CHAPTER 7

Agricultural Transformation, Institutional Changes, and Rural Development in Ayeyarwady Delta, Myanmar

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1. Introduction

1.1 Rationale

Myanmar is an agricultural country. The agriculture sector accounts for 34 percent of its gross domestic product (GDP) and 15.4 percent of total export earnings. It also employs 61.2 percent of the total labor force. The importance of agriculture in Myanmar is underscored by the stated objective of having agriculture as the base of the country's economy and the engine for the overall development of other sectors. The agriculture sector suffered severe setbacks between 1962 and 1988, but the recovery phase, which was dubbed the "New Agricultural Transformation," began in 1989. The sector has been enjoying steady growth for the past twenty years, especially with the liberalization in cropping and marketing, which is supported by the Ministry of Agriculture and Irrigation (MOAI).

Rural development is the priority in Myanmar's development policy. The government has issued five rural development principles and formed a special department to implement these principles. The programs achieved positive development in the rural areas.

Ayeyarwady Delta is located in the southern part of the middle plains of Myanmar. Its total area is approximately 13,566.5 square miles. It consists of three regions: Yangon, Ayeyarwady, and part of the Bago region. Geographically, the delta is bordered by Rakhine state on the northwest, the Bay of Bengal in the west, and the Andaman Sea in the south. An estimated 40 percent of Myanmar's total population lives in the delta. Of that proportion, 85.1 percent live in the rural area of the delta, working mainly in agriculture for their income and livelihood and producing food for their community. The agricultural sector of the delta region thus provides food for the community, employs the majority of the regional populace, and contributes surplus for regional and national growth. The Ayeyarwady Delta is known as the "rice bowl" of the country because of the vast paddy farms occupying the whole region. Its rich alluvial soil is very suitable for agricultural production. As the production volume of its agricultural sector, including the fish and meat subsectors, is quite huge, the Ayeyarwady Delta has come to be regarded as the lifeline of Myanmar's economy. This study aims to analyze the development of the Ayeyarwady Delta area in terms of agricultural transformation, institutional changes, and rural development.

1.2 Objectives

The objectives of this study are to:

1. examine agricultural transformation and performance in connection with the economic and agricultural policy reforms passed since 1988;
2. examine sources of changes and transformation in agriculture, the pricing policy and open market for produce, internal market access, and export potential;
3. look into the current progress of rural development through the implementation of rural development principles; and
4. identify policy directions to ensure more sustainable agriculture and rural-regional development in Myanmar.

1.3 Organization of the Research Report

The paper is divided into four parts. The first part deals with the introduction and is followed by overview of Myanmar's agriculture sector, including an overview of agriculture in the socialist economist system and a chronology of agricultural reforms. Part three constitutes agricultural transformation towards growth. Rural development principles and their implementation will be covered in part four. The final part will be the findings, conclusion, and recommendations.

2. Overview on Agriculture in Myanmar

2.1. Overview of Agriculture during the Socialist Economic System

The objectives of the agricultural development program were as follows:[1]

1. to increase agricultural production by raising productivity;
2. to increase the use of scientific methods in agriculture;
3. to improve the structure of the agrarian system;
4. to improve the social conditions in rural areas; and
5. to organize the peasantry throughout the country.

By enforcing the Amendment to the Land Nationalization Act[2] in 1965, the landlord system, which had prevailed for over a century, was finally abolished during the Revolutionary Council period. Since agriculture is the mainstay of Myanmar economy, the Socialist government undertook support measures, such as cultivation of fallow lands, construction of irrigation facilities for dry zones, flood-control work, and expansion of areas devoted to multicropping. In addition, the necessary agricultural inputs and farm implements, such as quality seeds, fertilizers, insecticides, tractors, and water pumps, were distributed to farmers to encourage intensive cultivation. To boost output through higher productivity, the government also implemented a "Green Revolution" featuring the use of chemical fertilizers and high-yielding varieties (HYV) of seeds.

Table 2.1 shows the total output of paddy rice in Ayeyarwady Delta over a twenty-year period beginning 1963-64 to 1986-87. According to these figures, the sown acreage of

[1] Myat Thein, *Economic Development of Myanmar* –p-88
[2] The Land Nationalization Act was enforced in 1953.

paddy rice rapidly declined from 3.4 million acres in 1963-64 to 3.1 million acres in 1972-73. This happened because of two main factors: (1) the lack of security in the region and (2) the inability of the people to work in marginal areas because of the lack of security. The government carried out heavy operations in the Irrawaddy Delta during the 1960s and early 1970s. These operations continued until government forces quelled the rebellion in the region in 1972. Starting 1973, the sown acreage increased again. However, to reach an output exceeding the previous maximum acreage was still difficult because during the conflict, most of the marginal areas were destroyed by floods due to lack of maintenance.

Table 2.1. Rice Production in Ayeyarwady Delta from 1963/64-1986/87

Year	Sown acreage (thousand acre)	Output (thousand metric ton)	Yield/acre (metric ton/acre)
1963-64	3,413	2,445.35	0.72
1964-65	3,391	2,642.95	0.78
1965-66	3,358	2,492.38	0.74
1966-67	3,285	2,042.80	0.62
1967-68	3,229	2,513.11	0.78
1968-69	3,253	2,318.09	0.71
1969-70	3,227	2,442.98	0.76
1970-71	3,237	2,467.74	0.76
1971-72	3,220	2,441.52	0.76
1972-73	3,197	2,401.24	0.75
1973-74	3,220	2,484.02	0.77
1974-75	3,318	2,536.51	0.76
1975-76	3,304	2,655.47	0.80
1976-77	3,293	2,784.96	0.85
1977-78	3,298	2,816.99	0.85
1978-79	3,321	3,198.16	0.96
1979-80	3,329	3,457.93	1.04
1980-81	3,343	4,195.45	1.25
1981-82	3,339	4,288.96	1.28
1982-83	3,308	4,669.25	1.41
1983-84	3,190	4,542.06	1.42
1984-85	3,394	4,738.34	1.40
1985-86	3,243	4,466.89	1.38
1986-87	3,160	4,381.64	1.39

Source: Kan Zaw (1998); various issues of the Statistical Yearbook.

The output of paddy rice production fluctuated within the period under study until 1977-78 when the real potential growth rate of the agriculture sector emerged due to the intensive use of HYVs in the region. Starting 1977-78, not only has there been a yearly increase in the output of paddy rice but also in the yield per acre. This increase was the result of the vertical expansion (i.e., technological change) in paddy rice production. Technological change refers to the use of hybrid paddy rice seeds starting 1974.

Table 2.2. Rice Production in Myanmar from 1963/64-1986/87

Year	Sown acreage (thousand acre)	Output (thousand metric ton)	Yield/acre (metric ton/acre)
1963-64	12,256	7,782.77	0.64
1964-65	12,790	8,507.65	0.67
1965-66	12,948	8,055.10	0.62
1966-67	12,389	6,636.36	0.54
1967-68	12,328	7,769.41	0.63
1968-69	12,194	8,022.87	0.66
1969-70	12,402	7,984.68	0.64
1970-71	12,244	8,161.94	0.67
1971-72	12,293	8,175.06	0.67
1972-73	12,300	7,356.84	0.60
1973-74	12,014	8,601.89	0.72
1974-75	12,575	8,583.36	0.68
1975-76	12,792	9,207.61	0.72
1976-77	12,856	9,319.33	0.72
1977-78	14,104	9,461.89	0.67
1978-79	12,691	10,528.55	0.83
1979-80	12,955	10,447.89	0.81
1980-81	12,419	13,317.38	1.07
1981-82	12,987	14,146.55	1.09
1982-83	12,928	14,373.18	1.11
1983-84	12,370	14,350.09	1.16
1984-85	12,241	14,516.36	1.19
1985-86	12,459	14,484.03	1.16
1986-87	12,422	14,547.15	1.17

***Sources*:** Various issues of the Statistical Yearbook; Various issues of the *Report to the Pyithu Hlutaw* (People's Assembly).

Table 2.2 also illustrates the national output of paddy rice during the same study period. Data in tables 2.1 and 2.2 show that over 30 percent of the national paddy rice output was produced in the Ayeyarwady Delta, which also highlights the degree of specialization of that region in the national economy.

The second major crop in Ayeyarwady Delta was jute, one of the exports and industrial crops of the region. Table 2.3 shows the regional and national sown acreage of jute from 1963-64 to 1986-87. The sown area of jute in Ayeyarwady Delta was more than 50 percent than that in the whole country.

