuates around 18Kg. Rapid progress in Myanmar fisheries has resulted in the emergence of fishery as a significant food producing sector in its own rights. Factors that reflect the growth potential include rising demand for fish, increasing contribution of fishery to nutritional and food security, and the recognition of fishery as a sector for investment, employment and socio-economic development.

The challenge for the State is to manage fisheries in such a way that ensures the optimum and sustainable use of aquatic resources with economic efficiency . Myanmar has formulated its fishery development policy in accordance with its resource endowment and at the same time taking into consideration of national and international conditions. A number of important changes have been made in fishery system to be in line with market economic principles. These changes have greatly stimulated the productive capabilities of the fishery communities. As a consequence , the total production of fishery had grown from 0.73 million metric ton in fiscal year 1990/ 91 to 1.17 million metric ton in fiscal year 1999 /2000 representing 0.44 metric ton increase within a decade. The value of export earnings from fishery products has also increased markedly from US\$ 68.4 million in fiscal year 1993 /94 to US\$ 183.71 million in fiscal year 1999 / 2000.

2. ORGANIZATIONAL STRUCTURE

The department of fisheries was once under the Ministry of Agriculture and Forest . In 1983, the Ministry of Livestock Breeding and Fisheries was formed. The Department of Fisheries is responsible for the management of fisheries, conservation of resources, providing extension services, conducting researches and monitoring the status of fisheries. The Planning and Statistics Section of this Department is responsible for the compilation of fishery data. The section's functions are data collection, data analysis, drafting annual , and short- term national plans, concerning with fisheries. Production of fishery's statistical reports on monthly, quarterly and half yearly bases.

The organization structure of the Planning and Statistics Section is shown in Appendix (1) and (2).

3. FISHERY OBJECTIVES

Fishery objectives are;

- to promote all round development of the fisheries sector
- to increase fish production for domestic consumption and to export surplus to neighboring countries
- to encourage the expansion of aquaculture
- to upgrade the socio – economic status of fishing communities

4. FISHERIES RESOURCES

Fisheries resources fall into two : Freshwater and Marine water. Fishery surveys are conducted with a view to identify new fishing grounds, estimating stock , and adopting efficient means of exploitation. “Marine Fisheries Resources Survey and Exploratory Fishing Project” was carried out by DOF with assistance from FAO during 1979 / 83. Acoustic/ experimental fishing surveys were done with Norway Research Vessel name Dr. Fridtjof Nansen , and trawl surveys with a Myanmar vessel name 525.

Estimate of small pelagic fish such as sardine (nga kone nyo), chub mackerel (pla tu) and herring (zin bya) has been recorded a standing stock of about one million metric ton , out of which about half a million metric ton was considered a yearly maximum sustainable yield (MSY). It was found that biomass (standing stock) at pre- monsoon was about twice as high as during post-monsoon season.

Regarding demersal fish resource, namely, snapper (nga par ni), thread fin / Indian salmon (ka ku yan) and croaker (poke tin) their standing stock was estimated at about 800,000 metric ton, from this , about 550,000 metric ton, could be exploitable as maximum sustainable yield MSY. Thus, a total of about 1.05 million m..t, could be harvested yearly on a MSY basis within the whole shelf areas.

The last acoustic survey was carried out in fiscal year 1979/80 about 20 years ago. Reliable estimates need to be made with advanced methods for assessing the current status of marine life in Myanmar.

4.1 Freshwater Resources

Freshwater fisheries are mainly dependent on the riverine system of the country. The four main rivers are: the Ayeyarwaddy river which is about 2150 km long, the Chindwin river which is about 844 km long, the Sittaung river which is about 563 km long and the Than lwin river which is about 2400 km long . The river systems are rich in natural resources and are very important for open flood fisheries.

The inundated flood plains are estimated to form water surface of about (6) million

hectares for a period of (4-5) months a year. The total number of leasable fisheries in Myanmar is about 3722 , of which 3490 are still exploitable . The total area of fish ponds in 1999 was about 53123 hectares

4.2 Marine-water Resources

Myanmar has a long coastline that stretches approximately from 21° North to 10° North over a distance of 1800 km. With its large number of estuaries and islands, the length of the entire coastline will be close to 3,000 km. The continental shelf 0-200m depth covers an area of 225 km².

Since the total investment in the marine fisheries sector was considerable, it was felt that at least rough estimates of marine fisheries resources should be obtained, in order to make investments in fishing and fish focusing .

4.3 Shrimp Resource

The most extensive shrimp surveys were conducted with the assistance of OVERSEAS DEVELOPMENT AGENCY (ODA) (UK) off the Rakhine coast in fiscal year 1981/82. An annual standing stock of 4370 metric ton of shrimp was estimated in the survey area covering 14700 km² .

Shrimp surveys were also conducted off the Ayeyarwaddy and Tanintharyi coasts with FAO assistance in fiscal year 1981 / 82, but the standing stock could not be calculated due to insufficient number of trawl hauls . Considering Myanmar sea condition , yield per unit area has been assured , in terms of standing stock as 4000 m .t of shrimps for all regions. Current estimates need to be made for assessing the status of marine shrimp production.

5. ITEMS OF DATA COLLECTION

Fisheries in Myanmar are divided into fresh water fisheries and marine fisheries. Fresh water fisheries are classified as aquaculture fisheries, leasable fisheries and open flood fisheries whereas marine fisheries into in-shore fisheries and off-shore fisheries.

5-1 Freshwater Fisheries

(a) Aquaculture fisheries

The breeding of seed in ponds for final consumption.

Aquaculture involves using fertilisers, feed and medication. It is licensed by DOF

License Form

The following items of information are collected by the Forms for issuing license; License type, Area, Case diary, Township, Date of issue, Payment of License fee, etc

(a) Leasable Fisheries

Fisheries found in the flooded streams , tanks and ponds during monsoons are seasonal in nature .Fishery in the inland sector is leased out for exploitation and revenues collected by the DO F.

Land Revenue Form

The following items of information are collected by Land Revenue Form to leay land tax: name of Leasable fisheries, name of district office , license's name , case diary , water area , fishing period, date of issue , payment of fishery rent , name of implement , provisions , etc

(b) Open fisheries

With the exception of the streams, rivers and lakes. The right to fish is licensed out by DOF.

Tender License and Implement License Form;

The following items of information are collected by Tender and Implement license forms are license no., township, year, licensee, residence, official name of implement, general petty fishing license, maximum dimensions, length, width, site, special restrictions, date, signature, total fee paid, etc

5.2 Marine Fisheries

(a) In-shore fisheries

In-shore fisheries is being exploited by artisanal and small-scale fishermen with locally constructed small powered or un-powered vessels using simple fishing gears.

(b) Off-shore fisheries

The main species of fishes are pelagic and damersal fishes. The off shore pelagic and damersal fish require large mechanized vessel with advanced fishing gears for catch .

In marine fisheries, the common fishing gears are lances, harpoons, hooks and lines, stakes, set pouch nets, swing net, cast nets, drift gill nets, set gill nets, drag seines, gill seines, trawl nets, troll lines, purse seines, ring nets, etc They are licensed out by DO F

License Vessels form

The items of information collected by forms for issuing license for fishery vessels are: name of vessel, name of gear, horse power, Gross Tone, length, height, width of vessel, owner, engine power.

The number of Vessels with license to operate (off-shore fisheries) by State and Division is given in Table 5-2-1;

Table 5-2-1 Off-shore fisheries vessels by State / Division, fiscal year 1990/ 91-1999 /2000
(number)

<u>Year</u>	Head office	<u>Tanintharyi</u>	Mon	Rakhine	Yangon	Ayeyarwady	Total
1990-91	-	307	204	-	194	169	874
1991-92	-	393	10	-	251	277	931
1992-93	-	517	90	-	258	114	979
1993-94	-	416	56	1	238	76	787
1994-95	-	354	111	30	13	1132	1640
1995-96	-	415	432	332	14	1294	2487
1996-97	757	62	201	-	-	89	1609
1997-98	734	178	225	46	-	526	1709
1998-99	-	301	210	22	816	635	1984
1999-2000	436	369	224	35	226	742	2032

A rising trend is observed in the number of off – shore fishing vessels during the decade , fiscal year 1990/ 91 to 1999/ 2000 .

6. FISH PRODUCTION

Fish Production figure compiled from reports submitted by local offices from fiscal year 1989/90 to 1999/2000 are given in table 6-1

Table 6-1 Total fish Production , fiscal year 1990/91 to 1999/2000

(Metric Ton)

No.	Year	Fresh water fisheries	Marine fisheries	<u>Total</u>
1.	1990-91	145284	587985	733289
2.	1991-92	167236	590263	757499
3.	1992-93	193741	597637	791378
4.	1993-94	210948	599876	810824
5.	1994-95	220047	602885	8229232
6.	1995-96	217994	455393	673387
7.	1996-97	249758	633272	883030
8.	1997-98	201248	680838	882086
9.	1998-99	250861	759665	1010526
10.	1999-2000	288621	880018	1168639

Note : 1 metric ton = 1000 kg
= 2204.62 lb

Catch reports, landing statistics and frequent inspections and two surveys are carried out by DOF. Reliable information is needed for making decisions regarding the capabilities for expansion of fishing programmes. The marine fisheries reached a new record of 1.17 million metric ton in fiscal year 1999/2000. DOF manages fishing activities by licensing, prescribing standard procedures specifying exploitable species, permitting the use of environmentally friendly fishing gears and by regulating closed areas, closed season, etc..

7. FISHING CRAFT

Fishing is mostly done by indigenous crafts consisting of dug-out canoes, sailing boat, plank built boats and a few out-board and in-board engines. Department of Fisheries in fiscal year 1999/2000, indicated that there are about 11,191 non-powered crafts employed in marine fisheries.

A good part of which is fitted with small out-board engines within 1HP-5HP range with long shafts. The indigenous fishing craft are developed according to the requirement of the coastlines, which are usually flat and shallow. These boats have very shallow draught with the hull composed of a dug out with built up planks on the sides. There is no keel. All these types of constructions make the boats unsuitable for mounting in-board engines. Moreover they are not seaworthy, and can only operate during fair weather. The fleets are of sizes ranging from 15' to 40' in length. Usually in-board engines are installed in local craft with over 40' in length.

8. FISHING GEARS

Fishing gears in small-scale fisheries include (i) "fixed engine" (i.e. trap and basket) lift nets, stake nets and cast nets in the on-shore fisheries (Inter-tidal areas), and (ii) gill nets, drift nets, small shore-seines, set nets, hooks and cast net, in the in-shore fisheries sector. In the small-scale fisheries, fishery is done mainly, based on passive fishing techniques, such as fish being caught by luring or by chance. The most important and active fishing gear is encircling gill nets used for exploiting Hilsa sp

Small-scale fisheries sector has succeeded in increasing production due to mechanization of the craft, and introduction of synthetic imported fishing nets.

Large-scale fisheries use trawl, beam trawl, purse seine, Spanish mackerel gill net, Mackerel encircling gill net, push net and long line are used in the off shore fisheries sector.

9. FISHING GROUND

The coast line of Myanmar has been divided into the following 3 sub-areas to represent main ecological division:

- (a) The Rakhine coast Bordering with Bangladesh in the north, a narrow shelf area, a few islets down to 16°0' Latitude North. (Mawdin point)

- (b) The Ayeyarwaddy 16°.0 Latitude North (Mawdin point) area: shelf area between 16°.0 and 13°.30' Latitude North (Dawei point)
- (c) The Tanintharyi coast: From 13°.30' Latitude To about 10°.0 Latitude North (Kawthaung point) along the border with Thailand. This division has been initiated during acoustic surveys and trawl surveys .Survey fishing ground of Myanmar is shown in Appendix (3) . Current fishing ground of Myanmar is shown in Appendix(4) . There are (140) fishing grounds, each measuring (900) miles square or half degree square . There are (30) fishing grounds in Rakhine , (44) fishing grounds in Ayeyarwaddy , (14) fishing grounds in Mon and (52)fishing grounds in Tanintharyi coast for liscense .

10. FISHERY EXPORT

A 10 year data on fishery exports is given in Table 10-1 .

Table 10-1 Export of Fish and Shrimp, fiscal year 1990/91 to 1999/20000

Year	Fish		Shrimp/Prawn		Other		Total	
	Ton	US\$	Ton	US\$	Ton	US\$	Ton	US\$
1990-91	11621.10	5.90	1273.00	7.00	1033.5	0.1	13927.60	13.0
1991-92	11032.00	5.70	2672.90	15.8	554.1	1.0	14259.00	22.5
1992-93	21053.00	12.90	5827.10	34.0	1607.5	4.1	28487.60	51.0
1993-94	12884.10	12.70	6195.00	45.1	4136.7	10.6	23215.80	68.4
1994-95	78590.00	25.30	7940.00	63.2	10210.0	22.1	96740.00	120.6
1995-96	39740.90	28.50	8814.50	72.4	10805.4	12.8	54360.80	113.7
1996-97	41068.30	45.90	12827.80	95.6	13504.7	21.5	67400.80	163.0
1997-98	45853.20	54.20	13467.20	91.9	14859.0	21.0	74179.90	167.1
1998-99	70906.44	70.238	13764.42	96.94	42202.82	34.14	126873.73	201.33
1999-2000	72210.08	68.77	15536.01	90.68	28863.11	24.26	116609.20	183.71

Source; Customs Department

Export of fish and fish products have increased from US\$ 15.4 millions in fiscal year 1989/90 to US\$ 183.71 million in fiscal year 1999/2000.

Major species of shrimp and fish export are-

- (a) Freshwater shrimp
 Freshwater giant shrimp Yecho Pazun Tote

(b) Marine shrimp	
Giant tiger shrimp	Pazun Kyar
Green tiger/ Flower shrimp	Pazun sein kyar
White/ Banana	Pazun phu
Red tail / white	Pazun mee ni
(c) Marine fish (round)	
Silver pomfret	Nga mote phu
Chinese pomfret	Nga mote phu
Red snapper	Nga par ni
Hilsa	Nga tha lauk
(d) Marine fish (fillet)	
Snapper	Nga par ni
Sea bream	Nga wat
Grouper/ rock cod	Kyauk nga
Sea bass	Ka tha baung
(e) Freshwater fish	
Rohu	Nga myint chin
Catla	Nga gaung pwa
Tilapia	Tilapia

11. MARKET PRICES

DOF conducts regular price monitoring surveys in Yangon landing areas and whole sale markets. Items included in the Price Survey Forms are given below –

Market Survey Form

Name of market , name of species , production by items , low price/ high price , date

Landing Survey Form

Landing size , production by species , price by species , name of vessel , date

Total values of fish and shrimps landing at Yangon whole sale markets by months in fiscal year 1998/99 and in fiscal year 1999/2000 are given in Table 11-1

Table [11-1] Volume of Marine Production by Month, fiscal year 1998/99 to 1999/2000
(Metric Ton)

<u>Month</u>	1998-99			1999-2000		
	Freshwater fisheries	Marine fisheries	<u>Total</u>	Freshwater fisheries	Marine fisheries	<u>Total</u>
April	4541	5901	10442	5565	7002	12567
May	4474	4917	9391	6337	6653	12990
June	4902	4150	9052	6956	4497	11453
July	5944	3558	9502	7789	4149	11938
August	5764	3865	9629	7931	3459	11390
September	5400	6524	11924	7139	4211	11350
October	5457	8462	13919	68631	7080	13943
November	5346	8424	13770	6628	7802	14430
December	5720	9102	14822	6042	9185	15227
January	6772	7995	14767	5763	11670	17433
February	5478	6553	12031	4848	13237	18085
March	5583	7766	13349	5398	9794	15192
Total	65381	77217	142598	77259	88739	165998

Whole sale price

Whole sale price of fish are regularly collected by DOF . Yangon whole sale price in fiscal year 1998/ 99 and in fiscal year 1999/2000 are given in Table 11-1 and 11-2

Table [11-1] Whole sale price of selected freshwater fish fiscal year 1998-99 , 1999-2000
(Kyats)

No.	English common name	<u>Myanmar name</u>	1998-99		1999-2000	
			Low	High	Low	High
1.	Snake headed fish	Nga yant	120	660	120	700
2.	Cat fish	Nga khu	170	720	170	900
3.	Rohu	Nga myint chin	100	460	110	650
4.	Mrigala	Nga jinn	150	550	150	550
5.	Catla	Nga gaung pwa	80	360	130	400
6.	Hilsa	Nga thalauk	100	500	120	800
7.	Sea bass(Large)	Ka tha baung	200	720	180	900
8.	Sea bass(Small)	Ka ka dit	100	600	100	950
9.	Mango fish	Nga pon narr	170	570	170	600

Table 11-2 Whole sale price of selected Marine fish, fiscal year 1998/ 99 , 1999/2000

No.	<u>English common name</u>	<u>Myanmar name</u>	Kyats			
			1998-99		1999-2000	
			<u>Low</u>	<u>High</u>	<u>Low</u>	<u>High</u>
1.	Pike conger	Nga shwe	22	310	82	665
2.	Cat fish	Nga yaung	30	205	30	250
3.	Lizard fish	Nga pa lway	30	380	40	190
4.	Ilisha	Zin bya	31	550	50	500
5.	Croaker,Reeve's/yellow	Thin war	80	680	70	825
6.	Spotted croaker	Nat ka daw	52	375	100	320
7.	Croaker, Belangers	Gaung pwa	25	286	40	375
8.	Haitail, Large	Nga da gon	15	250	32	365
9.	White pomfret	Nga mote phu	28	1950	200	2350

Note ; 0.612 viss = 1 kg

12. LEGAL PROVISION

The state had promulgated the following four relevant fisheries laws to manage the industry more efficiently and to protect the environment effectively:

<u>Name of Fishery Laws</u>	<u>Year enacted</u>
1. Law relating to the fishing rights of foreign	1989
2. Law relating to aquaculture	1989
3. Myanmar marine fisheries law	1990
4. Freshwater fisheries law	1991

Fishery Laws are enforced according to the following objectives;

- (a) to further develop fisheries;
- (b) to prevent fish from extinction ;
- (c) to safeguard and prevent the destruction of fishing grounds;
- (d) to levy duties and fees payable to the state;
- (e) to manage fisheries and to take action in accordance with the Laws

In the promotion of fish culture, the DOF has distributed about 24.1 million baby fish in fiscal year 1996/ 97 and 26.7 million in fiscal year 1999/ 00, an increase of about (11%).

Hatchery area and baby fish distribution by DOF are given in Table 12-1;

Table 12-1 Baby fish Distribution , fiscal year 1996/97 – 1999/2000

Description	1996-97	1997-98	1998-99	1999-2000
Areas of hatcheries (acre)	218	205	242	210
Mrigala Nga jinn(000)	214700	228860	249266	144336
Common carp Shwewarnga jinn(000)	26700	27721	49324	123154
Total baby fish	241400	256581	298590	267490

13. FISHERY DEVELOPMENT

Exploitation of aquatic resources is promising. The State is giving high priority to provide adequate support for further development of fishery giving special attention to the production of low-cost freshwater fish as these contribute to food security for local people, and high priced marine fish and shrimp for international market. It is most likely , that inland fishery production will continue to grow , and that the marine products will also develop.

Because of continuous deterioration of inland water due to natural and man-induced changes in the fish habitats, the State has endeavored to increase fish production through aquaculture fishery. Thus aquaculture production started to increase beginning 1990's in response to policy measures laid down by the State. The enforcement of Laws relating to aquaculture in 1989, has resulted in sharp growth in aquaculture.

It is clear that a limitation exists in the capture of fisheries resources; further expansion of aquaculture is essential to meet the gap between supply and demand for aquatic food products. The move towards intensification of aquaculture is evident in many countries, and this trend will eventually lead to efficient production and expansion of aquaculture industry.

Key factors in the rapid production growth of aquaculture in Myanmar are the availability of hatchery-produced fish seed , and intensification of Research and Development activities. Although efforts are continuing, there has been limited success in mastering shrimp hatchery technologies and contribution of hatcheries to overall demand of shrimp seed is still insignificant. Aquaculture technologies in Myanmar still require substantial improvements to ensure eligibility , efficiency and easy application through training and extension services . While the major responsibility for providing appropriate training remains at the national level , external financial and technical assistance is required to strengthen national capacities and to provide supplementary training, particularly for higher-level personnel and in specialized skills.

There is still considerable potential for further development in aquaculture, especially mariculture an unexplored area in Myanmar. Productivity is expected to increase steadily in the coming years for the number of species that can be cultured in Myanmar increases . It has been envisaged that with concerted effort by the State and the private sector, aquaculture will contribute to Shrimp Culture and meet the production targets set for in the three year

plan fiscal year 2001/02 to 2003 / 04 . Annual shrimp hatchery production target are given in table 13-1 and shrimp farm production target in table 13-2 below

Table 13-1 Shrimp Hatchery Production Targets , fiscal year 2001/02 to 2003/04
(million)

No.	Hatchery	2001-02	2002-03	2003-04
1.	Wamaw	10	15	20
2.	Tarkayta	10	15	20
3.	Kyaukton	5	10	20
4.	Kunchankone	5	10	15
5.	Tazin	5	10	15
6.	Chaungtar	10	15	20
7.	Lonetar	20	30	50
8.	Kyaukphu	10	15	20
9.	Soemekyi	5	10	15
10.	Yechanpyin	10	15	20
11.	Mongtaw	5	10	15
	Total	95	155	230

Table 13-2 Shrimp Farm Production Targets , fiscal year 2000/01 to 2002/03

No.	Project Period	Extensive		Extensive Plus		Semi Intensive		Total	
		Acre	Production	Acre	Production	Acre	Producti on	Acre	Productio n
			Ton		Ton		Ton		Ton
1.	2000-2001	39544.77	1581.79	1516 3.92	2426.22	2528.84	1264.42	57237.53	5272.43
2.	2001-2002	39412.85	1576.51	2282 1.56	4336.10	5036.27	5036.27	67270.68	10948.90
3.	2002-2003	30992.50	1239.70	4015 2.00	9636.48	9182.50	11019.0	80327.00	21895.18

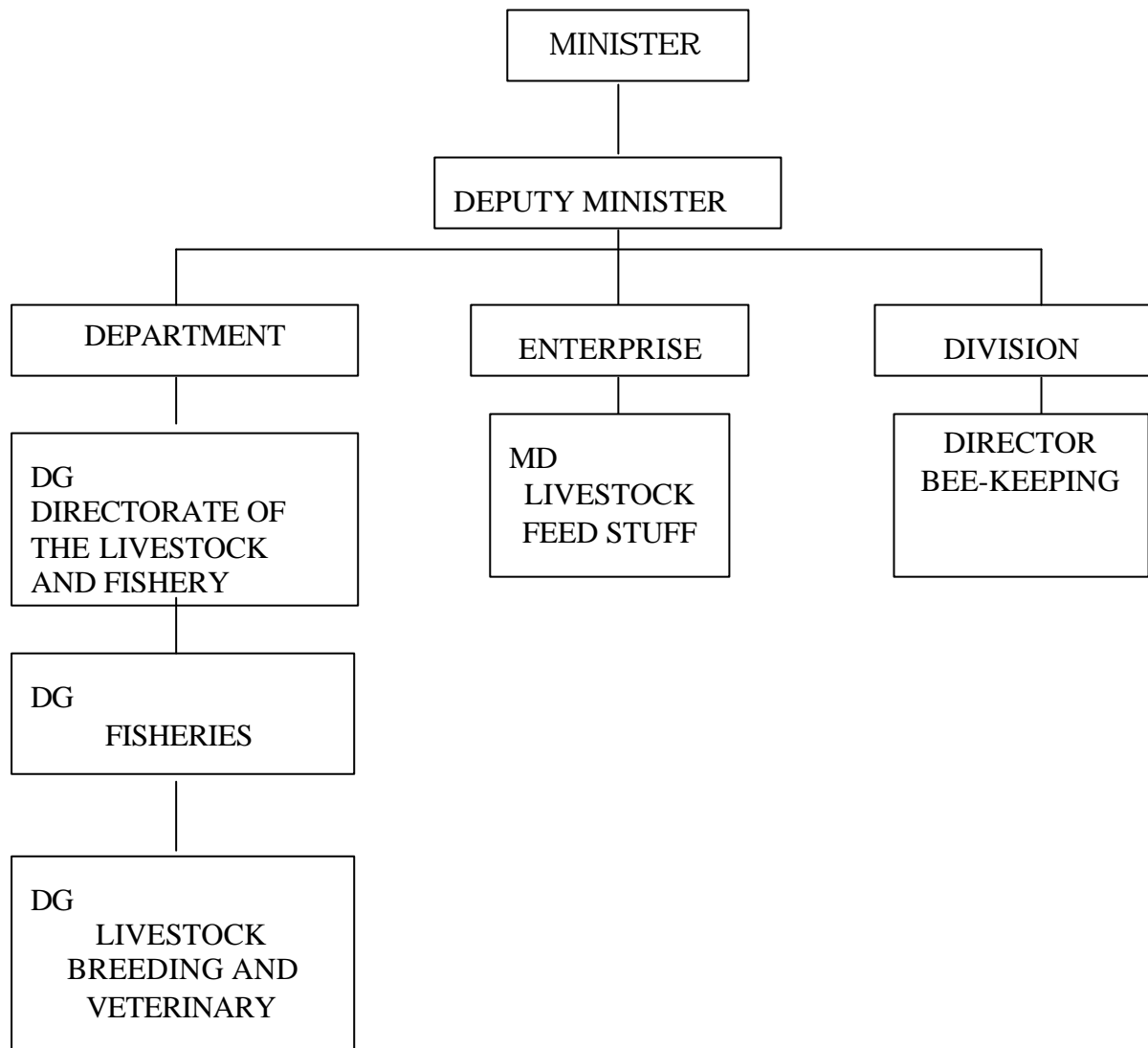
14. CONCLUSION

Yield increases through the application of new production technology, will continue to be the basic element for maintaining or raising production levels. Sustainability will become increasingly critical and might emerge as an urgent issue. It is recognized in Myanmar that to date, aquaculture practices have had no adverse effect on the ecosystem. The State is taking utmost care to establish a strong link between a sustainable development and a sustainable environment. The Department of Fisheries is providing assistance to private sector in the development of sustainable aquaculture i.e. environmentally sound, technically appropriate, financially viable and socially responsible aquaculture systems.

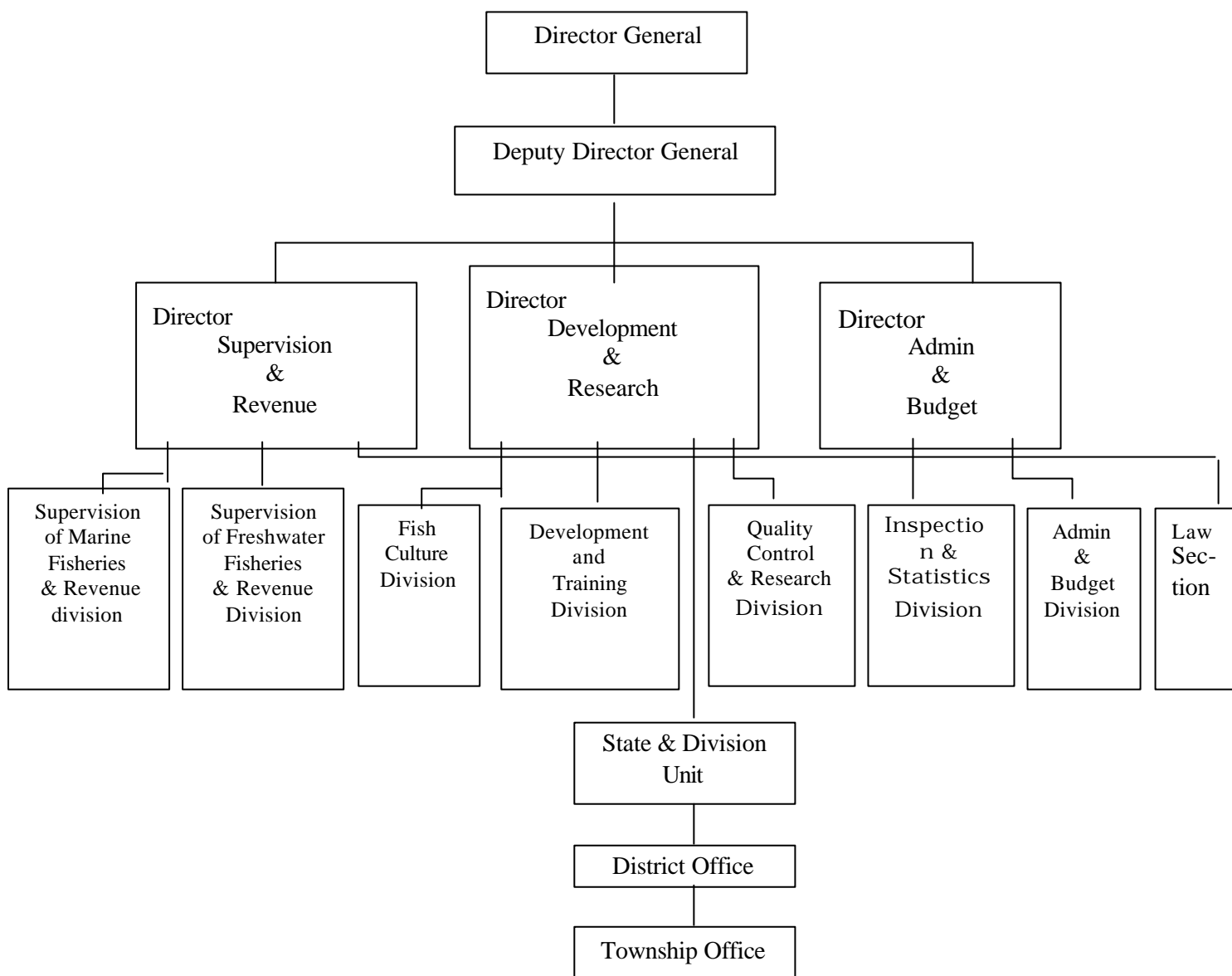
As financing is a major constraint to fishery development, Myanmar Livestock and Fisheries Development Bank and its branches, established at strategically important fisheries areas, are operating to provide short-term and long-term loans to fishery entrepreneurs.

Fisheries sector is still a significant sector in Myanmar economy; fish constitutes to be a major source of animal protein to the people. Moreover, it is one of the largest sources of foreign exchange earning sectors. Hence, fisheries statistics is extremely important in fishery management

ORGANIZATION CHART OF MINISTRY OF LIVESTOCK BREEDING AND FISHERIES



ORGANIZATION CHART OF DEPARTMENT OF FISHERIES



METHODOLOGICAL REVIEW OF STATISTICAL ACTIVITIES IN THE FORESTRY SECTOR OF MYANMAR

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SUMMARY

Myanmar is a country well endowed with natural resources and is regarded as a land of diverse culture and traditions. For systematic and fruitful exploitation and utilization of these natural resources on a sustainable basis, statistical data can be recognized as a vital tool for natural resource management and other sustainable development activities because they provide basic information that aids in making informed decisions, policies and plans. In this paper, methodological review of statistical activities in the forestry sector of Myanmar is fully explained. Moreover, problems, issues and constraints encountered during collection, reporting and dissemination of forestry sector statistics are presented and possible solutions are proposed.

INTRODUCTION

1. Country Profile

Myanmar, a tropical country in Continental South East Asia, is situated between latitudes 9° 58' to 28° 29' North and longitudes 92° 10' to 101° 10' East. The country has a total land area of 676,577 km². The country is most interesting from an ecological point of view as there is a wide range of latitudes, flat lands at sea level to snow-capped mountain peak of over 6,000 meters and deep rivers, wide range of temperature and rainfall. The country's length from south to north is about 2,090 km and the maximum width from west to east is about 805 km. In most part of the country, the temperature ranges between 25° C to 33° C during the rainy season, 10° C to 25° C during the cold season and 32° C to 38° C during the hot season. However, the temperature can reach up to 43° C during the hottest season, especially in the central dry zone. The rainfall, which is distributed over an average of 5 months of the year, also ranges from less than 800 mm to 5,000 mm. Due to wide ranges of latitudinal, topographical and climatic condition, the forest flora varies from sub-alpine to typical rain forest species. Moreover, wide varieties of fauna exist.