Table 2.3. Sown Acreage of Jute in Myanmar from 1963/64-1986/87

Year	Sown acreage (national)	Sown acreage (Ayeyarwady Delta)	% of total sown acreage
1963-64	54,380	34,360	63.18
1964-65	53,045	31,189	58.80
1965-66	72,226	41,711	57.75
1966-67	69,302	39,660	57.23
1967-68	86,770	48,817	56.26
1968-69	98,390	55,966	56.88
1969-70	103,295	54,741	52.99
1970-71	115,357	66,980	58.06
1971-72	224,226	133,797	59.67
1972-73	287,545	177,499	61.73
1973-74	290,898	198,664	68.29
1974-75	166,438	107,962	64.87
1975-76	148,104	104,082	70.28
1976-77	135,861	89,941	66.20
1977-78	175,901	119,711	68.06
1978-79	256,365	180,891	70.56
1979-80	260,420	173,259	66.53
1980-81	250,283	169,190	67.60
1981-82	122,343	67,839	55.45
1982-83	139,142	70,398	50.59
1983-84	166,321	85,755	51.56
1984-85	161,968	84,774	52.34
1985-86	151,436	83,350	55.04
1986-87	125,987	73,992	58.73

***Sources*:** Kan Zaw (1998); Various issues of the Statistical Yearbook.

In order of importance, the other crops grown in the region were groundnuts (peanuts), sesame, beans and other pulses, onions, chilies, and vegetables. Among these, peanuts, sesame, and beans were produced for consumption and commercialization but the others were produced for subsistence only.

Over a twenty-five-year period, the growth of agriculture in Ayeyarwady Delta was consistently above the national average. The government, therefore, exported the region's agricultural surplus.

2.2 Chronology of Reforms in Agriculture

The period under study was characterized by a shift towards a market economy. The analysis of the pattern of changes in the delta after 1983 was based on an impact analysis of the policy reforms made by the series of governments. The reform measure on agricultural policy started with the Socialist government that was in power in September 1987. Said policy was characterized by the lifting of the 21-year-old restriction on the procurement and domestic trade of rice and eight other crops, including wheat, maize, pulses, cotton, rubber, and sugarcane. This crucial policy reform was followed by several other reforms along with the ascension of the State Law and Order Restoration Council (SLORC) government to power in 1988. Myanmar's policy reform measures for the agriculture sector are shown in table 2.4.

Of these various policy reforms, the deregulation of the prices of major agricultural products, the removal of restrictions on private-sector participation in domestic and foreign trade, the introduction of summer paddy rice cultivation, and, more recently, the deregulation of paddy rice procurement by the State Economic Enterprise (SEE) Law changed the way the agricultural sector operates and functions. As a result, farmers were able to freely choose the crops they grew, stored, and sold at market prices. On the other hand, agricultural inputs, such as chemical fertilizers, pesticides, and hybrid seeds, were distributed either partially or wholly by the private sector. The marketing and export of agriculture products were also opened to private-sector participants. Thus, the policy reforms certainly changed the *modus operandi* in the agricultural sector.[3]

[3] Kan Zaw, "Agro-industrial Integration," p-9

Concomitantly, these policy reforms had a large influence on the delta region. The introduction of summer paddy rice cultivation opened up a new chapter in the delta's agriculture. Crop intensification and specialization occurred due to new technological changes and market response. In brief, the farm-structure situation became neither unimodal nor static. In fact, nonsubsistence farm families with ten or more acres of holdings found that the farm structure changed significantly.[4]

To support the growth of the agriculture sector, the MOAI set three objectives for the sector's development:

- to achieve surplus in rice production;
- to achieve sufficiency in edible oil; and
- to set up the production of exportable pulses and industrial crops.

[4] Ibid.

Table 2.4. Macro and Micro Policy Reforms in Agriculture Development in Myanmar

1987	Participation of private and cooperative sector in foreign trade
	Relaxation of the government's monopoly of the domestic marketing of rice and some important crops
1988	Removal of restrictions on private-sector participation in domestic and foreign trade
	Introduction of liberal Foreign Investment Law
	Restitution of small- and medium-size establishments
1989	Deregulation of prices
	Official revocation of the 1965 law establishing the Socialist Economic System
	Regularization of border trade
	Introduction of the State Economic Enterprise (SEE) Law allowing private-sector participation in economic activities
	Relaxation of restrictions on private investment
1990	Introduction of the law on 100 percent retention of export earnings
	Introduction of the Myanmar Agricultural and Rural Development Law
1991	Reestablishment of Myanmar Chamber of Commerce and Industry
1992	Announcement of lease-inefficient state-owned factories
	Announcement of government-owned palm-oil firms for sale
	Introduction of summer paddy rice cultivation in Ayeyarwady Delta
1993	Introduction of foreign exchange certificates (FECs)
1994	Introduction of Myanmar Citizens Investment Law
1995	Formation of Privatization Committee to facilitate the shift to a market-oriented economy and the smooth running of enterprises
1997	Introduction of new paddy-rice procurement systems—tender system, procurement by representative, preference sale and procurement system
	Procurement of paddy rice through the tender bid system in November 1997; however, the plan did not materialize and the requirement to sell paddy rice to the state remains as usual
1998	Leasing of fallow and virgin lands for cultivation or livestock breeding by private farmers, including foreign investors

Sources: Kan Zaw (1998); Thein and Than (1995); Various publications of the Myanmar government (1988—1996).

Table 2.5 shows the sown acreage of paddy rice from 1962 to 2008. It was clearly seen that in 2007—08, the total sown area devoted to rice was found almost double of 1962-63. Statistics in table 2.5 indicate that the total sown area of rice in the delta was more than 25 percent of the sown area for rice nationwide. Almost 80 percent of the total summer paddy rice in the country was also grown in the delta, underscoring the fact that the delta is the most significant and vital agricultural area in Myanmar.

Table 2.5. Sown Acreage of Paddy Rice (thousand acre)

Year	Sown acreage	Sown acreage	% of total sown
1962-63	11,953	3,173	26.55
1966-67	12,328	3,285	26.65
1976-77	12,547	3,293	26.25
1986-87	12,422	3,160	25.44
1987-88	11,531	3,133	27.17
1988-89	11,807	3,154	26.17
1989-90	12,057	3,203	26.57
1990-91	12,220	3,241	26.52
1991-92	11,935	3,245	27.19
1992-93	12,684	3,429	27.03
1993-94	14,021	4,352	31.04
1994-95	14,643	4,661	31.83
1995-96	15,166	4,892	32.23
1996-97	14,518	4,460	30.72
1997-98	14,294	4,506	31.52
1998-99	14,230	4,636	32.58
1990-00	15,528	4,920	31.68
2000-01	15,713	4,988	31.74
2001-02	15,940	4,997	31.35
2002-03	16,032	4,568	28.49
2003-04	16,168	4,724	29.22
2004-05	16,946	4,511	26.62
2005-06	18,259	4,801	26.29
2006-07	20,076	4,904	24.43
2007-08	19,990	4,956	24.79

***Sources*:** Kan Zaw (1998); Various issues of the Statistical Yearbook.

Rice yields in the delta are relatively better than rice yields in other parts of the country due to the increasing use of modern rice varieties along with intensive use of fertilizers. The utilization rate of chemical fertilizers in the delta happens to be the highest among the agricultural regions in Myanmar.

In terms of irrigated capacity, about 50 percent of total irrigated area is in the delta. The common type of irrigation usually seen here is the drainage-type irrigation system. If agricultural intensification is to be considered the major concern, the nature and production processes of both monsoon and summer paddy rice and other types of agricultural production (e.g.,fish farming) will have to be properly addressed. Before 1991-92, the traditional practice was monoculture rice cultivation. Some of the rice varieties grown in the delta region were local varieties which took about six to seven months from planting to maturation and harvest. Among these varieties was the late-maturing *nga kywe*, which was of such high quality and good repute that it occupied an important position in the export market before 1988. At present, farmers grow rice on a double-cropping basis, using different varieties with short maturation periods. Many of these are cross-breeds and varieties from the International Rice Research Institute (IRRI).

On the macroeconomic level, rice is critically important for economic and political reasons. As rice is the country's staple food, any agricultural policy aimed at economic development will have to focus on rice. It is, therefore, one of the major objectives of Myanmar's agriculture sector to produce surplus paddy rice for domestic consumption and for export. Table 2.6 shows the sown area of different crops in Ayeyarwady Delta. The size of the sown area devoted rice in the delta region hints at its importance among cereal crops and why policies on rice have been prioritized.

Total sown area of the different crops in Ayeyarwady Delta reached a record 6,986.98 thousand acres in 2007-08 due to a concerted effort and the policies aimed at improving the overall agricultural situation in the country. Government policies and agricultural strategies involved the exploitation and expansion of land resources. In other words, the government simultaneously implemented the twin policies of vertical expansion and horizontal expansion where many factors and forces were involved in the growth process.