Myanmar is endowed with natural resources such as forests, fertile lands, abundant fresh water and rich minerals. Myanmar is one among a few countries where half of the total land area is covered with dense forests. The country is best known for Teak (*Tectona grandis*), a premier tropical timber and as the world's prime supplier of natural teak. The forests are the habitats of diverse species of wildlife. Forest resources play a dominant role in improving the socio-economic life of the people. About 37 million live in rural areas and still depend upon the forest resources for livelihood. The forestry sector provides goods and services for domestic consumption as well as export markets. Forests are of paramount importance for national economic development and one of the major sources of export earning.

Environmentally, forests form a decisive factor in the ecological system.

In Myanmar, the increased population and the consequent rise in demand for forest land and forest products, forest resources have been decreasing rapidly, both in extent and quality. Myanmar Forest Department has, therefore, taken steps to check further depletion and degradation of the nation's natural wealth. Knowledge of the type, location, extent, quality and accessibility of land cover classes and of the current land-use situation is needed to establish a database. This database is essential for conceiving, and formulating, and implementing short, medium, and long-term development plans. Sustainable management of natural resources and environmental protection are the two elements that could ensure the resource advantage, which Myanmar enjoys. Forest inventory and remote sensing techniques are used to assess and monitor the forest resources. Location Map of Myanmar is shown in Figure 1.

2. Forest Policy and Legislation

Once Myanmar was a province of India under British Rule and the 1894 Indian Forest Policy was instrumental in the forest management of Myanmar. Policy measures were updated after Independence, but they were not in conformity with current forestry practices. In view of the importance of the Myanmar Forestry Sector in enhancing national socio-economic development, and ensuring ecological balance and environmental stability, the Government of the Union of Myanmar promulgated the new Myanmar Forest Policy in 1995. This Forest Policy was formulated in line with the Forest Principles adopted at the United Nations Conference on Environment and Development (UNCED), 1992 and other international forestry obligations.

The Forest Policy focuses on the protection of land, water, vegetation and wildlife, sustainability of forest resources, satisfying the basic needs of the people, efficiency in harnessing the full economic potential of the forests, people's participation in managing forests and in biodiversity conservation, and raising awareness of the people and the decision-makers about the important role of the forests in the socio-economic development of the nation.

The Forest Law (1992) in line with the objectives of the Forest Policy highlights environmental and biodiversity conservation, and extended set-up of permanent forest estates (PFEs) and protected areas system (PAS). The Forest Policy also aims at a balanced and complementary land use, gazetting 30 % of the total land area as reserved forest and 5% under protected areas system. Above all, the Forest Law provides opportunities for the promotion of private sector involvement in timber trade, and decentralizes the management responsibilities. It encourages community participatory approach in managing the forest resources, particularly to satisfy the basic needs of the rural people. It demonstrates a shift from the concept of revenue generation and restriction to motivation and share of management responsibilities with the people.

3. Land Use

The forests for administrative purposes are classified into reserved forests and unclassified forests. The total reserved forest area is about 25.2 million acres (10.2 million hectares) in 1989/90. Land use from 1994/95 up to 1997/98 is presented in Table

Table 1: Land Use by Type, FY 1994/95 - FY 1997/98

Land Use	Area							
	1994-95		1995-96		1996-97		1997-98	
	Thousand Acres	Thousand hectares	Thousand Acres	Thousand Hectares	Thousand acres	Thousand hectares	Thousand Acres	Thousand Hectares
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Forest								
1.1 Reserved	25,474	10,309	25,503	10,321	25,688	10,396	26,265	10,629
1.2 Unreserved	54,583	22,090	54,557	22,079	54,525	22,066	53,967	21,840
2. Agriculture								
2.1 Cultivated land	21,533	8,714	22,017	8,910	22,238	8,999	22,304	9,026
2.2 Fallow land	3,448	1,395	3,042	1,231	2,851	1,154	2,759	1,117
2.3 Area suitable for cultivation	19,953	8,075	19,697	7,971	19,591	7,928	19,558	7,915
3. Other land	42,195	17,076	42,370	17,147	42,293	17,116	42,333	17,132
total	167,186	67,659	167,186	67,659	167,186	67,659	167,186	67,659

Source : Settlement and Land Records Department, 1998.

II. REVIEW OF FORESTRY SECTOR STATISTICS

1. Forest Cover Status

Concerning the status of forest cover in Myanmar, appraisals have been made using aerial photographs during the period 1950 – 1962 and satellite images taken during the period 1970 – 1980. The 1989 Landsat TM imageries indicated that Myanmar was endowed with extensive natural forest cover. Facts about the forest cover as of 1989 are given in Table 2 and Forest Cover Status of Myanmar is shown in Figure 2.

Table 2: Forest Cover in Myanmar, 1989

Sr. No.	Land Category	Area (km ²)	% of Total Land Area
(1)	(2)	(3)	(4)
1.	Closed Forest	293,034	43.31
2.	Degraded Forest	50,733	7.50
3.	Forest affected by Shifting Cultivation	154,389	22.82
4.	Water Bodies	13,327	1.97
5.	Non-forest	165,094	24.40
	Total Land Area	676,577	100

Source: Forestry Facts and Figures of Myanmar, 1998.

About 43% of the total land area under closed forests and another 30% under woodlands. Closed and degraded forests, which can be considered as actual forest cover constitute 343,767 km² or approximately 51% of the total land area of the country.

The assessment of forest cover change conducted in 1990, which was also called the 1989 forest cover appraisal, revealed that the actual forest cover had decreased at an annual rate of 220,000 ha or 0.64% of the actual forested area during a period of 14 years from 1975 through 1989. This change was mainly due to shifting cultivation, illicit cutting, and encroachment for agricultural purposes.

However, the physical transfer of forestland into non-forest uses in the same period was only about 15,000 ha annually. According to the FAO publication "State of the World's Forest 1999", change in forest cover between 1990 and 1995 for Myanmar is estimated as 387, 000 ha per year or -1.4 %.

It is learnt that the latest appraisal of forest cover of Myanmar based on satellite data is available at the Forest Department.

2. Forest Resources

Myanmar is rich in forest resources. It is known to have about 7, 000 plant species, of which 1, 071 are endemic. Recorded vegetative species are given in Table 3.

Table 3: Recorded Vegetative Species

Sr. No.	Flora Species	Number of Species
(1)	(2)	(3)
1.	Big Tree	1,347
2.	Small Tree	741
3.	Bamboo	96
4.	Shrub	1,696
5.	Rattan	36
6.	Orchid	841

Source : Forestry in Myanmar, 2000.

Out of the 2, 088 big and small tree species, 85 species have been recognized and accepted as producing multiple-use timber of premium quality. Studies on the properties and utilization of the lesser-used timber species (LUS) are being carried out, and their utility extensively promoted. The objective is to increase commercial production and reduce the pressure on the premium quality timber.

3. Forest Types

Forest types are shown in Table 4.

Table 4: Area by Forest Types

Sr. No.	Type of Forest	Area (ha)	% of Total Forest Area
(1)	(2)	(3)	(4)
1.	Tidal Forest	1,376,900	4
2.	Beach and Dune Forest		
3.	Swamp Forest		
4.	Tropical Evergreen Forest	5,507,800	16
5.	Mixed Deciduous Forest	13,425,300	39
6.	Dry Forest	3,442,400	10
7.	Deciduous Dipterocarpus Forest	1,721,200	5
8.	Hill and Temperate Evergreen Forest	8,950,100	26
	Total Forest Area	34,423,700	100

Source: Forestry in Myanmar, 2000.

The forest flora in Myanmar is diverse varying from sub-alpine in the north through dry and moist mixed deciduous to tropical rain forest species in the south. The deltaic and coastal mangroves are the important breeding grounds for aquatic species. They enrich the fishing industries and provide the local people with food, shelter, small timbers, fuelwood and other forest products. About 60% (4,5 and 7 of the Table 4) are the forest types bearing valuable timber.

The forest area may also be divided by type of vegetation and productivity as shown in Table 5.

Table 5: Forest Area By Type Of Vegetation And Productivity

(,000 Ha)

Sr. No.	Type of Vegetation	Productive Forest	Unproductive Forest	Total
(1)	(2)	(3)	(4)	(5)
1.	Closed broad-leaved	20,655	11,908	32,563
2.	Mangrove	382	403	785
3.	Bamboo	963	-	963
4.	Conifers	113	-	113
	Total	22,113	12,311	34,424

Source: Forestry in Myanmar, 2000.

Estimated volume of growing stock of timber has been shown in Table 6.

Table 6: Volume of Growing Stock of Timber

Sr. No.	Type of Vegetation	Productive Forest		Unproductive Forest		Total
		Total (mil. m ³)	m ³ / ha	Total (mil. m ³)	m ³ / ha	mil. m ³
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.	Closed broad-leaved	1,859	90.0	357	30	2,216
2.	Mangrove	12	30.6	4	10	16
3.	Conifers	16	141.6	-	-	16
	Total	1,887		361		2,248

Source: Forestry in Myanmar, 2000.

Table 6 shows that the forests in Myanmar contain some 2.2 billion cubic metres of standing growing stock of timber. Allowing a conservative growth rate of 1.5 m³/ha/yr in the productive closed broad-leaved forest, the total annual growth could amount to about 33 million cubic metres. The status of permanent forest estate (PFE) at the beginning of 2000 is given in Table 7. Forest reservation has also been expedited to reach a total coverage of 30 % of the total land area by the year 2001.

Table 7: Permanent Forest Estate

Sr. No.	Legal Classification	Area (,000 ha)	% of total land area
(1)	(2)	(3)	(4)
1.	Reserved Forest	11,112	16.40
2.	Protected Public Forest	1,479	2.19
3.	Protected Areas System	1,527	2.26
	Total	14,118	20.85

Source: Facts about Ministry of Forestry, 1999.

4. Bamboo Forests

Bamboos grow abundantly throughout the country either mixed with tree species or in pure stands. Pure stands of Kayin-wa (*Melocanna bambusoides*) stretch over an area of about 8,000 km² in Rakhine State. Pure bamboo stands are also present in Tanintharyi Division. The Kayin-wa in Rakhine State has an estimated growing stock of 21.34 million metric tons capable of producing around 830,000 metric tons of pulp annually, while pure bamboo stands in Tanintharyi Division having a growing stock of about 6.09 million metric tons could provide an annual pulp yield of 247,904 metric tons, if the bamboo forests are managed under a cutting cycle of 10 years.

According to forest inventory data, the stock of bamboos growing mixed with tree species ranges approximately between 1.66 metric tons/ha and 8.71 metric tons/ha. In 1998/ 99 field season, a management level bamboo survey was conducted in Gwa Township of Rakhine State and Yekyi, Lemyethna and Thabaung Townships of Ayeyarwaddy Division. The

Ministry of Industry (1) used these bamboo data to conduct a feasibility study for establishing a pulp and paper mill in Thabaung Township.

5. Forest Plantations

Myanmar initiated the formation of teak plantations as early as 1856 on a small scale using taungya method. The extent of plantations reached a total of 47,167 ha by the end of 1941. Large-scale plantation forestry began in 1980 and more than 30,000 ha of forest plantations had been formed every year since 1984. Through large-scale plantations environmental stability has been maintained. Plantation forestry has always been the supplement to the natural forest management as envisaged in the Forest Policy, 1995.

Myanmar launched a Special Teak Plantation Programme in 1998 in addition to the existing normal teak plantation scheme. The Special Programme, while placing emphasis on increased timber production, will undertake trials to mitigate soil erosion problem associated with plantations. The Special Teak Plantation Programme with 40-year rotation is structured with a series of 8 consecutive phases. Each phase, with the duration of 5 years, consists of 20 plantation centers. Felling-cum-regeneration plan for a period of 5 years was prepared for each centre. The harvest will be made by clear cutting at the end of the rotation of 40 years.

Each plantation centre will establish 405 ha (1,000 ac) of teak plantation annually and a total of 40,500 ha would be planted by the end of the first phase at 20 plantation centres. The programmes would, therefore, have established teak plantations over an area of 324,000 ha by the end of the 40-year rotation. Apart from intermediate thinning yields, a sustainable production of 1.8 million m³ of teak is estimated to be annually available as final yield from 8,100 ha of these plantations by the end of the rotation. Table 8 and Table 9 show forest plantations by species and by type up to FY 1999/2000.

Table 8: Forest Plantations by Species up to FY 1999/2000

Sr. No.	Species	Area (ha)	%
(1)	(2)	(3)	(4)
1.	Teak ^a	280,963	42
2.	Pyinkado ^b	52,177	8
3.	Padauk ^c	15,527	2
4.	Pine	15,886	2
5.	Eucalyptus	74,621	11
6.	Other	236,023	35
	Total	675,197	100

Source : Planning and Statistics Division and Natural Forest and Plantation Division, FD, 2000.

a= *Tectona grandis*, b= *Xylia kerri*, c= *Pterocarpus macrocarpus*

Table 9: Forest Plantations by Type up to FY 1999/2000

Sr. No.	Type	Area (ha)	%
(1)	(2)	(3)	(4)
1.	Commercial	370,775	55
2.	Village Supply	188,550	28
3.	Industrial	50,315	7
4.	Watershed	65,557	10
	Total	675,197	100

Source : Planning and Statistics Division and Natural Forest and Plantation Division, FD, 2000.

6. Timber Resources

Majority of the important timber species such as teak (*Tectona grandis*), Pyinkado (*Xylia kerri*), Padauk (*Pterocarpus macrocarpus*), etc. and the LUS (Lesser-Used Timber Species) grow in the mixed deciduous type of forests. Many valuable species such as the dipterocarpus and some LUS can also be found in the evergreen type of forests.

Pure stands of dry dipterocarpus occur in the deciduous dipterocarpus forests whereas pines are generally confined to the higher altitudes in the north, and the Shan State. The Delta and the Coastal regions are dominated by mangrove forests, which are the main wood based fuel supplier for the country.

Until the beginning of 1996, Annual Allowable Cut (AAC) for teak was 609,500 m³. It was revised and a new AAC was prescribed at 409,062 m³ in late 1996 with a reduction of more than 200,000 m³. However, Myanmar is increasing the extraction of non-teak hardwoods as permitted by the AACs with the intention of stabilizing international trade in timber and ecosystem integrity. The current AACs for teak and other non-teak hardwoods are given in Table 10.

Table 10: Annual Allowable Cuts

Sr. No.	Trees Species	No. of Trees	Volume (m ³)
(1)	(2)	(3)	(4)
1	Teak	124,213	409,062
2	Other Hardwoods	1,795,424	3,236,071

Source: Planning and Statistics Division, FD, 1998.

7. Production and Export of Timber

Table 11 shows a gradual decline in annual production of teak. Although the present policy is to gradually reduce log exports, it still fails to achieve this objective due to lack of investment, infrastructure and technology to go into downstream internal processing.

Table 12 indicates that the share of forestry export earnings in the national economy has declined probably due to increases in foreign exchange earnings of other sectors. However, it has increased again in FY 1998/ 99 and FY 1999/ 2000.

Table 11: Production of Teak and Non-teak Timbers, FY 1990/91 – FY 1999/2000
(Cubic meter)

Sr. No.	Year	Teak Log	Non-teak Log
(1)	(2)	(3)	(4)
1.	1990-91	534,858	578,751
2.	1991-92	469,682	711,948
3.	1992-93	503,439	743,054
4.	1993-94	458,042	717,435
5.	1994-95	473,620	861,432
6.	1995-96	414,719	1,122,993
7.	1996-97	366,113	1,323,219
8.	1997-98	431,038	1,493,153
9.	1998-99	454,084	1,559,768
10.	1999-2000	470,365	1,533,192

Source: Forestry in Myanmar, 2000.

Table 12: Income Statistics of Ministry of Forestry, FY 1990/91 - FY 1999/2000
(Kyats in million)

Sr. No.	Year	Income (Local & Export)	Forestry export income as % of National Export Income
(1)	(2)	(3)	(4)
1.	1990-91	1,797.51	38.20
2.	1991-92	1,896.82	32.17
3.	1992-93	2,786.26	30.65
4.	1993-94	2,746.74	32.09
5.	1994-95	3,354.52	21.63
6.	1995-96	4,066.11	19.25
7.	1996-97	3,401.87	18.32
8.	1997-98	4,376.22	13.91
9.	1998-99	4,692.70	17.40
10.	1999-2000	5,953.71	17.80

Source: Forestry in Myanmar, 2000.

8. Small Timber and Non-wood Forest Products

Apart from big timber, the forests in Myanmar also produce small timber and a variety of minor forest products, namely, bamboo, rattan, cutch, bat guano, edible bird's nest, thatch, orchid, etc. The annual production of these minor forest products is also controlled by the Forest Department with the objective of achieving sustained production. Flow of small timbers and non-wood forest products is very important for domestic consumption and for income generation of local people. Table 13 shows some statistics for the last 5 years from FY 1995/96 to FY 1999/2000.

Table 13: Flow of Small Timbers and Non-wood Forest Products, FY 1995/96 -FY 1999/2000

Sr. No.	Particular	Unit	1995 to 1996	1996 to 1997	1997 to 1998	1998 to 1999	1999 to 2000 ^d
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Small Timbers						
1.	Post (Teak & Non-teak)	No.(,000)	74	56	130	46	148
2.	Pole (Teak & Non-teak)	No.(,000)	540	545	286	310	461
3.	Firewood	Cu.ton (,000)	17,926	17,672	17,950	17,566	18,383
4.	Charcoal	Cu.ton (,000)	184	191	68	90	201
	Non-wood Forest Products						
5.	Bamboo	No.(million)	921	956	960	951	1012
6.	Rattan	No.(million)	101	78	41	31	32
7.	Cutch	Viss ^a (,000)	125	112	171	276	226
8.	Bark	Viss (,000)	457	503	1,910	850	2521
9.	Thanakha ^b	Viss (,000)	230	239	209	140	263
10.	Thatch	No.(million)	902	774	776	764	834
11.	Indwe ^c	Viss (,000)	413	489	217	141	228
12.	Bat guano	Viss (,000)	169	155	172	152	186
13.	Pine resin	Viss(,000)	0	0	20	2	109

Source: Planning and Statistics Division, FD, 1999.

a = 1 viss is equivalent to 1.63 kg.

b = *Limonia accidissima*, Linn

c = Resin extracted from *Dipterocarpus spp.*

d = Data for 1999-2000 are provisional.

9. Wildlife Resources and Protected Areas

9.1 Wildlife Resources

Myanmar is often cited as the last frontier of global biodiversity in Asia. Recorded number of wildlife species in Myanmar natural forests are:

- 300 species of mammals;
- 360 species of reptiles;
- 1,000 species of birds;
- 1,200 species of butterflies; and
- 7,000 species of plants

Wildlife population had declined in the past years due to indiscriminate killing, hunting and habitat destruction. Of the wildlife species, quite a number of them are listed in the IUCN Red Data Book. However, some of the internationally threatened wildlife species are still found in Myanmar.

9.2 Protected Areas Management

In Myanmar, the first game sanctuary, Pidaung Wildlife Sanctuary, was established in 1918 in northern part of the country. So far, 23 sanctuaries and five parks, constituting about 2.26% (15,270 km²) of the total land area of the country have been established under the existing PAS, and proposals for forming new protected areas have also been made. Three more sanctuaries, namely Min-sone-taung, Pyadalingu and Inn-daw-gyi with a total area of 649.01 km² have been proposed.

Although Myanmar's forest cover is still in good shape, the protected area percentage is the lowest in Asia. Thus, it is stipulated in Myanmar Forest Policy, 1995 that the coverage of the PAS will be increased to 5% in the short term. In the long term it is intended to increase up to 10%. The map concerning Wildlife Sanctuaries and Parks of Myanmar is shown in Figure 3.

ORGANIZATIONAL STRUCTURES FOR DATA COLLECTION

1. Organizational Structures

The Ministry of Forestry (MOF) of Myanmar consists of 5 governmental institutions, of which 4 are primarily concerned with forestry, as follows:

1. Forest Department (FD) is responsible for protection, conservation and sustainable management of forest resources. Organizational structures of the Ministry of Forestry and the Forest Department are shown in Figure 4 and Figure 5 respectively.
2. Myanma Timber Enterprise (MTE) is responsible for timber harvesting, milling, downstream processing and marketing of forest products.

3. Dry Zone Greening Department (DZGD) is responsible for reforestation of degraded forestlands and restoration of the environment in the dry zone of Central Myanmar.
4. Planning and Statistics Department (PSD) is responsible for coordinating and facilitating the tasks of FD, MTE and DZGD in line with the directives laid down by the Ministry of Forestry, and acts as a forum on policy issues in forestry.

Myanma Timber Enterprise (MTE) is comprised of 7 departments. Timber Extraction, Milling and Marketing (Export), Milling and Marketing (In-country Sales) are the 3 key departments, directly engaged in and responsible for production and financial earnings.

Forest Department is the primary organization mandated to oversee the management of the country's forest and wildlife resources. FD is comprised of 10 divisions. Out of 10 divisions, Planning and Statistics Division is responsible for assessing, monitoring and evaluating changes in forest resources. This division collects, analyzes, reports and disseminates forestry sector statistics. It also prepares long term, mid term and operational (annual) plans. Under the Planning and Statistics Division, 3 sections, namely, Operation and Project Section, Forest Management Planning Section and Forest Resources Section are directly engaged in and responsible for generating information on the status of forests and ecosystems through the various projects.

2. Collection of Forestry Sector Statistics

Forest Department and Myanma Timber Enterprise are responsible for the collection of forestry and forest industry statistics. Forest Department keeps a record of statistics related to management and production, while Myanma Timber Enterprise collects statistics associated with felling, transport, processing and marketing of timber.

The Ministry of Industry (1), which owns pulp and paper mills in Myanmar, maintains information on pulp and paper.

3. Responsible Agencies for Data Collection

3.1 Operation and Project Section

(a) Staff Strength

Although the sanctioned strength is 14, the current strength is only 9 including clerical staff. Responsibilities of this section are:

1. preparation and monitoring of annual and mid-term plans of forest operations and extraction of forest products, preparation of project, supervision of forest reservation and revision of Forest Management Plans
2. preparation of plans, setting targets for forest products and forest operations, monitoring State/Division level progress reports (Form C and D)
3. keeping records of forest maps and preparation of land use maps using GIS and Remote Sensing Techniques

4. compilation of data from the monthly reports (Form C and D) of State/ Division
5. preparation of annual, quarterly, monthly and occasional reports

(b) Items Collected and Reference Period

Data on of forest operation come from 7 States and 7 Divisions every month to this section. Form C is used for describing the work done with respect to major operations such as Girdling of Teak, Green Teak Marking, Selected Felled Marking, Artificial Regeneration, Natural Regeneration, Thinning, Weeding etc.

The progress made regarding extraction of forest products such as Teak, Hardwood, Post, Pole, Firewood, Charcoal, Bark, Honey, Bee Wax, Resin, and Orchid etc. is reported with Form D.

Essential data as reported by each State/Division are compiled to get union total for 12 months observing the fiscal year from April to March. (Please see Form C and D in Appendix 1 and 2.)

(c) Method of Data Collection and Tabulation

Method of data collection is just compiling information entered onto Forms C and D from State/Division, and reported quarterly to the Ministry of Forestry for monitoring and evaluation.

(d) Constraints

Data flow through monthly reports from State/ Division level offices are not received regularly due to old communication system. Reports from remote area such as Chin State, sometimes took about one month to reach headquarters by post. Data transmission can be improved by means of advanced Information Technology such as fax and electronic mail (e-mail). The Forest Department does have fax facility yet; communication between State/Division level offices and Central Office is unsatisfactory due to problems in the telecommunication system. Acquiring advanced communication system, say, internet facility is the only solution.

(e) Proposed Solutions

Instead of the old communication system such as post and phone, the advanced information technology such as fax or electronic mail(e-mail) is necessary to install. To avoid unsatisfactory conditions of telecommunication system, the advanced and easily manipulated facility of communication system is essential.

3.2 Forest Management Planning Section

Forestry sector development is undertaken within the framework of a 10-year prospective programmes with flexible targets: areas to be protected; areas to be reforested; estimating demands and supply of forest products; felling and regeneration

programmes; management and conservation activities; research priorities, and administrative arrangements for staff requirements including estimates of costs and returns. Working plans for each forest division were drawn up and exercised starting from 1930s. The new 10-year Forest Management Plan superseded the previous working plans.

This section is responsible for monitoring and evaluation of 62 forest districts. Each district forest officer has to draw up individual management plans and the Central Office of Forest Department facilitates the execution and implementation of these plans.

(a) Staff Strength

The sanctioned strength inclusive of clerical staff, is 43. Two officers are assigned to monitor the progress of the forest management plan. Working groups are scattered at each division.

(b) Items Collected and Reference Period

Today, Forest Management Plans have to be drawn in the context of prevailing demographic, social, economic and environmental situations to a much more greater extent than in the past. However, Forest Department has so far failed to generate a sound database. Available data are fragmented and inadequate for necessity. Forest officers from each and every district should therefore be trained to collect, analyze and use the data.

(c) Method of Data Collection and Tabulation

Most of the districts have forest resource data on stand table, stock table and yield table for teak and hardwood, which are compiled from inventory conducted by the Forest Resources Section. For those districts which have not yet conducted inventory, they are advised to use One-shot Inventory Method.

A brief description of One-shot Inventory Method is given below:

Survey line has to be laid down starting from a suitable point and sample plots of size one acre extent (66'x 660') are fixed on the line at every 1000' interval. The number of sample plots is dependent upon time, manpower availability, and area in which inventory control has to be taken. The growing stocks of tree species, size (2' in girth at breast height and above) and bamboos have to be counted. On the same survey line, the number of sample plots should not be more than 5. If more sample plots are needed to get a wider distribution, another survey line has to be laid down. One-shot Inventory Design is shown in Figure 6. Trees and bamboos are collected by using specific field forms, namely, tree enumeration sheet and bamboo enumeration sheet shown in Appendix(4) and Appendix(5) respectively.

(d) Constraints

It is pertinent to mention that production of data is meaningless if there is no demand for it and if it is not continuously adapted to changing demand. This implies that there

has to be a strong and resourceful planning unit within the Forest Department with the knowledge and capability to influence data collection and to ensure that data are presented in a useful way.

Lack of expertise, and inadequately trained staff are the main obstacles to implement action plans. The implementation of forest policy and planning programmes needs mechanism for funding support to ensure that targets envisaged in the forest policy are achieved.

(e) Proposed Solutions

Regarding the inadequacy of trained staff and expertise, this can be better solved through international assistance and co-operation. The implementation of forest policy and planning programmes should be adequately funded and the mechanism of funding support modified to ensure that prescriptions and targets envisaged in the forest policy are achieved. A policy measure in this direction would be the establishment of forest development fund to be made operative outside the realms of the normal government budgetary allocation procedures. Possibility should also be explored for increased financial flows and technical assistance available from international agencies for innovative activities, capacity building, research, education and training.

3.3 Forest Resources Section

(a) Staff Strength

Sanctioned strength is 176, but the current strength is only 90 including clerical staff. Responsibilities of this section are:

1. Conducting national level forest inventory, covering about 2 million hectares each year.
2. Processing and analyzing the forest inventory data collected.
3. Constructing necessary tables based on forest inventory data.
4. Processing remotely sensed data and constructing GIS databases by using Remote Sensing Software and GIS Software.
5. Producing forest cover, land use and other maps.
6. Publishing regular and ad hoc reports.

(b) Items Collected and Reference Period

The Forest Inventory Unit, under the management of Forest Resources Section, has been conducting national level forest inventory since 1981-82. Forest inventory is usually carried out during open seasons starting from November to February annually. Although all forest products cannot be covered by the inventory, data on tree species having 20 cm and more in diameter at breast height are enumerated. Number of bamboo culms by species and by age class are counted. Green weights of bamboo by species and by age class are also measured. Moreover, information on natural regeneration of Kyun (*Tectona grandis*), Pyinkado (*Xylia kerri*) and other tree species are collected in order to assess the silvicultural condition of the forest.

(c) Method of Data Collection and Tabulation

For systematic and fruitful exploitation and utilization of forest resources on a sustainable basis, fresh and correct data are essential for forest resource management. In Myanmar, the forests play a vital role in the national economy. To produce forest products annually on a sustainable basis, it is necessary to manage the forests systematically and scientifically. In order to do so, fresh and correct data of the forest resources are essential to the forest managers.

In the past management plans (working plans) were drawn from the data obtained from girdling operations which had some limitations. Complete enumeration of teak was carried out down to 4' 0" gbh during teak girdling and data beyond this limit were lacking. Complete enumeration of marketable hardwood species within 1 foot girth class below fixed girth limit was also available in the Hardwood Selection Working Circle (HSWC). These enumeration data gathered in both Teak Selection Working Circle (TSWC) and HSWC were considered inadequate for more intensive management planning.

In addition, various inventory surveys based on statistical inventory designs were conducted in Myanmar from 1964 to 1975. Estimates from such surveys were used in calculating annual cuts from natural teak forests in 1969. These surveys provided reliable estimates for efficient management planning. However, as they were not on a continuous basis, they did not provide enough information on growth of the forests and also the mortality rate, which was essential for long-term management planning.

The Forest Department of Myanmar carried out the National Forest Survey and Inventory Project (BUR/79/001) with the assistance of UNDP/FAO from 1981-82 to 1985-86. Then the UNDP/FAO National Forest Management and Inventory Project (MYA/85/003) was implemented from 1986-87 to 1991-92. Beginning from 1992-93 and onwards, the national forest inventory was conducted by the Forest Department with its own resources.

The design of inventory at the Pre-Investment level belongs to the technique of systematic sampling. Individual sampling units, or sample plots are distributed systematically on a square grid of 3 km (3,300 yards) x 3 km (3,300 yards) over the forest area. As the basis for continuous inventory was designed on Sampling with Partial Replacement (SPR), one quarter of the sampling units was made permanent on a square grid of 6 km (6,600 yards) x 6 km (6,600 yards).

The sampling unit was of an inverted L-shape having an area of 1.05 ha. Each sample plot is an enumeration strip of 15 m width to the left and 15 m width to the right of a centre line, which runs 175 m in west-east direction and 175 m in the north-south direction. The strip is divided into 7 record units, numbered from 1 to 7 as shown in Figure 7. The layout of sample plots is illustrated in Figure 8. The centre of record unit No. 1 of each plot is marked on the 1" = 1 mile map by drawing circles. Red circles represent permanent sample plots whereas blue circles represent temporary sample plots. The centre of record unit No. 1 of each plot must be located in the forest as accurately as possible by measuring from a reference point identifiable both on map as used as on ground. Then the plot is established from there. The

reference points may be forest reserve or compartment boundary pillars, intersections or sharp bends of roads, bends and confluences of streams or similar landmarks. The distance as read from the 1" = 1 mile, i.e., 1 : 63, 360 map must be converted into metres.

The sampling design of the Reconnaissance Inventory was a stratified random cluster sampling. The clusters were made up of five sampling units each and allocated proportionately to the stratum area. The sampling unit was formed with twelve circular plots of 12 m radius arranged 40 m apart between the centres of two adjacent circles on a square tract. With 240 m in between the centres of four circles of the two adjacent units, their lay out in a cluster resembled that of a five points of a dice.