Table 2.6. Sown Area of Different Crops in Ayeyarwady Delta (thousand acre)

Year	1. Cereal crop		2. Oilseed crop	3. Pulses and beans	4. Industrial crops	Total sown area
	Rice	Others				
1988-89	3,154	22.2	130.4	160.6	-	3,467.2
1989-90	3,203	24.1	110.2	225	-	3,562.3
1990-91	3,241	23.8	104.4	299.6	-	3,668.8
1991-92	3,245	22.9	95.8	532	-	3,895.7
1992-93	3,429	24.8	104.9	546	-	4,104.7
1993-94	4,352	17.3	84.4	574.4	54.4	5,082.5
1994-95	4,661	29.1	137.7	820.5	64.48	5,712.78
1995-96	4,892	22.2	96.5	948.6	85.27	6,044.57
1996-97	4,460	20.4	78.86	847.3	76.72	5,483.28
1997-98	4,506	22.4	93.55	914.3	63.32	5,599.57
1998-99	4,636	22.2	98.55	956.5	72.33	5,785.58
1999-00	4,920	25.7	107.3	960.6	69.13	6,082.73
2000-01	4,988	49.6	113.2	1,141.4	84.34	6,376.54
2001-02	4,997	65.7	116.8	1,266.2	96.75	6,542.45
2002-03	4,568	48.1	111.3	1,263.9	91.55	6,082.85
2003-04	4,724	50.3	127.7	1,294.6	66.58	6,263.18
2004-05	4,511	40.1	144.6	1,460.7	54.78	6,211.18
2005-06	4,801	33.3	148.2	1,550.3	49.38	6,582.18
2006-07	4,904	23.9	149.1	1,619.4	35.88	6,732.28
2007-08	4,956	17.9	159.8	1,828.6	24.68	6,986.98

***Source*s:** Various issues of the Statistical Yearbook.

The importance of cereal crops in agriculture development is illustrated in Table 2.7.

Table 2.7. Sown Areas of Major Crops in Ayeyarwady Delta, 2007/08

Crop group	Major crops	Percentage of total sown area
Cereal crops	Rice, wheat, maize, sorghum	70.9
Oilseed crops	Groundnut, sesame, sunflower, mustard, niger, oil palm	2.3
Pulses and beans	Black gram, green gram, pigeon, pea, chick pea, soybean	26.2
Industrial crops	Jute, rubber, coffee, mulberry	0.4

***Source*:** Statistical Yearbook (2008).

After the adoption of market-oriented policies in 1988, farmers in the delta region and elsewhere in the country got the chance to grow any crop they wanted following market conditions. This is one of the crucial reasons why many farmers started double-cropping rice and other exportable crops like pulses and beans.

3. Agricultural Transformation towards Growth

3.1. Policy and Direction towards Agricultural Transformation

To facilitate the development of agricultural sector, the MOAI laid down four policies as follows:[5]

- To allow farmers freedom of choice in agricultural production
- To expand agricultural land and to safeguard the rights of farmers
- To encourage the participation of the private sector in the commercial production of seasonal and perennial crops and in the distribution of farm machinery and other inputs
- To encourage research and development (R&D) in order to improve the quality and increase the production of agricultural crops.

[5] Ministry of Agriculture and Irrigation, "Myanmar Agriculture in Brief " (2010), -- p 56

To implement these four main objectives, five strategic measures will be implemented:[6]

- Development of new agricultural land
- Provision of sufficient irrigation water
- Provision and support for agricultural mechanization
- Application of modern agro-technology
- Development and utilization of modern varieties

To support the development of new agricultural lands, the MOAI implemented the following measures:[7]

1. Reclaimed fallow and cultivable waste lands;
2. Developed farmers' embankment and integrated farming of paddy rice and fish in deep-water areas; and
3. Protected soil against erosion as well as developed terrace farming in the highlands and in sloping land areas.

In terms of water resources, Myanmar has access to a total of 870 million acre feet per annum but only about 6 percent of this volume is being utilized annually. Therefore, the MOAI implemented six measures to provide irrigation water:[8]

- Construction of new reservoirs and dams;
- Proper management of the storage and utilization of runoff water from watershed areas;
- Renovation of existing reservoirs to raise storage capacity and ensure efficient delivery of irrigation water;
- Diversion of water from streams and rivulets into adjacent ponds or depressions during high water levels for storage using sluice gates;
- Lifting of water from rivers and streams through pump irrigation; and
- Efficient utilization of groundwater.

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6 Ministry of Agriculture and Irrigation, "Myanmar Agriculture in Brief " (2001), -- p 5
7 Ministry of Agriculture and Irrigation, "Myanmar Agriculture in Brief " (2001), – p 6
8 Ibid.

Myanmar has been exploring the use of farm machinery for crop cultivation instead of the more traditional draught cattle and manpower since colonial times. However, the effort has not been entirely successful due to lack of skills and experience. After independence, the government implemented agricultural mechanization schemes involving the distribution of farm machinery to farmers, production of farm machinery suitable to Myanmar's agricultural land, land expansion and development, and tilling in planned cropped areas. Following the market-oriented economic system, both the public and private sectors have increasingly utilized farm machinery and equipment in every stage of the agricultural production process. Table 3.1 shows the types and number of farm machinery used in Myanmar.

Table 3.1. Utilization of Machinery and Farm Implements in Myanmar, 2008/09

Type of Machinery	**Number**
Tractor	11,759
Power tiller	137,202
Threshing machine	21,284
Thresher	7,899
Dryer	549
Intercultivator	225,012
Seeder	46,354
Harvester	3,220
Water pump	169,881

***Source*:** Myanmar Agriculture in Brief (2009,80).

3.2 Response to Transformation and Its Impact

One-fourth of Myanmar's total land area of 167.7 million acres is cultivable land. Before independence, the government implemented land expansion programs with the goal of boosting revenues from the export of agricultural products. Although the civil war that happened immediately after independence damaged some cultivated land, the Revolution Council regime made an effort to reclaim fallow and new agricultural lands.

After taking over the reins of the government in 1988, the SLORC passed measures that resulted in a smooth and secure transportation system, a market-oriented economy, and

stable crop prices. Thus, crop-sown areas throughout the country significantly increased as data in table 3.2 show.

Table 3.2. Development of Agricultural Lands in Myanmar

Year	Net sown acre (million)	Increased acre (million)
1900	11.5	-
1948-49	14.5	3
1988-89	19.9	5.4
1999-2000	25	5.1
2007-08	32.7	7.7

***Source*s:** Myanmar Agriculture in Brief (2001 and 2009).

The MOAI also improved existing agricultural lands with proper drainage, irrigation, and farm roads. Traditionally, Myanmar's agricultural businesses have focused on small-scale crop cultivation. These days, however, the private sector is being encouraged to develop modernized, large-scale agricultural businesses. Private-sector companies operating on a national level and associations are encouraged and granted rights to develop new agricultural lands in flooded area and deep water area for the cultivation of paddy, pulses, oilseeds, industrial crops, rubber, oil palm, and other types of crops. They are also allowed to develop existing fallow, waste, and virgin lands characterized by low productivity and high land-reclamation cost. Table 3.3 shows the total area of lands granted to national entrepreneurs for large-scale commercial farming.

Table 3.3. Areas Granted to National Entrepreneurs for Large-Scale Commercial Farming (as of 31 Jan 2009)

State/Division	No. of companies	Granted areas (acres)
Kachin	9	331,134
Kayin	1	781
Sagaing	28	100,294
Taninthayi	36	672,550
Bago (East)	9	5,859
Bago (West)	7	13,913
Magwe	38	19,9013
Mandalay	18	10,446
Yangon	7	30,978
Shan (South)	9	70,772
Shan (North)	9	40,937
Ayeyarwady	28	193,353
Total	**199**	**1,670,030**

***Source*:** Myanmar Agriculture in Brief (2009, 74).

Moreover, the MOAI has implemented an upland reclamation project to meet the following objectives:[9]

- Replace the slash-and-burn method of agriculture with terraced farming, ensuring surplus food for people living in the upland regions;
- Enable the people in hilly regions to live in permanent settlements;
- Eliminate the cultivation of poppy for opium by encouraging terraced farming to improve the living standard of people in hilly regions; and
- Preserve and protect the natural environment.

Table 3.4 shows the current situation in land reclamation for terraced farming in upland areas.

[9] Ministry of Agriculture and Irrigation, "Myanmar Agriculture in Brief" (2010), – p 82

Table 3.4. Reclaimed Land for Terraced Farming in Upland Areas, As of End of Jan 2009 (in acres)

Region	No. of Machinery	Government	Farmers	Total
Shan (North)	11	6,757	3,801	10,558
Shan (East)	10	2,034	3,805	5,119
Shan (South)	9	3,500	2,863	6,363
Chin	14	2,028	2,694	4,722
Kyaukhtu	-	202	-	202
Ann Township	-	100	-	100
Napyidaw	3	232	-	232
Total	47	14,853	12,443	27,296

***Source*:** Myanmar Agriculture in Brief (2009, 75).

Myanmar has been constructing irrigation systems for crop cultivation since the reign of kings in the country's history. After independence, the government implemented various irrigation projects to maximize the utilization of water resources. After 1988, the government poured large capital investment and harnessed manpower and machinery to build many dams and reservoirs nationwide. Through the use of domestic resources and expertise, water resources are now being utilized considerably throughout the country. Total irrigated area is shown in table 3.5.