The sampling design of the Management Inventory was exactly the same as that of the Pre-Investment inventory except that more information was collected from each sample plot. The methods and periods of data collection in Myanmar forests is shown in Figure 9.

Regarding the enumeration of tree and bamboo, trees of 20 cm and more in diameter at breast height are enumerated on the whole plot, i.e. on the strip of 15 m horizontal distance to either side of the centre line. Trees of 10 cm and more and less than 20 cm in diameter at breast height are enumerated on three circular subplots with a radius of 15 m each. The centres of these subplots are at the centres of record unit No. 1, 4 and 7. Trees of 5 cm and more and less than 10 cm in diameter at breast height are enumerated on three circular subplots with a radius of 10 m each. The centres of these subplots are at the centres of record unit No. 1, 4 and 7. Bamboo is also enumerated on these subplots.

Tree and bamboo data are collected by using specially designed forms, namely tree enumeration sheet and bamboo sheet. These enumeration sheets are shown in Appendix(6) and Appendix(7) respectively.

With a sampling intensity of about 0.1%, the forest inventory at the Pre-Investment level was designed to assess the volume of current utilized tree species of 40 cm+ diameter with a precision of $\pm 20\%$ at 95% probability within a forest area of 50,000 ha. Although inventory is basically independent with a sampling design, its efficiency is to be improved by post-stratification based on forest type maps developed from aerial photographs. The sampling intensity of the forest inventory at reconnaissance level was less than 0.1%, while the Management Inventory had been conducted with a sampling intensity of 0.5% to assist in the development of medium and long term integrated forest management and utilization plans for selected model areas.

On the basis of national forest inventory data, the following outputs are regularly produced:

1. Stand Table
2. This table shows the number of tree by GBH classes, by species and by species group.
3. Stock Table
4. This table shows the volume of tree by GBH classes, by species and by species group.

5. Bamboo Table
6. This table shows the number and green weight of bamboo culms by species and by age classes.
7. Annual Allowable Cut (AAC) Table of teak and other hardwoods
8. This table consists of the annual yield of teak and other hardwoods.
9. AAC Table of bamboos
10. This table consists of the annual yield of bamboo species.
11. Forest Resources Data Book
12. This book consists of stand table, stock table, bamboo table, AAC table of trees, AAC table of bamboo and the respective bar charts and pie-charts. Generally, this book is published by township or district or state/division.

(d) Constraints

National forest inventory cannot be conducted in Kayin State, Kayah State, Mon State and Tanintharyi Division due to lack of security. Even for the remaining States and Divisions, forest inventory cannot be done in some areas due to inaccessibility, lack of security, and difficulty in recruiting manpower. For instance, Kyaukkyi Township and Shwegyin Township of Bago Division have the above-mentioned constraints. Due to rising labour charges, manpower with specific skills cannot be used in full capacity when establishing the sample plots. For secure remote areas, it is not easy for getting labourers due to difficulties in transportation and in finding labour from sparsely populated areas. Although the salaries have been increased, the daily allowance is not amended yet. Due to very low daily allowance, public service personnels are reluctant to stay in the forest.

(e) Proposed Solutions

The following solutions are proposed for overcoming the constraints encountered.

1. In remote areas, stratified random sampling should be adopted instead of systematic sampling.
2. Budget allotment for conducting national forest inventory should be increased so as to cover rising labour charges.
3. Daily subsistence allowance should be increased sufficiently to cover living costs.
4. One-shot inventory Method should be applied in those areas where forest inventory cannot be conducted.
5. National forest inventory should be carried out on a continuous basis so as to know the status and condition of the natural forests.
6. Permanent sample plots should be fully protected for a prolonged period so that successive measurements can be done.

4. Analysis, Utilization and Dissemination of Forestry Sector Statistics

Original forestry data are called primary or core data. Based on the core data, stand table, stock table and bamboo table are produced. Estimated data mentioned in these tables are known as secondary data. Generally, these secondary data are used to analyze status, growth and condition of natural forests. Especially, these data are used to calculate AACs of teak, hardwood and bamboo. These AAC data are prescribed for the townships by the Planning

and Statistics Division of the Forest Department. In accordance with the prescribed AACs, teak and hardwoods are harvested in each township.

Other examples concerning the analysis of the forest inventory data are : (1) DBH (Diameter at Breast Height) or GBH (Girth at Breast Height) distribution of tree species, (2) Density of tree species, (3) Composition of tree species, (4) Distribution of forest types, (5) Estimated number of trees per acre or per hectare, (6) Age class distribution of bamboo species, (7) Estimated number of bamboo culms per acre or per hectare, (8) Average weight of bamboo culms by bamboo species, (9) Distribution of bamboo species, etc.

The forestry and forest industry statistics are made available to the State Peace and Development Council(SPDC), Ministry of Forestry(MOF), Planning Department and Central Statistical Organization (CSO) under the Ministry of National Planning and Economic Development, ITTO and FAO. The flow of reporting and dissemination of forestry sector statistics is shown in Figure 10.

Important publications on forestry and forest industry statistics are listed below:

Annual publication

1. Notes on Forestry in Myanmar
- published by the Forest Department, Ministry of Forestry.
2. Forestry Fact Sheet
- published by the Forest Department, Ministry of Forestry.
3. Forest Resources Data Book
- published by Planning and Statistics Division of the Forest Department, Ministry of Forestry.
4. Forestry in Myanmar
- published by the Forest Department, Ministry of Forestry.
5. Statistical Data of Myanma Timber Enterprise
- published by the Myanma Timber Enterprise, Ministry of Forestry.
6. Review of the Financial, Economic and Social Conditions
- published by the Planning Department, Ministry of National Planning and Economic Development.
7. Statistical Yearbook
- published by the Central Statistical Organization, Ministry of National Planning and Economic Development.

Monthly publication

1. Selected Monthly Economic Indicators
- published by the Central Statistical Organization, Ministry of National Planning and Economic Development.

ROLE OF GIS AND REMOTE SENSING FOR FORESTRY SECTOR STATISTICS

1. Forest Resource Information

Forest resources are being degraded and depleted worldwide as a result of increasing human needs, agricultural expansion and environmentally harmful mismanagement. As development activities have intensified and expanding populations have spread onto increasing marginal lands, problems of deforestation, soil degradation, wetland drainage and diminished biological diversity have become important environmental concerns. Thus, there is an urgent need for adequate information bases from which appropriate resource management strategies and interventions can be derived.

Since Forest Resources Assessment 1990(FRA 1990), new information requirements have emerged, including location-specific or spatial data which support efforts in sustainable forest management and assessment of forests' environmental functions. FAO Global Forest Resources Assessment 2000 (FRA 2000) is the most comprehensive and a complete assessment of the state of the world's forest. FRA 2000 includes information on forest area (status 2000 and change), ecological aspects of forests and economical potentials of forests. One major part of FRA 2000 report is the assessment and standardization of existing country data on forests.

Over the last 20 years, new technology has increasingly been used in assessing forest resources, including microcomputers, long-distance surveying via low or high resolution satellite, and GIS and Global Positioning System (GPS). Considering the essential role of forest assessment and surveillance, forest authorities should allocate adequate resources for assessment and surveillance. Like other developing countries, Myanmar has to improve its forest inventory resources.

2. Forest Resource Monitoring Using Geoinformatics

2.1 Conventional Remote Sensing System

Remote Sensing technology in the form of Aerial Photography, was introduced in Myanmar as early as 1920s for forestry purposes and revision of topographic maps. Aerial photography continued to play an important role in topographic maps compilation and forest cover assessment. The large parts of the country had been covered by aerial photography in two different periods 1950s and 1970s. No complete coverage of the whole country has ever been undertaken.

2.2 Development of Geoinformatics

Satellite Remote Sensing was first introduced into Myanmar in 1980 by FAO/UNEP Project. Landsat MSS images taken between 1972 and 1979 with 1 : 1,000,000 scale B/W prints for all bands and one colour composite transparency containing 44 scenes each were provided for forest cover assessment. Manual interpretation method was used in making an assessment of the forest cover area of the whole country. The reference year for this appraisal was 1975. Six land-use classes were identified, namely, (i) closed forest, (ii) degraded forest, (iii) closed forest affected by shifting cultivation, (iv) degraded forest affected by shifting cultivation, (v) non-forest area and (vi) water. Though deforestation has occurred increasingly it has never been systematically determined until Landsat imageries were obtained.

The UNDP funded project BUR/79/001 "National Forest Survey and Inventory Project" (NFI) began in 1981 and about 50% of the country was covered by aerial photography. Two sets of Landsat MSS imageries for the period 1974-1980 at 1:1,000,000 and 1:250,000 were acquired. The follow-up project (MYA/85/003) "National Forest Management and Inventory Project" (NFMI) provided more funds to continue with aerial photography and at the termination of the project, over 95% of the country was covered by aerial photography, leaving only the border areas and some hilly areas. Over 400 forest type maps were produced using new photographs. A set of Landsat TM imagery for the period 1989-90 at 1:500,000 scale was acquired and a countrywide land-use map was produced by visual interpretation. This forest cover appraisal was the fourth one conducted in a series of appraisals.

With funds provided by NFMI (MYA/85/003) Project, a PC based Arc/Info GIS was installed in July 1993. Several geographic databases and land-use maps were produced on a pilot basis using the GIS system.

For the first time in Myanmar, a digital image processing system PCI EASI/PACE was installed at the Forest Department in early 1996 with the financial assistance received from Watershed Management for Three Critical Areas Project (MYA/93/005). The image processing system was incorporated with the GIS system to produce land-use maps for sustainable development of critical areas. The Forest Department under the Ministry of Forestry has been a pioneer in the application of GIS system in Myanmar and has now become one of the major GIS users having a moderately well equipped GIS unit. Although the Global Positioning System (GPS) technology was in use for a number of years, the introduction of its application to Myanmar was quite recent. The Forest Department obtained its first GPS units through FAO/ UNDP Project (MYA/93/005). Now, several GPS units are used for locating ground control points in the process of digital image processing. The Magellan GPSs were used to record the locations of permanent sample plots established in Sagaing Division in 1998/99. The Survey Department of the Ministry of Forestry is taking a good advantage of the system in locating benchmarks throughout the country.

2.3 Present Image Classification Methodology

Image classification methodology in common use at the Forest Department is still manual classification. In this methodology, remote sensing software is used to improve the visual interpretation by enhancing the spectral differences between the objects under the study and to choose the best band combination that can provide maximum information for the display of a colour composite. After the best image for the specific purpose is created, a paper print of the image is produced and visual interpretation is carried out on the paper print-out with the aid of aerial photographs, forest type maps and local knowledge. Ground truthing is done eventually after the initial interpretation. GPS is used for this purpose. After the final classification, results are digitized and fed into the GIS system. Basic map data such as roads, streams, forest reserve boundaries, etc. are also digitized from topographic maps and created map layers. They are overlaid onto the classified image layers to get the final map. At the same time, spatial statistics for each class are calculated by using both Arc/Info Table Module and Excel software.

2.4 International Co-operation

International organizations, mainly FAO/UNDP, have provided technical support for capacity building in the areas of remote sensing and GIS infrastructure to the Forest Department. Beginning fiscal year 1995/ 96, a three-year Information System Development Project (ISDP) was implemented with "The Forest Agency of the Japanese Ministry of Agriculture, Forestry and Fisheries" for the management of tropical forests in Myanmar. During the project period, the Japan Forest Technical Association (JAFTA) acquired the most recent Thematic Mapper (TM) satellite data and conducted digital image processing in Japan. With the assistance of the staff of the Forest Department, field inspection was carried out twice a year in Myanmar. Topographic maps (quarter inch, 1:253,440) indicating the boundary information of the townships and reserved forests were acquired from the Forest Department and used for geometric compensation and preparation of overlay information. Finally, forest type maps and related data in the form of forest registers were produced and presented to the Myanmar Forest Department. After the termination of the three-year project, the project was extended for one year, and 5 more Landsat scenes were digitally classified. During the four-year project period, altogether 23 Landsat scenes have been completed through digital processing. On the whole, the project provided computer hardware and software, satellite digital data, false colour composites, forest type maps and forest registers to the Forest Department.

ESCAP/NASDA provided the Forest Department with computer hardware and software, remote sensing and GIS facilities and satellite digital data for a research project on "Monitoring the Land-Use Changes in Thaton District of Mon State between 1993 and 1997". This project adopted the integrated application of GIS and Remote Sensing for monitoring changes in land-use situation in Thaton District, Mon State. The map showing all land-use changes of Thaton District between 1993 and 1997 is given in Appendix 6.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

Myanmar is endowed with a highest percentage of forest cover in the Asia Pacific region. Myanmar possesses an unusual diversity of flora and fauna. The biodiversity, being a natural heritage of the country, it deserves to be safeguarded for the benefit of both present and future generations.

Myanmar is no exception in facing issues like, unsustainable land use practices, lack of clear-cut land use policy, encroachment, deforestation, poaching, lack of trained staff and human resources, insufficient availability of funds and equipment, etc. The destruction of natural forests is a global concern. The issue is not confined only to the countries where these forests exist.

Developing countries, like Myanmar, have to utilize forest resources for their economic and social development. Keeping in line with the New Forest Policy, the Forest Department practices a balanced approach towards conservation and development issues implicit in the concept of sustainable forestry. It is important to systematically manage forest resources for

the long-term benefit and development of the State. Resources must be used in a sustainable manner so that the earth will be able to sustain not only the present generation but also the generations to come.

For management and planning of natural resources, precise, frequent and timely statistics is a requirement. Remote Sensing brings an answer to resource managers who have been concerned with the spatial distribution, identification and inventory of resources over a large geographical area. GIS fulfils the increasing need to combine remotely sensed data with other ancillary and varied data such as DTM, soil types, weather and political boundaries, etc. In this way remotely sensed data can be used as inputs to a GIS for analysis and decision making.

In Myanmar, the responsibility of natural resource management is shared among various agencies, departments and ministries. Different agencies usually manage particular resources independently within their domains. Thus, the mechanism for inter-ministerial co-ordination on natural resource management issues still need to be established.

At present, there is no well-integrated arrangement for managing the country's natural resources. An integrated natural resource management approach needs to be established for formulating appropriate policy, for conceiving plans and for regulating framework to ensure that the natural resources are well managed. Environmental awareness, active participation of local community and co-ordination of other agencies such as agriculture, forestry, fishery, livestock and local authorities are essential dimensions required for resource management.

2. Recommendations

In order to effectively manage, protect and sustainably use the forest resources, the following recommendations should be made for the improvement of method of data collection, tabulation and dissemination of forestry sector statistics:

- (a) Precise, fresh and timely statistics on forestry sector should be collected and compiled regularly.
- (b) Methodological review of statistical activities for forestry sector should be done once in every five years or whenever deemed necessary.
- (c) Present survey method should be modified from time to time to facilitate data collection and to save time and expense of the survey.
- (d) Items of data collection and timing of the survey should be compromised depending upon available sources, manpower and finance.
- (e) Specially designed field sheets and questionnaires forms should be simple and clear as much as possible.
- (f) Computer databases for forestry sector statistics should be established by using a suitable database software so that many organizations can share the databases easily and conveniently.
- (g) Advanced telecommunication system such as fax or electronic mail (e-mail) should be

applied to speed up the flow of reporting and dissemination of forestry sector statistics.

- (h) Forestry sector statistics approved by the Ministry of Forestry, should be disseminated to the relevant organizations that use forestry statistics.
- (i) Priority should be given to collect the kind of data in urgent need.

METHODOLOGICAL REVIEW OF STATISTICAL ACTIVITIES FOR NATIONAL CENSUS OF AGRICULTURE

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1. INTRODUCTION

The national economy of Myanmar is predominantly agricultural because most of the populations are directly involved in it as farmers, traders, processors or workers. It is therefore, important for planners to find out the economic and social factors, which affect the process of production on the farms of millions of farmers. Thus, information on the agricultural holdings is a basic requirement for framing sound schemes of development. The demand for such information can be met most effectively only through a census of Agriculture.

In 1953, the first census of Agriculture was undertaken covering about 2,143 village tracts in the neighborhood of 252 towns. Plans were made to carry out Censuses of Agricultural during the period, FY 1978 / 79 FY 1981 / 82; but they did not reach the stage of implementation.

In 1982, SLRD in consultation with representatives from FAO Regional Statistical office for Asia and the Pacific, drafted a programme of activities which ultimately led to project MYA/ 85/ 004. " Agricultural Census and strengthening of the System of Agricultural Statistics ."The 4 / 88 session of Cabinet, convened on 11 May 1988, approved the Project proposal and the Project Document was signed on 22 August 1988.

2. ORGANIZATIONAL STRUCTURE OF THE CENSUS

According to the 1990 round of World Census of Agriculture 1993 Myanmar Census of Agriculture was carried out by the Settlement and Land Records Department under the Ministry of Agriculture and Irrigation , with financial and technical assistance from UNDP/ FAO.

The Census operation started in September 1990 with the arrival of an Agricultural Census/ Sampling adviser; the planning , preparation, recruitment and training of field staff took two years .The actual enumeration was carried out concurrently in all parts of the country in 1993 from February 22 to April 11.

Five division heads of office assisted the National Project Director (NPD) and Technical advisers. These divisions of Agricultural Census Office (ACO) were: Administrative Services, Geography, Field Operation, Census and Statistics, and Computer.

National Agricultural Census Committee (NACC) was formed with representatives from many Government agencies and local organizations and met on many occasions in April 1991 and October 1992 to formalize the terms of reference (TOR) and to ensure proper coordination of activities at various stages of census operation. The steering Committee was chaired by the Minister for Agriculture and Irrigation, and Director Generals and Managing Directors of the Departments concerned served as members.

The Technical committee, working groups and task forces of NACC, were subsequently formed to implement the TOR of NACC. The technical committee had been instrumental in setting up acceptable concepts, definitions and standards for the Census. The sub-committees also approved the final version of census questionnaire and the statistical tables for preparing the preliminary and final reports.

Census sub- committees were also established at each level of administration; from Division/ State, via District, through Township and down to the ward / village tract in order to ensure that data collection work could be carried out smoothly.

All 207 sanctioned post plus 100 additional temporary staff and 4 FAO administrative support staff were recruited

UNDP / FAO provided assistance for the purchase of computing, printing and cartographic equipment; the provision of overseas training to staff in Agricultural Census and Statistics, data processing and Cartography; and the appointment of technical advisers who assisted SLRD in the preparation and conduct of the 1993 Census of Agriculture.

3. CENSUS ITEMS

The census items of the 1993 agricultural census was in accordance with the basic principles laid down in FAO's Programme for the 1990 World Census of Agriculture. A number of topics (reference points) or (item) recommended by FAO with respect land tenure, land use and forest and fishing activities were omitted in order to keep the census as simple as possible. Some additional items were collected for livestock.

Current agricultural information on crop production and yields, livestock production or quantities of fertilizer used, and other input were excluded partly for reducing the incidence of the release of conflicting statistics and partly for these data were available a basic from SLRD, MAS, Animal Husbandry Veterinary Department respectively.

Small holding which make a very small contribution to total agricultural production were also excluded because the inclusion in the census would greatly increase the workload of enumerator. The minimum size set in the census was 0.10 acre.

4. CENSUS METHODOLOGY

The Census methodology used involved identifying agricultural holdings on the basis of the place of residence of persons operating; i. e the holders: The land operated by an agricultural holding comprised of all land under the control of a holder regardless of location, and therefore included land called parcel in different village tracts or townships.

An Agricultural Holding is the statistical unit, in the Agricultural Census it is defined as an economic unit of agricultural production under a single management. Agricultural production included all land and livestock activities.

5. SAMPLING METHODOLOGY

A flexible sample design was chosen for the 1993 census of agricultural. A two stage area sampling was used in rural areas , and a systematic random sampling was used in urban areas.

5.1 Rural areas

Two stage area sampling was used:-

- first stage : selection of a stratified sample of enumeration areas (EAs) with probability proportional to the expected number of holdings. (stratified PPS sampling);
- second stage; within selected EAs, the selection of a sample of agricultural holdings using systematic random sampling .
A different methodology was used in some areas:
 - -in township where EAs were small ,a large second stage sampling fraction was applied, systematic random sampling was used for the first stage selection of EAs. This was to avoid distortions in the second stage sample arising because of rounding.
 - -in townships with very few holdings or where a large sampling fraction was taken, all EAs were selected. This amounted to the use of list sampling.

5.2 Urban areas

There are two parts of the sample. Areas where agricultural holdings were well concentrated were covered using two stage sampling ,in the same way as for rural areas. In other areas, where there were few scattered holdings within a largely urban community, systematic random sampling was used. The list of agricultural holdings in these areas was compiled using information available from SLRD offices.

Two categories of agricultural holdings were completely enumerated- holdings with 50 acres or more of agricultural land, and non-house hold holdings (e.g co-operative farms)

Different sampling procedures was applied in three sectors:

- area sample sector , comprising all rural areas plus urban areas with concentrations of holdings;
- list sample sector, comprising all other urban holdings;
- complete enumeration sector

In every sector, holdings in a given township had the same chance of being included in the sample.

5.3 Formation of EAs

Each township was divided into EAs based on the information provided by the township offices, using kwin maps, surveyors' local knowledge and field visits. An EA usually contained between 50 and 100 holdings. EAs consisted of areas with clearly defined boundaries, comprising a kwin, a group of kwins, a part of a kwin, a whole village, or a part of a village. Maps were prepared to clearly identification of EAs. Each EA was given a two digit number as part of the geographic coding system.

5.4 Stratification of EAs

Each township was divided into strata taking into consideration two factors:

- different agricultural conditions throughout the township.
- travel time involved to reach parts of the township. to ensure good representation of all types of agricultural (condition) and producing more reliable census data.

5.5 Total sample size

The total sample size (for both the area sample and list sample sectors) was set at about 250,000 agricultural holdings (an overall fraction of sampling 7.7 %). This took into account three factors:

- the sample provided an average of 18,000 sample holding per State / Division and 900 sample holdings per township, which was sufficient to provide detailed tables at the State / Division level and a limited range of information for each township;
- with 4,500 enumerators, it provided a workload of 50 to 60 sample holdings for each enumerator, the workload was consistent with enumeration time set;
- it was estimated that data entry work for the total number of questionnaires, using 30 computers, could be completed within eight months, as would be necessary if the first census data and preliminary reports were to become available 12 months after data collection.

5.6 Allocation of sample to States / Divisions and Townships

The allocation of sample between States/Divisions and Townships were determined so as to meet the need for census estimates to be produced at three geographic levels Union State/ Division and Township- with three competing sample allocation elements :

- To form Union level estimates, it would be appropriate to allocate sample to States / Divisions and Townships in proportion to the number of holdings. This would, however, provide too little sample holdings in small States/ Divisions and Townships to produce reliable estimates.

- To make estimates for each State and Division, it would be best if approximately equal sample sizes were taken in each State and Division, with the sample allocated to townships in proportion to holding numbers. This would mean that reliable estimates could not be made in small townships because of small sample sizes.
- For the production of township estimates, optimum allocation would provide approximately equal sample sizes in each township. The disadvantage of this procedure would be the large differences in sample sizes between States and Divisions, which would mean that the accuracy of estimates for States and Divisions would vary markedly.

The final allocation was a compromise between the three options. A sample of between 700 and 1,000 holdings were allocated to each township, with sample sizes adjusted to increase sample sizes in smaller States and Divisions. It was decided that separate estimates would not be produced for some very small townships, and they were allocated small samples appropriate to their contribution to the corresponding State or Division estimate .

The important parameter for the sample design was the sampling fraction (i.e the proportion of holdings to be sampled), which varied between States and Divisions. Sampling fractions ranged from 4 to 6 % in the bigger States/ Divisions, up to nearly 40% in the smallest State (Kayah). The expected sample size was highest in Shan and Sagaing , reflecting the large number of townships in these areas.

The allocation of sample holdings by major administrative divisions is shown as below.

Sample allocation by State/ Division, Myanmar Agricultural Census, 1993

State/ Division	No. of Townships	No. of EA's	Selected EA's	Estimated Holdings	Expected Sample Holdings	Average Sampling fraction
01. Kachin	17	1340	802	67886	12345	18.18
02. Kayah	7	198	185	11269	4476	39.72
03. Kayin	4	1119	466	55034	5426	986
04. Chin	9	1334	478	55921	9595	17.16
05. Sagaing	35	8550	2359	440063	28971	6.58
06. Tanintharyi	10	1783	888	84396	11237	13.31
07. Bago	27	5432	1792	343062	21566	6.29
08. Magway	25	7153	1967	380296	21731	5.71
09. Mandalay	25	7921	2029	419525	21131	5.04
10. Mon	10	2150	1183	84944	11510	13.55
11. Rakhine	17	4362	1336	209416	16559	7.91
12. Yangon	14	2462	1010	120750	11294	9.35
13. Shan	46	5259	2439	260729	32117	12.32
14. Ayeyarwady	26	11533	2120	520971	24514	4.71
Total	272	60596	19054	3054262	232472	7.61

5.7 Sample selection procedure

5.7.1 Area Sample Sector

(1) PPS Selection of EAs

Within a given township, the sample design fixes two parameters:

- f , the sampling fraction for the township;
- n , the cluster size or target number of sample holdings per selected EA in each stratum (n may differ from stratum to stratum).

The number of EAs to be selected from each stratum (m_i) can be determined based on these two parameters.

Within each stratum, EAs were selected with probability proportional to the estimated total number of holdings in the EA, using systematic sampling. The systematic selection was based on an ordering of EAs, first by village tract / ward number, and then by EA number within village.

For each selected EA, systematic random sampling was used, based on the predetermined cluster size. An EA skip interval was calculated by dividing the expected number of holdings in the EA by the cluster size. This was used for the selection of sample holdings within the EA. This skip interval was applied to the actual number of holdings in each EA (determined from a listing of holdings in the EA). Thus, the actual sample size in each EA differed from the cluster size - if there were more holdings than expected in an EA, the number of sample holdings was greater; while if there were fewer holdings than expected, the sample number was smaller. This was an important feature of the sampling methodology to ensure correct probabilities of selection.

The method of sample selection was such that each sample holding in the township had the same chance of selection in the sample; i.e. a probability of selection of f .

The EA sample selection was done using the computer programme AGRISAMP Sample Selection System.

(2) Stratified Random Selection of EAs

The area where systematic random sampling was used for the selection of sample EAs, first and second stage sampling fractions were determined appropriate to providing the required overall sampling fraction, f . For example, a 1 in 6 overall sampling fraction might be achieved by taking a sample of 1 in 2 EAs, with 1 in 3 holdings sampled in each selected EA. The application of a fixed sampling fraction in each selected EA meant that the expected sample sizes varied from EAs to EAs.

(3) Areas in which all EAs are selected

The area where all EAs were selected, the required sampling fraction for the township, f , was applied to holdings in each EA. For example, if the required overall

sampling fraction was 1 in 3, than all EAs would be selected and a sampling fraction of 1 in 3 holdings in each EA would be taken.

5.7.2 List Sample Sector

Lists of holdings in those areas not covered by the area sample were compiled in each township. The list was ordered ward by ward. In some cases , land and livestock holdings were separately identified and the ordering was done on this basis.

Systematic random sampling was used. The sampling fraction was the same as that used in the township for the area sample sector.

6. PRODUCTION OF TABLES

The main part of the Census output was cross-tabulation. Cross tabulations provided estimates of the number of holdings (or persons, parcels, etc.) in various categories. ' clean ' raw data consisted of 221 (168 original + 58 derived) data items. Tables were produced using the CENTS module of IMPS. Survey weights and derived items were then calculated and inserted onto the edited data file and a series of weighted tables were produced. The tables were then closely scrutinized to check for their consistency with information from other sources. Problems were traced back to their source questionnaires, amendments were made as necessary, and tables were re-run.

Output tables were produced for both the preliminary and final census reports .About 102 cross -tables were presented in the final reports of Myanmar Census of Agriculture 1993.

The following are some selected tables produced by the Myanmar Census of Agriculture 1993.

Table. 1. Distribution of Holding size of all Land Holdings, 1992-93.
(percent of Total land Holding/ Land Holding areas)

Holding size (acres)	Number of Holdings	percent	Total Holding area (acres)	Percent
< 5	1,464,574	53.65	3,522,705	20.70
5 and < 10	759,045	27.81	5,292,982	31.10
10 and < 20	413,734	15.16	5,507,484	32.36
20 and < 50	91,061	3.33	2,381,469	13.99
50 +	1406	0.05	313,218	1.85
Total (Union)	2,729,820	100.00	17,017,858	100.00

Table 2 Distribution of Holding Size of Household-based Land Holdings , 1992-93.
(percent of Total land Holding/ Land Holding areas)

Holding size (acres)	Number of Holdings	percent	Total Holding area (acres)	Percent
< 5	1,464,556	53.66	3,522,652	20.98
5 and < 10	759,026	27.81	5,292,858	31.54
10 and < 20	413,694	15.16	5,506,925	32.82
20 and < 50	90,996	3.33	2,379,290	14.18
50 +	986	0.04	79,908	1.85
Total (Union)	2,729,258	100.00	16,781,633	100.00

Table 3 Distribution of Holding Size of Non-Household Land Holdings , 1992-93.
(percent of Total land Holding/ Land Holding areas)

Holding size(acres)	Number of Holdings	percent	Total Holding area (acres)	Percent
< 5	18	3.20	53	0.2
5 and < 10	19	3.38	124	0.05
10 and < 20	40	7.12	559	0.24
20 and < 50	65	11.57	2179	0.92
50 +	420	74.73	233,310	98.77
Total (Union)	562	100.00	236225	100.00

Table 4 Characteristics of All Holdings , 1992-93. (Percent of Total Holdings.)

Characteristics	All Holding	Percent	Household based Holdings	percent
Holding Types:	2,942,898	100.00	2,924,385	100.00
Land:	2,729,820	93.33	2,729,258	93.33
Livestock.	195,078	6.67	195,047	6.67
Female Holders	292,297	9.99	292,292	10.00
Had Schooling	2649256	90.58	2,649,256	90.59
Permanently working on Holding	2,252,995	77.03	2,252,995	77.04
Used water pumps	127,123	4.35	126,885	4.34
Employed paid workers	1340,307	45.82	1,339,938	45.82
Employed permanent workers	279,13	9.54	278,819	9.53

7. EVALUATION OF CENSUS RESULT

A paper highlighted the results from the Census sample enumeration and complete enumeration conducted for Thanlyin Township and Kungyangon Township. This paper was presented at the National Workshop on the Agricultural Census held in 1994, February 10-15.

(1) The comparison of results from the sample enumeration and complete enumeration indicated :

Census under estimated	1. no : of holding ,
	2. area of parcels operated by holding;
	3. annual crop area harvested ,
	4. total arable land
	5. total rice harvested area
	6. HYV harvested area;
	7. no : of cattle owned,
	8. no : cattle used as draught animal;
	9. no : of buffaloes owned,
	10. no : of buffaloes kept .
Census over estimated	1. irrigated area,
	2. annual crop land area,
	3. annual crop area sown,
	4. fallow land
	5. no : of buffaloes used as draught animals,
	6. no :of draught animal owned,
	7. no : of chicken kept,
	8. no : of duck kept,
	9. non agricultural land,
	10. permanent crop land
Negligible	1. size distribution of holding areas,
	2. age and composition of holders and household members,
	3. availability of production inputs.

The extent of differences was within an acceptable range of precision; this fact proved that information obtained from surveys using proven sampling and statistical methods were just as reliable and useful as those information obtained from complete enumeration.