Table 3.5. Total Irrigated Area in Myanmar

Year	Irrigated area (million acre)	Increased irrigated area (million acre)
1900	0.833	-
1948--49	1.348	0.515
1988--89	2.516	1.168
1999--2000	4.32	1.804
2007--08	5.56	1.24

***Source*:** Myanmar Agriculture in Brief (2001, 2009).

Before 1988, the number of irrigation projects was 138. Due to the efforts of the government, the number of irrigation projects completed between 1988—89 and 2009 rose to 219. The total number of irrigated areas increased from 1.3 million acres before 1988 to 2.8 million acres by 2009. The total number of irrigated areas was 12.5 percent of the total net sown area in 1987—88; by 2007—08, it had increased to 17 percent of net sown area. Apart from the construction of dams and weirs, 322 river-pump stations and 7,927 tube wells were also established. Out of 39.94 million people in the rural areas, 14.73 million gained access to water supply.

The MOAI introduced mechanical paddy rice threshers and dryers to completely eliminate the traditional way of processing paddy rice (i.e., by threshing it on the floor). Farm mechanization enabled farmers to save time, labor, and human energy. Cropping intensity also increased as data in table 3.6 show.

Table 3.6. Cropping Intensity in Myanmar, 1948/49-2007/08

Year	Cropping Intensity (%)	Increase (%)
1948-49	106	
1988-89	119.6	13.6
1999-2000	146.5	26.9
2007-08	168	21.5

***Source*:** Myanmar Agriculture in Brief (2001, 2009).

Increased cropping intensity further boosted mechanization of agriculture. Factories under the MOAI and the Ministry of Industry (MOI) together with small-scale, private factories assembled and produced farm machinery used in all stages of the cropping cycle—from land preparation to harvesting and drying. Some types of machinery were also imported for distribution to farmers.

To increase agricultural production, the MOAI implemented technology transfer on crop cultivation practices, appropriate cropping patterns, provision and proper utilization of agricultural inputs, and systematic plant protection practices to farmers. There are large-scale demonstration plots and blocks of crop production zones at the entrance of each

township. Farmers are encouraged to use appropriate agro-techniques and apply organic and bio-fertilizers. In addition, the MOAI is undertaking farmers' education activities through the mass media (e.g., newspaper, radio, television, journals), distribution of educational pamphlets, individual and group training and visits by extension workers.

The MOAI has conducted important research studies on the breeding of high-yielding varieties (HYVs) and upgrading the quality of seeds. It has also embarked on the production of hybrid varieties under bilateral and commercial cooperation programs. In order to upgrade the quality and increase the yield of existing field crops, fruits, and vegetables, the MOAI has been importing new and improved varieties from abroad and distributing these to farmers. A seed law is now being prepared to provide a legal framework for seed importation, handling, production, and marketing.

Increased cropping intensity boosted the production of all major crops, including rice and pulses, to levels higher than that which prevailed prior to 1988. Total rice production steadily moved from 7,409.56 thousand metric tons in 2000-01 to 8,509.95 thousand metric tons in 2008-09. Crop production data are presented in table 3.7.

Table 3.7. Crop Production in Ayeyarwady Delta (thousand metric tons)

Year	Paddy rice (rainy season)	Paddy rice (summer season)	Paddy rice (total)	Pulses and beans
2000-01	4,684.33	2,725.23	7,409.56	429.92
2001-02	4,716.34	2,668.58	7,384.92	474.14
2002-03	4,538.94	2,111.35	6,650.30	466.89
2003-04	4,980.68	2,373.55	7,354.23	556.86
2004-05	5,252.85	1,899.16	7,152.00	704.64
2005-06	5,563.55	2,310.33	7,873.88	798.28
2006-07	5,669.46	2,448.20	8,117.67	900.79
2007-08	5,844.82	2,444.91	8,289.72	1,049.06
2008-09	5,948.89	2,561.06	8,509.95	1,083.29

***Source*:** Ministry of National Planning and Economic Development.

Since the delta is the major rice production area, it is obvious that the sharp increases in the total output of rice and pulses on the national level is due to the multiple-cropping

system practiced intensively in the delta. The free market situation and the steep increase in the prices of rice and pulses have led farmers in the region towards more land intensification. The prices of rice and pulses are shown in table 3.8.

Farmers, especially those in the southern part of delta, found the prices of summer paddy rice most profitable, especially when cultivation of it began in 1992-93. The increasing use of machinery and farm implements in agriculture also increased the output of summer and monsoon paddy rice, pulses, and beans. In addition, the large difference between the domestic price and the international price of rice encouraged farmers to produce more. Table 3.9 illustrates the Yangon prices (domestic prices) and international prices of rice.

Table 3.8. Prices of Rice and Pulses, 1991/92-2007/08 (kyat per ton)

Years	Paddy rice	Black gram	Green gram	Soy bean	Chick pea	Pigeon pea
1991-92	9,642	13,569	13,592	11,564	10,429	21,572
1992-93	9,642	14,490	20,881	15,174	10,746	20,072
1993-94	15,583	21,574	28,453	29,620	33,107	29,480
1994-95	15,583	28,827	31,774	29,624	37,798	34,809
1995-96	17,530	43,556	35,778	26,289	41,832	37,402
1996-97	29,704	45,802	57,047	39,650	46,893	45,524
1997-98	71,137	61,227	86,333	59,422	75,803	80,111
1998-99	70,122	66,889	100,116	64,400	106,741	105,778
1999-2000	70,122	112,680	98,136	100,065	133,492	132,002
2000-01	70,122	166,112	110,384	111,548	127,549	114,212
2001-02	70,122	15,555	202,222	211,555	186,666	132,222
2002-03	78,643	248,888	287,777	233,333	194,782	222,444
2003-04	274,400	217,777	228,666	233,333	217,507	256,666
2004-05	297,043	269,111	295,400	233,333	245,913	245,155
2005-06	448,000	395,111	406,528	258,844	368,463	269,111
2006-07	597,500	774,667	625,333	261,333	423,652	295,555
2007-08	623,309	590,334	538,223	436,707	492,150	450,801

***Sources*:** Various issues of the Statistical Yearbook.

Table 3.9. Domestic Price and International Price of Rice (US$ per ton)

Year	Yangon Price	International Price	% of profit
2003	141	220	56.0
2004	99	230	132.3
2005	118	240	103.4
2006	128	242	89.1
2007	184	240	30.4

***Source*:** Union of Myanmar Federation of Chambers of Commerce and Industry.

3.3 Institutions and Infrastructure for Agricultural Development

3.3.1 Institutions for Agricultural Development

The government established the Land Record and Agricultural Department in 1888 when Myanmar was still a British colony. In 1906, the Department of Agriculture was established separately. To promote the agricultural sector, the government set up the Agricultural College in 1924. This college became the Agricultural University in 1964. In 1999, it was renamed Yezin Agricultural University.

Myanmar being a predominantly agricultural country, the government established the Peasant Council in 1968, aiming to put the activities of agricultural production into operation. The Peasant Council developed a scientific agricultural system, made welfare available to farmers, and gave advice regarding agriculture and livestock breeding, all under the guidance of the centrally planned economic system.

According to the Land and Rural Development Programme, the Land and Rural Development Cooperation (Myay-Kyay-Shin) was established in 1952. In 1972, the government organized three departments; namely, the Agricultural Department, Land Record, and Land and Rural Development Cooperation. Collectively, the three departments were known as Agricultural Cooperation (Le-Sight-shin). The Agricultural Mechanization Department was established separately even before the three aforementioned departments were organized. On April 1, 1989, Agricultural Cooperation

was renamed Myanmar Agriculture Service and placed under the guidance of the government. The Department of Agricultural Research was founded on January 1, 2004 to conduct extensive agricultural research in all states and divisions nationwide.

Prior to producing output for local consumption, the objectives of the agricultural sector are to (1) export surplus agricultural products to increase foreign exchange earnings and (2) effect rural development through agricultural development.[10] In line with this, the MOAI's primary aim is to increase crop production. To meet this objective, the MOAI and the institutions under it carry out their respective functions. These institutions are the:

- Department of Agricultural Planning
- Myanmar Agricultural Service
- Irrigation Department
- Agricultural Mechanization Department
- Settlement and Land Records Department
- Water Resources Utilization Department
- Myanmar Agricultural Development Bank
- Department of Agricultural Research
- Survey Department
- Yezin Agricultural University
- Myanmar Industrial Crops Development Enterprise

To facilitate agricultural development, the government of Myanmar provided research and extension activities, agricultural credit, irrigation water, agricultural mechanization, and new agricultural land.

Research and extension activities for the crop sector were done through the Central Agriculture Research Institute (CARI) and the Extension Division of the Myanmar Agriculture Service (MAS), both of which are under the MOAI. The activities of CARI include conducting basic crop research; breeding HYVs and upgrading the quality of crops; producing hybrid varieties through bilateral and commercial cooperation; and introducing improved varieties of field crops, fruits, and vegetables from abroad to

[10] Ministry of Agriculture and Irrigation, "Myanmar Agriculture in Brief " (2010), -- p 57

upgrade crop quality and increase yield. CARI also works closely with international organizations like the United Nations Development Programme (UNDP) and the Food and Agriculture Organization (FAO). It also collaborates with international research institutes such as the International Rice Research Institute (IRRI) and the International Centre for Research in Semi-Arid Tropics (ICRISAT).