(2) Comparison of Census with other data sources-

A comparison of the census results with the cropping pattern system and land utilization data from SLRD, livestock data from Livestock Breeding and Veterinary Dept., irrigation data from Irrigation Dept., fertilizer and pesticide from Myanma Agriculture: Service; (farm) machinery and implements data from Agriculture farm

Mechanization Dept; encountered difficulties in drawing conclusion due to:

- different concepts and definitions applied
- the Agricultural Census covered agricultural holdings (land and livestock) only agricultural or livestock activities carried out with only a few scattered fruit trees or a very small plots of cultivated land in villages and livestock activities with only a single cow or few chickens were not considered to be holdings.
- only holdings operated by households and Government farms, cooperatives and other non- household (special holdings) agricultural activities were included in the Census. Farms operated by monasteries, school, and religious orders / organizations were excluded .On the other hand, lands outside the township operated by holders living inside the township were included.
- the Census data referred only to these areas included within the scope of the Census. SLRD, in compiling its statistics, made estimates for remote areas. A substantial proportion of township and State / Division level data particularly from Kayah, Shan and Kachin States for rice and annual crops were omitted from the census.

(3) Workshop

A 5day national workshop on the "1993 Myanmar Census of Agriculture and the Strengthening of the System of Agricultural Statistics" was conducted in 1994, from 10-15 February with assistance from UNDP and the government of Myanmar. A total of fifty-three representatives from Planning and Statistics Departments, Institute of Economics UNDP,FAO,the private sector participated at the workshop.

The workshop served as the forum for :

- providers and users of agricultural statistics to discuss the issues arising from the current state of agricultural statistics ; to identify the most important issues and problems and the solutions and actions to deal with shortcomings were identified;
- funding agencies to assist Myanmar in improving its statistical systems and capability; and
- find ways to strengthen existing agricultural statistical system and sustain a reliable and timely flow of information in the long run and making them more responsive than in the past.

Two major outputs produced by the workshop are

1. Multi-year Programme of Agricultural Statistics
2. Plan of Action for the establishment of a system of Agricultural Statistics.

(4) Reliability of estimates

The major aggregates, for holding area, annual crop, cattle and size of holdings had relative standard errors less than 10 per cent .Precision for rice harvested area and other crop data, particularly at townships levels fell within the range of 5 % to 25 % . The reliability of crop data depends on how widespread the crop was grown in a township and the variability between holdings .

8. PROBLEMS

- SLRD was mis-conceived by farmers as the land tax assessment agency. Compulsory sale of crops, made farmers to be cautious in giving information on crop production / yield.
- Staff who gained data processing skill from the 1993 agri: census left SLRD and joined high paying jobs in the private sector.
- According to the sample design, The stratification work can not be done properly due to the lack of time.
- Agricultural holdings in some Urban areas were deliberately left behind during the last census for the holding sizes were too small .
- During the last census, an EA usually formed 50 to 100 holdings. But there were some EAs which had more than 150 holdings. Moreover, within the selected EAs, the estimated number of holdings differed considerably from the actual listing number of holdings.

9. UTILIZATION

The base line data from the census can be used for:

- identifying problems at the farm /holding level;
- formulating and implementing project activities;
- looking at the impact a project activities on the environment:
- looking at factors influencing agricultural production process and the ways that land and other resources are being utilized ;
- benchmark for monitoring progress and evaluating the achievement of programmes .

10. DISSEMINATION OF CENSUS RESULTS

Census results were released starting from June 1995, and final reports were sent to the State Law and Order Restoration Council (State Peace and Development Council), UNDP, FAO, Central National library, Universities library, Ministries and Departments concern . Census Reports were also put on sale at reasonable prices .

11. NATIONAL CENSUS PROGRAMME

The 1993 Myanmar census of Agriculture was a nation-wide census, it was conducted by the Department of Settlement and Land Records with financial and technical assistance from UNDP/FAO. Preparatory works such as recruitment of staff, selection of sample design , designing of questionnaires, forming EAs, making and pre-tests and pilot-tests, selecting of EAs and sample holdings within the selected EAs, etc--- started in late September 1990, and the whole census operation took about two years. The actual census operation was carried out by trained enumerators under the supervision of township agricultural census officers over a period of three weeks from February 22 to April 11, 1993.

The reference period of the 1993 agricultural season corresponded to the 12 months from 1-4-

1992 to 31-3-1993.

A series of operations viz manual or machine editing data processing, tabulation and analysis of census results and report writing were done at the head quarters in Yangon from the completion of census enumeration in 1993 to 1995. The work plan for the 1993 Myanmar census of agriculture is shown in Appendix (a). A post-enumeration survey (PES) was also carried out from September 1993 to April 1994 to evaluate the extent of completeness of the census enumeration, to check the accuracy of response, and to detect errors, if any, arising from different phases of data processing.

SLRD has already formed a preparatory work committee for the conduct of the 2003 census of agriculture committee is now preparing a project proposal giving details about work plan, financial and equipment needs. The project proposal is being prepared according to the guideline of the World Census of Agriculture 2000. The 2003 census of agriculture will start in 2001 / 2002 . The draft work plan for the 2003 Census of Agriculture is shown in Appendix (b) .

12. CONCLUSION AND RECOMMENDATION

Agriculture is definitely going to predominate other economic sectors in employment and income generation. Myanmar is still self-sufficient in food production, and food security can only be guaranteed by providing farmers with agricultural inputs through expanded agricultural services. As land use practices and sustainable natural environment are inter-related, information on on-and off- farm economic activities is imperative. The 1993 Agriculture Census of Myanmar provided data on many facets/ aspects of farming, livestock raising, growing perennial crops, etc. Basic infrastructure is being developed; transportation and communication were accorded high priorities. Access to remote, border areas has been greatly improved.

Efforts are now being made for conducting a census of agriculture in 2003. Special attention should be given to the following areas-

- (i) Capacity building; new recruits need training in statistics, cartography, computer software application, etc.
- (ii) Extending coverage; remote border areas, omitted from enumeration, should be covered in 2003
- (iii) Satellite imaging; maps produced with the help of GIS, and RS data should be used for demarcating Enumeration Areas.
- (iv) Border Area Development; complete enumeration should be used in border areas
- (v) Preparation Stage; sufficient time is at least two years should be given for preparation work associated with sampling design, questionnaire development including field tests, training staff for field operation etc.

COMPILATION OF NATIONAL ACCOUNTS AND GROSS DOMESTIC PRODUCT ON AGRICULTURE IN MYANMAR

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I. INTRODUCTION

Data on national accounts, gross output, gross domestic product (GDP) and national income are compiled in virtually every country in the world to serve as basic indicators of national wealth, economic growth and standard of living. These indicators are used for adopting economic policies. The national accounts data not only serve as the barometer of the current economic situation of individual countries but also as the basis for drawing development plans and providing directives in achieving the national economic objectives.

Generally, GDP is compiled under one of the following three methods depending on the availability of basic data:

- Gross output and intermediate input data (Product Method)
- Final demand data (Expenditure Method)
- Value-added data (Income Method)

II. FRAMEWORK OF NATIONAL ACCOUNTS AND GDP CONCERNING AGRICULTURE

1. Compilation of National Accounts

Compilation of national accounts data in Myanmar was initiated in fiscal year (FY) 1951/52. The Central Statistical Organization (CSO) (formerly Central Statistical and Economic Department -CSED) under the Ministry of National Planning and Economic Development (NPED) computed, compiled and published the national accounts data from FY 1951/52 to FY 1962/63. During this period, sectoral net output values were computed based on gross output and intermediate consumption data. However, sectoral classifications were not in line with the present System of National Accounts (SNA). Since FY 1963/64, the Planning Department (PD) under the Ministry of NPED made improvements in the methodology and presentation of national accounts data. Efforts were also made to modify Myanmar system of national account in conformity with the criteria specified in the United Nations System of National Accounts (UNSNA) as much as possible.

The SNA in Myanmar and the methodology adopted for the computation of basic indicators for reflecting the overall economic situation of the country including net output value on agriculture sector and livestock and fishery sector are presented in this paper.

1.1 Sectoral Classification

After 1962, Endeavours had been made to develop a national accounts system which would accurately and realistically reflect developments in the national economy. In order to facilitate formulation and implementation of sectoral economic development plans, a system of sectoral classification disaggregating the economy into (14) economic sectors under three main categories such as goods, services and trade, based on input homogeneity and output similarity had been adopted. These classifications are as follows: -

- **Goods**
 - Agriculture Sector
 - Livestock and Fishery Sector
 - Forestry Sector
 - Energy Sector
 - Mining Sector
 - Processing and Manufacturing Sector
 - Power Sector
 - Construction Sector

- **Services**
 - Transportation Sector
 - Communications Sector
 - Financial Institutions Sector
 - Social and Administrative Services Sector
 - Rentals and Other Services Sector

- **Trade**
 - Trade Sector

Agriculture, livestock and fishery, forestry and mining sectors have been considered separately since the Myanmar economy is mostly dependent on primary products or goods. Hence, GDP is computed for all the (14) economic sectors mentioned above.

1.2 Methodology

GDP is the value of aggregate or total production of goods and services in a country during a given time period - usually a year. In Myanmar, GDP, the main indicator of national accounts statistics is computed according to UNSNA as far as possible using product method due to the availability of basic data. The other two methods namely income and expenditure methods are also simultaneously computed for the purpose of checking and counter-checking the result obtained from product method. In theory, GDP as measured by all three methods should be the same.

1.2.1 Method of gross output and intermediate input data (Product Method)

Formulation and implementation of the previous planned economic system calls for formulation of regional as well as sectoral development plans. Emphasis has, therefore, been placed on the computation of regional

aggregate output by sector. The net output value of a sector is computed by deducting the value of intermediate inputs, i.e material and services cost (Ms) from the value of sectoral aggregate outputs. In this way, data on cost of production by commodity is compiled and computed in order to derive technical coefficients for each sector. The total GDP is computed by summing up the net output value of (14) economic sectors. This process of deriving GDP from the gross output and intermediate input data may be expressed in algebraic form as follows:-

$$Y = O - Ms$$

where Y = Gross Domestic Product
 O = Gross Output
 Ms = Intermediate Inputs

Sustained efforts have been made to constantly improve the accuracy and reliability of commodity production and sectoral gross output data. In addition, measures have been taken to compile cost of production data in detail to facilitate calculation of necessary technical co-efficients. These technical co-efficients are reviewed to reflect the changes in cost structure, technological change and other changes, resulting from the developments in the national economy. Priority had been given to compile detailed production cost data on State Economic Enterprises (SEEs). Income and expenditure data are also compiled for other State departments and organizations while periodic economic and sample surveys were conducted to obtain more accurate cost data of the Private Sector.

Prices Employed in Valuation of Goods and Services

The statistics relating to the value of production, goods and services, consumption and investment of the nation are calculated in both current and constant prices. GDP valued in current year's prices is called the Nominal GDP and valued in constant prices by taking the prices of a base year is called Real GDP. Producers' prices and wholesale prices are employed commodity wise in details in calculating the value of the national accounts data. To analyse the changes of the economy in real terms, FY 1969/70 constant prices were employed in formulating plan targets and also in measuring the performance of the economy as macrostatistics in real term covering the period FY 1974/75 to FY 1993/94. However, with a view to indicate and to reflect the real economic condition of the country, FY 1985/86 constant prices are employed in compiling the national accounts statistics since FY 1989/90.

In the valuation of sectoral gross output at constant prices, specific constant prices for the commodities produced by the productive sectors, specific freight rates for specified commodities and passengers transported by various transport organizations and export commodities are readily available. However, in the compilation of constant price series for investment, import, inventory and services of some of the service sectors, appropriate deflators such as wage deflators, general deflators of goods and services and consumer

price index (CPI) have to be applied due to limited availability of price data. GDP deflator can be defined in formula as follows:-

$$\text{GDP deflator} = \frac{\text{Real GDP}}{\text{Nominal GDP}} \times 100$$

1.2.2 Method of Final demand data (Expenditure Method)

As mentioned earlier, GDP is primarily computed based on product method and the data are checked and counter-checked by the other two methods. In the process of computing by expenditure method, fairly accurate data for total exports, total imports and stock changes are available. In relation with total investment, those for State and Cooperative sectors are obtained from organizations concerned. However, those for the Private Sector are estimated taking into consideration the relevant statistics shown below.

- Increase in land-use for agricultural production.
- Distribution of capital goods to Private Sector by SEEs and Cooperatives.
- Increase in agricultural capital inputs such as draught cattle and other agricultural equipment.
- Increase in registration of various vehicles and building permits.
- Imports of capital goods by Myanmar nationals working abroad.
- Foreign direct investment under Foreign Investment Law and investment of Joint-Venture Corporations.

The GDP computed based on the final demand data (expenditure approach) may be expressed as follows:-

$$Y = C + I + St + E - Im$$

where	Y	=	GDP
	C	=	Consumption (residual value)
	I	=	Total Investment
	St	=	Stock Changes
	E	=	Export
	Im	=	Import

In adopting this approach of computing by expenditure method in the preparation of national accounts data, estimates for total investment, stock changes, exports, and imports are available. Consumption data, however, has to be derived as a residual value in the preceding equation due to paucity of consumption data.

1.2.3 Method of value added data (Income Method)

Efforts for the computation of GDP based on detailed sectoral value-added data (income method) are still underway. In Myanmar, data on GDP by income method could not be presented in the publications on national accounts statistics due to the lack of data on depreciation especially for Private Sector. The Private Sector investment itself is estimated on the basis of relevant statistics. Data on aggregate

components of value-added for national economy, however, are compiled to facilitate international comparison, information on national income and Gross National Product (GNP) are forwarded periodically to the U.N and affiliated organizations.

GNP data can be defined as follows:-

$$\text{GNP} = \text{GDP} + \left[\begin{array}{c} \text{receipts of factor income from} \\ \text{the rest of the world} \end{array} \right] - \left[\begin{array}{c} \text{payments of factor income} \\ \text{to the rest of the world} \end{array} \right]$$

The GDP computed based on income method may be expressed as follows:-

$$Y = W + D + Tx \pm Sn$$

where Y	=	GDP
W	=	Total Compensation of Employees
D	=	Consumption of Fixed Capital
Tx	=	Indirect Taxes
Sn	=	Operating Surplus

1.3 Current Position

In Myanmar, the centrally planned socialist economic system had been replaced by a market-oriented system based on liberalized open-door economic policy since FY 1989/90. However, the methodology of compilation of national accounts in Myanmar does not change basically. As part of the institution of market oriented economic policies, the Private Sector is permitted to engage virtually in all economic activities. According to the economic system, participation of Private Sector is extended. Presently, in GDP and Investment, Private Sector component ratio has increased. With a view to monitoring and reviewing on the plan performance within a year, GDP is compiled on monthly, quarterly and on regional bases. On the other hand, GDP is computed by ownership such as, State, Cooperative and Private sectors.

III. GDP CONCERNING AGRICULTURE SECTOR

1. Net output value of Agriculture Sector

Net output value of agriculture sector is computed by product method, deducting cost of intermediate inputs (or) Ms from gross output value. This process of deriving net output value by product method may be expressed in terms of an economic model as follows:-

$$Y = O - Ms$$

where	Y	=	Net Output Value
	O	=	Gross Output Value
	Ms	=	Material and Services Cost

In the computation of net output value for agriculture sector, net output value of individual crop is initially calculated by deducting intermediate inputs or Ms cost such as seed, fertilizer, pesticide, other services etc. from gross output value of the respective

crops. Net output value of the agriculture sector as a whole is computed by summing up the net output value of 60 crops used in the agriculture sector.

1.1 Valuation of Gross Output Value

Gross output value is calculated by multiplying quantity of output and producers' price of an individual crop and then summing up the output value of 60 crops to obtain gross output value for the agriculture sector.

Output and producers' prices of some crops such as other fruit trees, vegetables, other edible crops, medicinal plants and other inedible crops are not available. In such case, sown acreage and per acre value are used to obtain gross output value of such crops.

1.2 Valuation of material and services cost

Material and services cost is calculated by multiplying sown acreage and per acre cost of each crops and then summed up the cost of 60 crops to obtain total material and services cost of the sector as a whole. Material and services cost includes cost of seeds, chemical fertilizer, pesticides, natural fertilizer, value of goods used within the year, rentals for hiring agricultural implements and other services costs used in the production of crops.

The net output value of agriculture sector is computed by ownership such as State Sector, Cooperative Sector and Private Sector. Net output of State Sector and Cooperative sectors are derived from the data provided by respective Ministries. However, net output value of Private Sector of agriculture sector has to be derived as residual value.

IV. GDP CONCERNING LIVESTOCK AND FISHERY SECTOR

1. Net output value of Livestock and Fishery Sector

In the computation of net output value of livestock and fishery sector, the same product approach method is applied. The net output value of individual commodity or product is initially calculated by ownership such as State Sector, Cooperative Sector and Private Sector. The net output value for the sector as a whole is derived by summing up the net output value of 36 products by ownership from livestock and fishery sector. This process of deriving GDP can be expressed in economic model as follows:-

$$Y = O - Ms$$

where Y = Net Output Value

O = Gross Output Value

Ms= Cost of Intermediate Inputs (or) Material and Services Cost

1.1 Valuation of Gross Output Value

Gross output value can be calculated by multiplying quantity of output and producer's price of an individual products and then summing up the 36 products to obtain gross output value for livestock and fishery sector.

1.2 Valuation of Material and Services Cost

Ms cost can be calculated by multiplying output and the stipulated percentage of Ms cost included in individual output. Hence, Ms cost for the sector as a whole can be obtained by summing up the Ms cost of all products.

Ms cost includes costs of distribution of pedigree livestock and fish fingerlings, animal feedstuff, animal health services, dissemination of improved methods, rentals and other material and services cost expended in livestock breeding, meat and fish production within the year.

V. SOURCES OF DATA

In computing net output value for agriculture sector and livestock and fishery sector, basic statistics relating to output, producer's prices and Ms cost of each commodity by ownership were stipulated with the coordination of Ministries concerned and their subordinate departments and enterprises as shown below:-

1. Agriculture Sector

1.1 Ministry of Agriculture and Irrigation

- Myanma Agriculture service
- Settlement and Land Records Department
- Myanma Farms Enterprise

1.2 Ministry of Industry (1)

1.3 Ministry of Cooperative

1.4 Ministry of Defence

2. Livestock and Fishery Sector

2.1 Ministry of Livestock Breeding and Fisheries

- Livestock Breeding and Veterinary Department
- Livestock Feedstuff and Milk Product Enterprise
- Department of Fisheries
- Beekeeping Department

2.2 Ministry of Agriculture and Irrigation

- Myanmar Agriculture Service
- Myanmar Farms Enterprise
- Myanmar Cotton and Sericulture Enterprise

2.3 Ministry of Mines

- Myanmar Pearl Enterprise

2.4 Ministry of Home Affairs

- Prison Department

2.5 Ministry of Co-operative

- Co-operative Department

2.6 Ministry of Defense

- Livestock breeding farms and fish culture ponds under Defense Services

There have been considerable improvements in accuracy and availability of detailed statistics pertaining to the State and Cooperative sectors required for the preparation of national accounts. The reliability of data for the Private Sector has also improved due to efforts made to refine these data by compiling results from periodic economic surveys, work permits and licenses issued to private enterprises. Moreover, Ministries concerned are responsible for estimating the values of output and expenditure for sectoral private production of goods and services. Similar improvements have been made in intermediate input data for the State and Co-operative Sectors. Costs of production for State Sector are estimated based on income and expenditure statements of respective agencies. Of particular significance is the advances made in the compilation of intermediate input data for the Private Sector, especially in agriculture, the key sector of the economy. Costs of cultivation of important crops are estimated on the basis agricultural censuses and surveys.

VI. ISSUES AND PROBLEMS ENCOUNTERED TO AVAILABILITY AND CONSISTENCY OF VARIOUS PRIMARY DATA

1. Data gaps

1.1 National Accounts

- In Myanmar, the current system of national accounts basically follows the 1968 UNSNA, but to a certain extent incorporates the recommendations given in the 1993 UNSNA. Officials have limited knowledge and exposure, in computation of national accounts, they need further training.
- Mechanisms for collecting data for the private sectors need to be strengthened. Data for private sector on agriculture, livestock and fishery and forestry sectors are provided by the Ministries concerned. However, data for Private Sector related to mining, processing and manufacturing, construction and transportation sectors are estimated on the basis of duties, work permits, licenses issued etc;

additional information was collected by means of periodic surveys and case studies.

- In order to improve the method of computing GDP by income approach, it is necessary to have more reliable data on salaries and wages, depreciation and surplus etc. for the Private Sector in particular.

1.2 Agriculture

- Data on sown area of all crops are available. However, data on yield and production of crops are available with the exception of fruit crops, vegetables, edible crops, medicinal plants and other in-edible crops. The value of output for these crops are estimated based on output value per sown acre for each crop.
- Like some countries, fruit crops, vegetables and flowers are quite important to the national economy as exportable crops. Hence, data for the output of these crops should be collected separately.
- Out of 60 crops, data on cost of cultivation of about 22 crops are available. Cost of cultivation of other important crops needs to be collected as well.
- In cost of cultivation, regarding fertilizer, only the cost of chemical fertilizer is calculated. However, the cost of natural fertilizer and bio-chemical, organic fertilizer should also be included.
- In the monthly and quarterly reports provided by the respective Ministry, data on area and output of some important crops are available. However, data on perennial crops and other crops need to be collected to have more and wider coverage.

2. Proposals for Improvement

For the improvement in the computation of national accounts and net output value of agriculture sector, the following proposals are recommended:-

2.1 National Account

- To provide training courses in order to adapt the 1993 UNSNA.
- To conduct regular periodical surveys and special studies in the following fields by the respective Ministries and agencies to have wider coverage and to improve the accuracy of statistics for the Private Sector.
 - Production
 - Investment
 - Cost structure
 - Prices (Producer's prices, whole sale prices, retailed prices etc.,)
 - Household expenditure
 - Salaries and wages
 - Depreciation
 - Surplus

2.2 Agriculture

- To provide data on output of fruit crops, vegetables and varieties of flowers which are quite important to the national economy.
- To conduct small-scale surveys or studies on cost of cultivation of other important crops.
- To provide area and output of perennial crops and other crops in the monthly and quarterly reports.
- To provide cost of natural fertilizer and bio-chemical fertilizer by ownership such as State, Cooperative and Private sectors in calculating cost of cultivation.

3. The main difficulty in computation process

In Market-oriented economy, private sector plays major role in the whole economy. Private sector's development programme within the framework of economic development plan is being carried out in Myanmar. To formulate private sector's development programme, it is necessary to obtain accurate data for that sector. At present, data for private sector is obtained through estimation based on the relevant statistics and information. To improve the accuracy of private sector's data, Planning Department is making all out efforts in coordination with organizations concerned. In this regard, data such as production, cost structure and prices for private sector should be compiled by an appropriate organization.

Sustained efforts have been made to constantly improve the system of national accounts with respect to methodology adopted as well as presentation of national account data to have more and wider coverage, particularly in the private sector which still account for a substantial portion of domestic production, and to be in line with the method of United Nations SNA. It is most earnestly hoped that exchange of views on computation of national accounts and GDP on agriculture and participants experiences made possible by this technical workshop will contribute much to resolving the numerous problems and difficulties encountered in compilation of national accounts and computing GDP on agriculture. It is also anticipated that the discussion on specific problems and issues experienced by the participants and approach and measures adopted in overcoming these problems will significantly contribute to the development of better system of national accounts and GDP on agriculture.

While availability of data on production, cost of production, income and expenditure pertaining to state and co-operative sectors can be said satisfactory, data for private sector needs much room for improvement as they are mainly derived through estimates based on non-regular ad-hoc statistics and information. Measures needs to be taken to obtain more reliable data for Private sector particularly because the sector is playing predominant role after introducing Market-oriented economy.

Crops used in computing GDP for Agriculture Sector

- | | |
|--|---|
| <p>1. Cereal Crops</p> <p>1. Paddy</p> <p> 1. Monsoon paddy</p> <p> 2. Summer paddy</p> <p>2. Wheat</p> <p>3. Maize</p> <p> 1. Maize (seed)</p> <p> 2. Maize (cobs)</p> <p> 3. Maize (sheath)</p> <p>4. Sorghum</p> <p>5. Other cereal</p> <p>2. Beans and Pulses</p> <p>6. Matpe (Black gram)</p> <p>7. Pedisein (green gram)</p> <p>8. Butter bean</p> <p>9. Bocate (Cow pea)</p> <p>10. Sultani</p> <p>11. Sultapyra</p> <p>12. Soy bean</p> <p>13. Gram (Chick pea)</p> <p>14. Pelun (Cow pea)</p> <p>15. Pesigon (Pigeon pea)</p> <p>16. Peyin (Rice bean)</p> <p>17. Pebyugalay (Duffin bean)</p> <p>18. Pegyi (Lablab bean)</p> <p>19. Pegya (Lima bean)</p> <p>20. Sadawpe (Garden pea)</p> | <p>21. Penauk</p> <p>22. Peyaza (Lentil)</p> <p>23. Other beans and pulses</p> <p>3. Oil Seed Crops</p> <p>24. Groundunt</p> <p> 1. Groundnut (Monsoon)</p> <p> 2. Groundnut (Winter)</p> <p>25. Sesamum</p> <p> 1. Sesamum (Monsoon)</p> <p> 2. Sesamum (Winter)</p> <p> 3. Sesamum (Summer)</p> <p>26. Sunflower</p> <p>27. Mustard</p> <p>28. Other Oil Seed Crops</p> <p> 1. Niger</p> <p> 2. Oil palm</p> <p> 3. Other oil seed crops</p> <p>4. Fibre Crops</p> <p>29. Cotton</p> <p> 1. Wagyi cotton</p> <p> 2. Mahlaing cotton</p> <p> 3. Long Staple cotton</p> <p>30. Jute</p> <p>31. Kenaf</p> <p>32. Other fibres</p> |
|--|---|

5. Industrial Crops

- 33. Rubber
- 34. Sugarcane
 - 1. Sugarcane for industrial use (Matured)
 - 2. Sugarcane for industrial use (Young)
 - 3. Sugarcane for juice (Matured)
 - 4. Sugarcane for juice (Young)

35. Toddy

36. Mulberry plant

6. Tobacco and Allied Crops

- 37. Myanmar tobacco
- 38. Virginia tobacco
- 39. Betel nut
- 40. Betel vine
- 41. Other tobacco and allied crops

7. Spices

- 42. Chillies
 - 1. Chillies (dried)
 - 2. Chillies (green)
- 43. Onion
- 44. Garlic
- 45. Other spices

8. Other Edible Crops

- 46. Potatoes
- 47. Coffee
- 48. Tea leaves
- 49. Coconut
- 50. Cassava

- 51. Plantain
- 52. Other fruits trees
- 53. Vegetables
- 54. Miscellaneous food crops (other edible crops)

9. Medicinal Plants

- 55. Medicinal plants

10. Other Non Edible Crops

- 56. Tha-nat-phet
- 57. Dani
- 58. Animal feed
 - 1. Straw
 - 2. Others
- 59. Tobacco Stalk
- 60. Other non-edible crops

Crops used in estimating output value and material and services cost

1. Toddy
2. Mulberry plants
3. Betel leaves
4. Plantain
5. Other fruit trees
6. Miscellaneous food
crops (other edible crops)
7. Medicinal plants
8. Tha-nat-phet
9. Dani
10. Other animal feed crops
11. Other non edible crops

Commodities used in compiling GDP for Livestock and Fishery Sector

I. Livestock and Livestock Product

1.	Animal and animal products	5.	Net increase in the number of animal
1.	Draught cattle	20.	Cattle
2.	Fresh milk	21.	Buffalo
3.	1.Hide and skin (cattle)	22.	Goat/Sheep
4.	Hide and skin (goat and sheep)	23.	Pig
2.	Meat product	24.	Fowel
5.	Beef	25.	Duck
6.	Mutton	26.	Turkey / geese
7.	Pork	27.	Guini – fowl
8.	Fowl meat	28.	Quail
9.	Duck meat		
10.	Turkey meat		
11.	Guini-fowl egg		
12.	Quail meat		
3.	Egg products		
13.	Fowl egg		
14.	Duck egg		
15.	Guini-fowl egg		
16.	Quail egg		
4.	Other products		
17.	Feather		
18.	Silk cocoon		
19.	Honey (Breeding)		

II. Fish and other marine products

1. Fresh water fish and prawn

- 29. Fish culture
- 30. Prawn culture
- 31. Leasable fisheries
- 32. Open fisheries

2. Marine fish and prawn

- 33. Marine fish
- 34. Marine prawn

3. Other marine products

- 35. Pearl
- 36. Shell

Appendix A

Draft Work Plan for 2000 Census of Agriculture

Sr. No	ACTIVITY	DURATION	RESPONSIBLE PERSONAL
1	INITIAL PREPARATORY WORK	5 months	
	1. Formational of National Census Committee and Technical Sub-Committee.		NPD
	2. Establishment of core project staff		NPD,ADMIN
	3. Establishment of budget and expenditure expenditure control		NPD,NC
	4. Initial decision on timing,scope,enumeration plans,etc.		NPD,NC
	5. Preparation of detailed time table and work plan.		NC,All Divisions
	6. Estimation of budget, detailed staff requirements and equipment		NC,All Divisions
	7. Development of concepts, table formats and questionnaires.		NPD,NC,CENSUS
	8. Preparation of quality control and operational control procedures		TSC,COMPUTER NC,CENSUS
	9. Recruitment and training of additional headquarters staff.		Computers All Division
	10. Preparation of training for field staff		
	11. Development of enumeration procedures and materials		NC,FIELD NC,CENSUS
	12. Development of sample design and construction of sampling frame		FIELD NC,CENSUS,
	13. Cartographic preparation.		TCDC NC & MAPPING
	14. Pretesting questionnaires and data collection procedures in the field.		NC,CENSUS FIELD
	15. Acquisition		NC,All Division
2	FINAL PREPARATION	6 months	
	16. Conduct and evaluation of experimental census		NPD NC. All Division
	17. Finalization and printing of questionnaires instruction manuals, forms etc.		NC, Stat, Mapping Computer, Field
	18. Development of data processing produces and computer programmes.		NC, stat , Computer
	19. Preparation and distribution of field-use maps.		NC, MAPPING, FIELD
	20. Conduct of census publicity		NC, ADMIN, FIELD
	21. Recruitment and training of field office staff.		ADMIN, CENSUS,

**Appendix A
(continued)**

Sr. No	ACTIVITY	DURATION	RESPONSIBLE PERSONAL
	22. Establishment of census field offices.		FIELD
	23. Recruitment and training of field supervisors and enumerators.		FIELD
	24. Sample selection for census enumeration		NC, CENSUS
	25. Test of data processing procedures, quality control procedures.		NC, CENSUS. Computer , Field
	26. Recruitment and training of editor and data keyers.		NC, CENSUS, Computer
3	ENUMERATION	2 months	
	27. Objective measurement of area.		NC, Field, Census
	28. Sampling enumeration.		NC, Field, Census
4	POST-ENUMERATION WORK	6 months	
	29. Conduct and analysis of post-enumeration Survey		NC, Field, Census
	30. Receipt and filling of census questionnaires		FIELD
	31. Manual edit of questionnaires		CENSUS
	32. Data entry for computer processing		Computer
	33. Computer edit.		Computer , Census
	34. Tabulation of preliminary edit.		Computer , Census
	35. Tabulation of final census results.		NC, Computer, Census
	36. Computation and review of sampling variance.		NC, Census
	37. Review and Analysis of results.		NC, Census
	38. Preparation of publication map and charts.		NC , Mapping
	39. Publication of preliminary census report.		NC, Admin Census
	40. Publication of final census reports		NC, Admin Census
5	TECHNICAL AND METHODOLOGICAL DOCUMENTS	3 months	
	41. Preparation of technical and methodological documents.		NC, All Division
6	DEVELOPMENT OF MULTIYEAR PROGRAM OF STATISTICS	2 months	
	42. Development of multiyear programme of statistics.		NC, All Division