Myanmar implemented the Whole Township Production Program (WTPP) in the 1970s, earning international recognition for its efforts in extending broad support to agricultural production (e.g., distribution of HYVs and fertilizers and provision of advisory services).
To support the country's agricultural development efforts, the Myanmar Agricultural Development Bank (MADB) provides crop loans covering the different cultivation seasons (i.e., premonsoon, monsoon, and winter season) and medium- and long-term loans for agricultural development programs. International nongovernment organizations (NGOs) contracted with the UNDP and the United Nations Office for Project Services (UNOPS), such as PACT, GRET, and Grameen Trust, also started offering microcredit schemes starting 1997.

The Irrigation Department under the MOAI, which is responsible for providing irrigation water, has been improving irrigation facilities since the early 1990s.

The government formed the Myanmar Industrial Development Committee in 1995 to help transform traditional methods of agricultural production into mechanized farming and to promote the use of farm machinery and implements. The Agricultural Mechanization Department and Myanmar Heavy Industries are the primary local manufacturers of farm machinery and implements.

The government has also been developing new agricultural lands since the early 1990s by using cultivable, fallow, and waste lands for plantation, orchard, and seasonal crops.

Following the market-oriented economic system, the MOAI has implemented the following measures to promote private-sector participation, attract foreign investments, and accelerate growth and development: [11]

[11] Myat Thein, *Economic Development*, p-189

- Tractors under the Agriculture Mechanization Department (AMD) have gradually been sold to expand private-sector farm mechanization;
- Distribution of farm inputs like chemical fertilizers, pesticides, and seeds that were formerly handled solely by the MAS was gradually transferred to the private sector while subsidies on farm inputs are being removed;
- Plantation estates were leased out to private entrepreneurs for a term of 10 to 15 years;
- Contract farming agreements were forged with the private sector for the production of annual crops and plantation crops such as rubber, oil palm, cashew nuts, etc.

In 2008, the government allowed the establishment of "rice specialization companies" to develop the rice industry. The objectives of rice specialization companies are to (1) produce high-quality rice; (2) increase rice production to ensure sufficient domestic supply and produce exportable surplus; (3) enhance yield per acre; and (4) improve the living standard of farmers. In line with these objectives, rice specialization companies have undertaken the following functions:

- Extend seasonal loans with an interest rate of 2 percent to farmers and distribute the necessary inputs (e.g., fertilizers, quality seeds, and farm machinery)
- Support the construction of rice mills by cooperating with local communities
- Distribute appropriate farming technologies to farmers

There are currently thirty-seven rice specialization companies in Myanmar. The established rice specialization companies in Ayeyarwady delta region are shown in table 3.10.

Table 3.10. Established Rice Specialization Companies in Ayeyarwady Region

No.	Companies	State and region	Township
1	Gold Delta Co., Ltd	Ayeyarwady	Danubyu
2	Adipade Laeyar Co., Ltd	Ayeyarwady	Kyaiklat
3	Ayeyardepar Pathein Co., Ltd	Ayeyarwady	Pathein
4	Ayeyar Delta Co., Ltd	Ayeyarwady	Pathein
5	Ayeyar Pathein Co., Ltd	Ayeyarwady	Pathein
6	Hinthada Rice and Paddy Co., Ltd	Ayeyarwady	Hinthada
7	Ayeyarwaddy Green Land Co., Ltd	Ayeyarwady	Phyapon
8	Kyeiklat Rice Production Co., Ltd	Ayeyarwady	Kyeiklat
9	Myaungmya Dragon Co., Ltd	Ayeyarwady	Myaungmya
10	Ayeyar Myitwakyunpaw Co., Ltd	Ayeyarwady	Bogalay
11	Myitwakyunpaw Co., Ltd	Ayeyarwady	Kyonpyaw
12	Seinkyun Yadanar Co., Ltd	Ayeyarwady	Mawlamyinggyun
13	Shwekanthar Co., Ltd	Ayeyarwady	Kangyidawnt
14	Shwemyay Kyaunggone Co., Ltd	Ayeyarwady	Kyaunggone
15	Towayeyar Co., Ltd	Ayeyarwady	Dedaye
16	Wakema Rice and Paddy Co., Ltd	Ayeyarwady	Wakema
17	Yaywaddy Co., Ltd	Ayeyarwady	Maubin
18	Yegyi Rice and Paddy Co., Ltd	Ayeyarwady	Yegyi
19	Zalon Ayeyar Co., Ltd	Ayeyarwady	Zalon
20	Zalon Shaesaung Co., Ltd	Ayeyarwady	Zalon

***Source*:** Myanmar Rice Industry Association (MRIA).

3.3.2 Infrastructure for Agricultural Development

Since the SLORC government came to power in 1988, one of its main objectives has been to maintain the "secure and smooth running of transportation, communication, and commodity flows." Accordingly, it exerted efforts to improve existing infrastructure by prioritizing the building of roads, dams and reservoirs, railroads, ports, and airports. The following table shows the construction of infrastructure related to agricultural development in the Ayeyarwady delta region.

Table 3.11. Infrastructure for Agricultural Development in Ayeyarwady Delta

Subject	Count	1988	2005	2006	2007	2008	2009
Water supply task							
Dams, Lakes, Reservoirs, Drains							
- Tasks completed	num	4	n/a	12	13	13	13
- Ongoing tasks	num	-	n/a	2	1	1	1
- Benefited area	acre	2,910	n/a	290,331	300,331	300,331	300,331
River water-pumping project							
- Task completed	num	-	23	23	24	24	24
- Ongoing tasks	num	-	6	6	5	5	5
- Benefited area	acre	-	-	-	28,627	28,627	28,627
Damming Creek	num	-		11	14	14	24
- Benefited area	acre	-		11,210	12,195	12,195	22,984
Artesian wells	num	-	716	716	716	716	716
- Benefited area	acre	-	6,169	6,169	6,169	6,169	6,169
- Total benefited area	acre	2,910	347,322	347,322	347,322	347,322	358,111
Tractor station	station	14	n/a	n/a	n/a	18	14
Rural Water Supply Task							
Villages where tasks are to be carried out	village	-	2,361	2,615	3,214	3,646	4,249
Completed work	work	-	2,700	3,447	4,158	4,775	5,700

***Source*:** Various issues of the Chronology of National Development.

The government has paid special attention to the improvement of basic infrastructure in the remote rural regions of the delta and the frontier border areas. It has raised capital for the improvement of the road-transport and land-route road network in Ayeyarwady Delta. Almost all townships that were previously connected only by waterways are now connected by a road-transport network (even if some of the connections consist only of earth roads). The most obvious improvement was the Yangon-Pathein highway connecting the regional capital of Pathein with the city of Yangon. Special infrastructure projects implemented in delta region are shown in table 3.12.

Table 3.12. Special Infrastructure Projects for Ayeyarwady Delta Development

Types of Projects	Name of Project	Location/Region
Bridges		
1	Nawaday (Pyay Bridge) - A bridge across the Ayeyarwady River, near Pyay Township	Bago, Ayayarwady, Rakhine, Magway, and East-West Connection (inter-regional connection)
2	Myaungmya Bridge - A bridge across Myaungmya River, near Myaungmya	Ayeyarwady, Yangon, East-West Connection (inter-regional connection)
3	Ma-U-Bin Bridge - A bridge across the Ayeyarwady River, near Ma-U-Bin	Ayeyarwady, Yangon, East-West Connection
4	Nyaungdon-Setkawt Bridge - A bridge across the Ayeyarwady River, near Nyaungdon	Ayeyarwady, Yangon, East-West Connection
5	Pin-Lai-Lay Bridge - A bridge across Latputta-Ainmae	Ayeyarwady, Yangon, East-West Connection (inter-regional connection)
6	Bayin-Naung Bridge - A bridge across Pan-hlaing River, Yangon	Yangon-Ayeyarwady, Gateway to Yangon City (inter-regional connection)
7	Insein Bridge - A bridge across Hlaing River, Yangon	Yangon-Ayeyarwady, Gateway to Yangon City (inter-regional connection)
8	Khattiya Bridge	Maubin, Ayeyarwady Region
9	Daydalu Bridge	Pyapon, Ayeyarwady Region
10	Seikmachaung Bridge	Bogalay, Ayeyarwady Region
11	Natchaung Bridge	Bogalay, Ayeyarwady Region
12	Myaungmya Bridge	Myaungmya, Ayeyarwady Region
13	Bo Myat Tun Bridge	Nyaungdon, Ayeyarwady Region

***Sources*:** Kan Zaw (1998); New Light of Myanmar and other government publications related to the special project implementation committee (1997); Chronology of National Development (2009).

The East-West connection is strategically important to strengthen physical integration. Accordingly, the government extended road networks across the Ayeyarwady to strengthen rural-rural and rural-urban linkages. The presence of numerous rivers and creeks in the delta region and the shift to the market-oriented economic system prompted the government to construct bridges in order to facilitate inter-regional connection. Some of the finished bridges include the Pantanaw, Gonnhindan, Shwelaung, Wakema, Dedaye, Dahka, Pathein, Panmawady, Ngawun, and Kyungone bridges. Consequently, travel time by car within the region has been reduced to a few hours' time.

It is evident that tremendous development has occurred since 1989 in regional transportation networks, economic infrastructure, and road construction. Data on road improvements are presented in table 3.13.

Table 3.13 Road Improvement in Ayeyarwady Delta

Subject	Count	1988	2005	2006	2007	2008	2009
Urban Development							
Urban Roads	**Mile/Pharlon**	**490/4**	**617/6**	**667/6**	**698/6**	**731/1**	**770/0**
Bituminous road	Mile/pharlone	155/1	204/6	241/6	266/6	283/7	310/0
Metalled road	Mile/pharlone	89/4	101/4	109/4	115/1	127/4	138/4
Granite road	Mile/pharlone	24/3	35/7	35/7	36/0	36/0	36/0
Earth road	Mile/pharlone	221/4	275/5	280/7	280/7	283/6	285/4
Urban bridge	**bridge**	**783**	**n/a**	**n/a**	**n/a**	**1,166**	**1,243**
Concrete	bridge	503	n/a	n/a	n/a	680	726
Wood	bridge	104	n/a	n/a	n/a	152	154
Conduit	conduit	141	n/a	n/a	n/a	275	304
Other	bridge	35	n/a	n/a	n/a	59	59
Rural Development							
Rural roads	**Mile/Pharlon**	**837/1**	**2,998/**	**3,305/**	**3,517/**	**3,561/2**	**3,762/**
Bitumonous road	Mile/pharlone	20/3	49/5	54/3	56/0	58/0	58/4
Metalled road	Mile/pharlone	132/2	435/3	560/1	620/7	653/0	727/7
Granite road	Mile/pharlone	106/6	127/7	132/4	135/7	137/6	161/1
Earth road	Mile/pharlone	577/6	2,385/	2,558/	2,705/	2,712/4	2,815/
Rural bridge	**bridge**	**88**	**358**	**523**	**654**	**562**	**625**
Concrete	bridge	31	n/a	n/a	n/a	90	102
Wood	conduit	48	n/a	n/a	n/a	221	243

Conduit	bridge	9	n/a	n/a	n/a	226	255
Other	bridge		n/a	n/a	n/a	25	25

***Sources*:** Various issues of the Chronology of National Development.

Road improvements are evident from efficiency in travelling time, frequency and numbers of vehicles. A summary of developments in the different modes of transport is shown in table 3.14.

Table 3.14. Improvements in Transport Network in Major District Towns of Ayeyarwady

	1990		1992		1997		2010	
Movement	**Ship**	**Motor Car**	**Ship**	**Motor Car**	**Ship**	**Motor Car**	**Ship**	**Motor Car**
Yangon-Pathein								
Types of vehicles	B-Class	No road transport	B & W	Cargo, BM	B & New Chinese B	BM, Tour Bus, Salon	B & New Chinese B	BM, Tour Bus, Salon
Capacity	150		150	40*5=200	400	40*12=480	700	40*20=800
Volume	100 tons		100 tons		250 tons		450 tons	
Travel time	16--20 hrs		16--18 hrs	6--9 hrs	14 hrs	6 hrs	14 hrs	5 hrs
Distance				136 miles		136 miles		136 miles
Yangon-MyaungMya								
Types of vehicles	T-Class	No road transport	T & S Class	Cargo	B & New Chinese B	BM, Tour Bus, Salon	B & New Chinese B	BM, Tour Bus, Salon
Capacity	280		400	20*2=40	400	20*6=120	600	20*10=200
Volume	50 tons		110 tons	6*2=12 tons	110 tons	20--30 tons	200 tons	30--40 tons
Travel time	24 hrs		24 hrs	6--10 hrs	24 hrs	6--8 hrs	24 hrs	5--7 hrs
Distance				109 miles gravel rd.		109 miles gravel rd.		109 miles gravel rd.
Yangon-Hinthada								
Types of vehicles	T-Class	No road transport	T-Class	BM & Hilux	T-Class	BM, Air-con Bus	T-Class	BM, Air-con Bus
Capacity	T*2=520		T*2=520	20*6=120	T*2=520	40*16=640	T*2=52	40*20=800
Volume	50 Tons		50 tons	20 tons	50 tons	45 tons	50 tons	50 tons

Travel	72 hrs		72 hrs	8--10 hrs	72 hrs	5--6 hrs	72 hrs	4-5 hrs
Distance				81 miles gravel rd.		81 miles		81 miles
Yangon-Nyaungdon								
Types of vehicles	T-Class	Dodge, Dyna	T-Class	BM & Hilux	Cargo Tug only	BM, Air-con Bus	Cargo Tug only	BM, Air-con Bus
Capacity	150	10*10=30	150	30*25=75		40*80=320		45*90=4050
Volume	120	20 tons	120 Tons	100 tons		120 tons		140 tons
Travel	12 hrs	3--4 hrs	12 hrs	2--2.5 hrs		1.5--2 hrs	12 Hrs	1--1.5 hrs
Distance		Gravel		34 miles tar road		34 miles Ac road		34 miles Ac road
Yangon-Kyaungon								
Types of vehicles	T-Class	No road transport	T-Class	Dyna	T-Class	BM, Air-con Bus	T-Class	BM, Air-con Bus
Capacity	120		150	40*4=160	150	40*9=360	200	40*15=600
Volume	100		120 Tons	20 Tons	120 tons	72 tons	140 tons	90 tons
Travel	24 hrs		24 hrs	5--6 hrs	20 hrs	4 hrs	20 hrs	4 hrs
Distance				79 miles gravel rd.		79 miles gravel rd.		79 miles gravel rd.
Pathein-Myaungmya								
Types of vehicles	B & W Class	No road transport	W & B Class	No road transport	B & New B Class	Dyna/Hilux	B & New B Class	Dyna/Hilux
Capacity	400		400		500	40*2=80	600	40*4=160
Volume	120		120 Tons		120/50	2 tons	130 tons	3 tons
Travel	4 hrs		4 hrs		4 hrs	3 hrs	4 hrs	2.5 hrs
Distance						32 miles gravel rd.		32 miles gravel rd.

***Sources*:** Kan Zaw (1998); author's survey on the transport network.

The road connection between the delta region and Yangon was established in the early 1990s. This physical land route connection between the delta and central regions ended the long-standing "dendritic market system," which was a legacy of the colonial period in the delta. It also facilitated interaction between the delta and central regions and improved center-periphery relation.

3.4 Agriculture Trade and Markets for Agriculture

3.4.1 Marketing Channels and Linkages

The market system in Ayeyarwady Delta was generally characterized as a “dendritic market system” that connected dependent villages to the port city. Apart from the dependent village, the market channel was composed of three other major elements: local town, strategic town, and port city. The basic marketing channels in delta were formed by the dependent, agriculture-based villages that are connected with the locality and the strategic district town. Each district consisted of five to six townships where each township served as a local market center. The commodities produced within the locality were sold at the local market or at the center adjacent to the village. Marketing channels were characterized by a mono or single tract system. The maximum distance in which producers did their marketing was up to the adjacent locality where they exchanged their farm produce with the necessary consumer goods and inputs for the next cropping. Thus, every producer passed along the main rivers and waterways on their way to the adjacent local centers. The transport cost involved in the single tract system resulted in a large deduction of producer surplus from the farm sector. In many years before1990, producers in the delta faced with the mono system of marketing for their products.

Agricultural products produced in the delta were transported to the port city of Yangon for export or to the Bayintnaung wholesale trading center in Yangon for redistribution to the local market. The government resolved to facilitate the stronger flow of goods and services into major trading areas like Yangon and, consequently, invested a considerable amount of capital in regional infrastructure. The waterways of the Ayeyarwady Delta, which consists of a huge network of small and big rivers, was previously regarded as the chief means of transport and travel before 1988. Soon after the SLORC government took power, waterways were soon replaced by other transport networks. Nowadays, bridges combined with a network of highway roads have made life much easier.

As a result of new infrastructure in the delta, the marketing of agricultural products was done on a wider and more efficient scale. All activities connected with agriculture became more concentrated, thereby achieving a higher rate of growth in production as well as

yields. A good transportation system has an effect on a lot of people living in the delta. Marketing or transportation of agricultural goods from other parts of the delta to Yangon sometimes took two to three days in the past. With the new infrastructure, this was shortened to a couple of hours. As market development relies mostly on improved inter- and intraregional road connection, it is evident that the newly built infrastructure in the delta region significantly changed the existing dendritic market system to an "intermatch market system" that connected the region with international markets.

Good transportation systems, in fact, turned the whole delta into a more dynamic region. After 1991—92, when double-cropping of rice together with other new types of production like rice-fish farming was introduced into the area, the production of rice, peas, and beans significantly increased. When the bulk of the agricultural output was channeled to the export market, there was a need for greater mobilization of natural resources and capital. The government and the private sector took the initiative to mobilize all the necessary resources inside the region. The efficient use of new resources along with the use of existing resources resulted in an increase in both production and yield. Increased agricultural production in the region is assumed to have increased regional income as well.

3.4.2 Trade and Markets for Agriculture

As external demand increased, paddy rice producers in the region were ready to respond to the growing demand from the urban center through the improved road networks. To boost trade performance in line with the new, market-oriented economy, the following trade liberalization measures were introduced:[12]

1. Private individuals or enterprises were allowed to engage in the export/import business, which was previously handled only by the state.
2. Border trade was regularized to develop and strengthen bilateral trade relations with Myanmar's five neighboring countries. The Department of Border Trade was established, with its eleven branch offices providing one-stop service for border trade matters in collaboration with other concerned departments.
3. Export and import procedures were realigned.

[12] Ministry of Commerce, Directorate of Trade, Trade and Investment of the Union of Myanmar, 2006.

4. Technical barriers to trade were lowered and simplified export/import procedures geared towards trade facilitation and promotion were implemented.
5. As an incentive, exporters were allowed to retain all of their export earnings for them to use said earnings in the importation of goods.
6. Trade notifications were issued, specifying the rules to be followed in order to conform to the changing internal and external business environment.
7. Imported items like fertilizers, agricultural machinery and implements, insecticides and pesticides, medicines, and raw materials were exempted from commercial tax and customs duties.
8. The Chambers of Commerce and Industry was reactivated and reorganized as the Union of Myanmar Federation of Chambers of Commerce and Industry (UMFCCI) for the purpose of helping the private sector promote trade and industry.

Due to the complete privatization of the agriculture sector, the commodities that private individuals and enterprises can now freely trade in include rice, which was once controlled by the state as a strategic crop. Table 3.15 shows Myanmar's volume of exports of selected agricultural products.

Table 3.15. Export Volume of Agricultural Products in Myanmar (thousand metric ton)

Commodity	Rice and Rice Products	Pulses	Maize	Oilcakes	Raw rubber	Raw cotton	Raw jute
1988-89	48	17	1	16	2		
1989-90	169	56	14	29	2		5
1990-91	134	195	20	25	1	*	
1991-92	183	195	41	16	8		*
1992-93	199	449	44	25	18		
1993-94	261	514	40	35	23		
1994-95	1,041	425	70	14	24		
1995-96	354	610	62	31	25	*	5
1996-97	93	595	103	7	26	*	2
1997-98	28	769	50	*	22	4	5
1998-99	120	622	174	1	30	4	
1999-2000	55	561	89	11	30	2	
2000-01	251	831	148	*	20	3	4
2001-02	939	1,035	90	*	25	*	30
2002-03	793	1,038	219		22	*	8
2003-04	168	1,211	151		20		6
2004-05	182	873	255		14		
2005-06	180	865	90		29		
2006-07	15	1,156	183	*	9		
2007-08	358	1,141	156		19		

***Source*:** Various issues of the Statistical Yearbook.

Note: * less than one unit

As can be seen in the table 3.15, although rice was the main export in 1988-89 and 1989-90, pulses and beans became the main exports starting 1990-91. Generally, Southeast Asia was Myanmar's major market for rice up to 2003-04. The Middle East replaced Southeast Asia as a major export market for rice starting 2004-05. Other Asian countries also

became important rice export markets in 2007-08. The situation in rice exports is shown table 3.16.

Table 3.16. Direction of Rice Export Trade (thousand metric ton)

Year	Southeast Asia	Rest of Asia	Middle East	America	Europe	Africa	Oceania	Total
1988-89	2	12			10	24		48
1989-90	29	78	5		5	52		169
1990-91	15	66	3	10		40		134
1991-92	47	57				79		183
1992-93	4	75	6			114		199
1993-94	16	57	3		11	174		261
1994-95	635	99		15	16	276		1041
1995-96	261	44		26		23		354
1996-97	47	20	*		1	25		93
1997-98	1	27			*	*		28
1998-99	66	20		*	3	31		120
1999-2000	20	23			12			55
2000-01	46	174	*		6	25		251
2001-02	367	55	367	8	57		85	939
2002-03	321	35	350	31	14		42	793
2003-04	78	53	33		4			168
2004-05	28	48	66		31			173
2005-06	49	31	90		1	9	9	189
2006-07	3		12					15
2007-08	55	194	44		7	58		358

***Sources*:** Various issues of the Statistical Yearbook.

***Note*:** * less than one unit

Table 3.17 presents the share of various agricultural products in total exports. The share of gas in total exports became bigger after 2000. Data, however, indicate that agricultural products are still important in Myanmar's total exports.

Table 3.17. Composition of Exports (%)

Year	Agricultural Products	Animal Products	Marine Products	Timber	Base Metal and Ores	Precious and Semiprecious Minerals	Gas	Garments	Other Commo-dities	Total Exports
1988-89	5.90	0.23	2.81	30.47	3.23	2.77	0	0.37	54.22	100
1989-90	15.18	0.11	4.73	31.46	2.40	3.07	0	0.49	42.55	100
1990-91	26.26	0.18	6.05	36.63	2.64	3.15	0	0.29	24.79	100
1991-92	28.20	0.15	5.85	34.91	1.80	2.02	0	2.21	24.86	100
1992-93	31.12	0.06	7.79	28.53	0.81	3.25	0	2.92	25.53	100
1993-94	28.38	0.12	9.18	30.97	0.72	4.12	0	5.49	21.01	100
1994-95	42.34	0.10	12.16	20.90	1.20	2.07	0	6.76	14.48	100
1995-96	46.12	0.14	12.22	20.82	1.39	2.72	0	5.96	10.63	100
1996-97	36.10	0.16	16.16	17.95	0.60	2.90	0	7.33	18.80	100
1997-98	30.28	0.12	14.66	13.23	0.47	3.21	0	6.76	31.27	100
1998-99	27.98	0.50	13.93	11.68	1.10	2.21	0.07	6.97	35.57	100
1999-00	17.91	0.31	9.02	10.34	3.23	2.45	0.35	30.42	25.98	100
2000-01	18.15	0.29	7.33	6.30	2.54	2.85	8.72	29.72	24.09	100
2001-02	17.63	0.25	5.03	10.97	1.68	0.74	24.79	17.42	21.48	100
2002-03	14.07	0.11	5.59	9.38	1.41	1.25	29.66	14.91	23.61	100
2003-04	16.59	0.09	6.84	14.51	2.41	2.53	24.63	13.92	18.47	100
2004-05	10.92	0.10	6.19	13.39	3.27	3.68	34.72	7.66	20.08	100
2005-06	12.28	0.10	5.56	13.32	3.13	6.58	30.20	7.68	21.15	100
2006-07	13.31	0.06	4.52	9.79	2.13	7.43	38.89	5.34	18.55	100
2007-08	13.26	0.06	4.68	8.40	1.35	10.08	39.49	4.41	18.28	100

***Source*:** Various issues of the Statistical Yearbook.

4. Rural Development Principles and its implementation

4.1. Government's Five Principles for Rural Development

In Myanmar, 70 percent of total population lives in the rural areas. The government's rural development program covers health, education, water and sanitation, transportation, and communication. The agricultural sector is a major source of income for the rural people, so the government provides guidance for rural development in the form of five principles. These five principles, which are aimed at promoting the living standards in the rural areas, are:

1. Providing better transportation
2. Providing water supply for agricultural purposes and ensuring potable water
3. Raising the education standard
4. Providing better health care services
5. Developing agriculture and livestock-breeding activities

To facilitate the development of rural areas, two principles were added:

1. Providing rural libraries for educational support
2. Providing rural electrification

4.2. Implementation of Rural Development Principles and Impact on Rural Communities

The tasks concomitant to the actualization of the five rural development principles are being implemented nationwide under the guidance of the government. The government has been building dams, reservoirs, and river water-pumping infrastructure nationwide to provide sufficient water for agricultural purposes and to ensure the availability of potable water in the rural areas.

It has been developing the agricultural sector in accordance with the new, market-oriented economic system. To raise education standards (one of the five principles for rural development), the Information and Public Relations Department under the Ministry of

Information opened self-reliant libraries in the rural areas. The government has also been establishing electricity-generating plants (in the rural areas) that use biogas, rice husks, and coconut-palm leaves for fuel.

To develop agriculture and the rural economy, the government introduced better and modern methods for maximizing crop yields and encouraged the breeding of livestock, fish, and prawn. This increased farm incomes and promoted the standard of living of the rural populace in general and farmers in particular. The MOAI has undertaken education activities on the progress of agricultural production. To give rural people better access to health care services, the government has established rural health centers. With 70 percent of the country's total population living in the rural areas, implementation of the five principles for rural development is expected to improve the income and standard of living in these areas. The progress of crop production in Ayeyarwady Delta is presented in table 4.1.

Table 4.1. Progress of Crop Cultivation in Ayeyarwady Delta

Subject	Count	1988	2005	2006	2007	2008	2009
Land resource							
- Sown acreage	acre	4,246,800	4,415,592	7,999,007	8,836,638	8,084,165	9,101,796
- Virgin and vacant land	acre	1,182,532	181,103	186,049	149,490	130,628	129,236
Crop cultivation Extended paddy cultivation							
- Monsoon paddy acreage	acre	3,154,021	3,508,291	3,666,702	3,700,025	3,647,168	3,700,017
Summer paddy acreage	no		1,421,860	336,057	586,815	603,181	-
- Total production	basket (in thousand)	190,207	370,943	213,425	264,533	264,940	15,640
-Regional rice sufficiency	percent	202	296	294	297	298	295
Progress in acreage of							
Beans and pulses	acre	271,720	1,407,104	1,390,588	1,651,787	1,673,191	84,482
Sugarcane acreage	acre	-	304	268	291	311	339
Maize acreage	acre	6,406	70,064	16,827	12,764	6,774	298
Rubber acreage	acre	92	2,310	6,607	11,995	16,139	19,050
Oil palm acreage	acre	-	-		5	5	5
Pepper acreage	acre	-	3,057	6,012	6,656	6,865	7,023
Edible oil crops							
Groundnut acreage	acre	85,257	107,559	89,060	107,649	106,620	32,107
Sesame acreage	acre	45,250	32,658	-	-	-	22,200
Sunflower acreage	acre	136,474	237,708	156,970	350,022	400,052	3,230
Jatropha	acre turn	-	-	11,553	219,062	451,198	463,494
Land reformation by machine	station	2,293,076	-	-	-	2,372,287	25,670,463
Tractor station		14	-	-	-	18	14

***Source*:** Various issues of the Chronology of National Development.

The government reclaimed virgin and vacant land after 1988. Consequently, the area of cultivable land increased year by year, with total sown acreage also increasing from 4.2 million acres in 1988 to 9.1 million acres in 2009.

However, Cyclone Nargis, one of the severest natural disasters in the history of Myanmar, hit on May 2, 2008. The cyclone destroyed a large number of houses, schools, hospitals, dispensaries, office buildings, mills and factories, storehouses, power lines, and telephone lines in Ayeyarwady Delta. The toll on human and animal lives was also significant. Sea water destroyed salt lands, cultivated lands, wells, and lakes. Although the devastation was unprecedented, the government and the people were able to get relief and rehabilitation efforts going within a short period. The state, ministries, NGOs, and other entities spent a huge amount of money for relief and rehabilitation and for instituting long-term mitigation measures against natural disasters in the cyclone-hit areas. Thanks to the support of the government, crop cultivation in the whole delta did not decrease considerably, although there was a decrease in the total output of paddy rice and in the cultivated areas of edible oil crops, beans and pulses, and maize due to Cyclone Nargis.

There was progress in the breeding of livestock, fish, and prawns (table 4.2) as a result of the government's promotion of, and support for, this activity. This was intended to raise farm incomes and the standard of living of the rural populace.

Table 4.2. Progress of Livestock Breeding in Ayeyarwady Delta

Subject	Count	1988	2005	2006	2007	2008	2009
Extended livestock breeding							
Buffalo	head	297,006	321,000	338,000	345,052	216,386	222,519
Cattle	head	1,118,522	1,190,000	1,240,000	1,263,993	1,144,364	1,166,754
Sheep/Goat	head	31,007	64,000	77,000	83,197	80,482	86,290
Pig	head	606,224	843,000	1,067,000	1,162,202	1,106,232	1,193,780
Chicken	head	5,460,701	9,237,000	12,176,000	13,558,132	13,013,924	14,227,780
Duck	head	1,788,643	2,374,000	2,932,000	3,158,814	2,720,465	2,904,566
Turkey, Goose, Muscovy duck	head	311,971	358,000	394,000	406,749	342,353	352,006
Quail	head			10,000	11,524	12,270	13,803
Fish and prawn breeding							
Fish breeding pond	acre	979	84,796	104,909	111,553	111,553	112,207
Prawn breeding pond	acre		40,158	56,855	56,855	56,855	56,855

***Source*:** Various issues of the Chronology of National Development.

The government believes that providing better health care to the rural people contributes to their productivity and their ability to work and earn income. It has thus increased the number of rural health centers. Table 4.3 illustrates the increase in the number of rural health centers from 1988 to 2009.

Table 4.3. Number of Rural Health Centers in Ayeyarwady Delta

Subject	Count	1988	2005	2006	2007	2008	2009
Rural health centers	center	185	195	195	196	196	203

***Source*:** Various Issues of the Chronology of National Development.

Regarding the government's programs for comprehensive development, the twenty-four Development Zones for Economic and Social Infrastructure are actively being created and the pursuit of rural development based on the five rural development principles are being actualized to promote socioeconomic progress (Kan Zaw 2006).

4.3 Support for Sustainable Rural Development

The activities initiated by the government and international organizations in support of rural development aim to boost crop production, crop diversification, and crop and livestock farming. Such activities also aim to effect community development through the construction of village roads and the provision of agricultural credit and other agricultural inputs. In addition, the government, with the technical and financial assistance of the UNDP and FAO, implemented the Integrated Rural Development Project to facilitate the conduct of self-sustaining improvement in human capability and welfare.

In 1989, the State Peace and Development Council (SPDC) turned its attention to developing the rural border areas. These areas quickly developed within a few years' time due to the effective coordination and cooperation among the agencies involved in the initiatives. The government then launched a nationwide rural development program based on the following ideas:

- to strengthen and develop agriculture, livestock, and fishery production for economic development
- to provide proper social services, such as health care, education, nutrition, and sanitation
- to provide water for the irrigation of cultivated crops and for household use

- to build roads and bridges for better communication and transportation with other areas within and outside the region
- to develop rural industries based on the agricultural products and other available materials within the area

International agricultural research centers (IARCs), the FAO, and UNDP have also implemented many approaches to make sustainable agricultural and rural development possible.

5. Findings, Conclusions, and Recommendations

The review and analysis of agriculture in Ayeyarwady Delta highlighted the optimistic hope, prospects, and potential for sustainable development in the delta region. It was found that rice farming, in general, is the most important economic activity and the principal means of livelihood in the delta. Since the geographical features and the climate is most favorable for rice, the majority, or nearly all, peasant farmers in the area grow rice as the main crop and other exportable crops like green gram, black gram, chick peas, and pigeon peas.

The government allowed the establishment of rice specialization companies in 2008 to develop the rice industry. There are currently thirty-seven rice specialization companies, of which twenty are operating in the Ayeyarwady region. Rice specialization companies provide agricultural credit to farmers with an interest rate of 2 percent to help them purchase inputs, such as seeds, fertilizers, pesticides, and the like. For this type of credit, farmers have to repay their loans in cash or in kind upon harvest.

Agriculture is the primary livelihood in the delta region, but it has undergone different policy reforms and measures for more than a century. The sector obviously needs further investment and technological advancement to sustain the level of production. As agriculture development reaches higher levels, the cost and price structure also increases. To meet increasing cost conditions, the agriculture credit policy should be reviewed and updated to keep up with the current trends of development. On the other hand, the repayment system should be enforced to maintain an effective credit system. Furthermore,

private banks should be encouraged to provide service in the rural areas to supplement the government's credit scheme.

One of the most important reforms to be considered is the reform in land-use policy and agrarian structure. At present, all lands are owned by the state and farmers have the right to use land through the legacy of ancestors or through the law of inheritance. The government has issued thirty-year leases for the use of cultivable land up to 2,000 hectares (or 5,000 acres) for private farming.[13] As technology advances and profits from farming become more favorable to farmers with large landholdings, they will buy land-use rights to further expand their landholdings. These issues should be seriously considered if rural development is to remain sustainable in the future.

In general, infrastructure development in the delta has totally shifted the marketing channel from the dendritic market system prevalent in postcolonial times to the intermatch market system in practice today. The stronger the rural and local infrastructure grows, the stronger will be the rural-urban linkages. In fact, in this case, the linkages between the farming rural region and the city (Yangon) has become more integrated through the road networks that have been built.

Finally, the government has undertaken many development programs in Myanmar's rural regions. Not all of these interventions have been successful. Training is essential to promote efficiency, increase knowledge, and built the capacity of the rural populace. To improve farm income, support in the form of agricultural inputs (e.g., fertilizers, agro-chemicals, quality seeds, irrigation, credit) is also necessary. Decisions on the necessary training programs and agricultural inputs, however, should originate from the community instead being imposed from external or central sources. The same is true for decisions involving crop production, livestock farming, and other income-generating activities. Past experience has shown that rural development initiatives based on a centrally planned approach are not successful. Therefore, a decentralized approach would be best in the implementation of Myanmar's rural development programs.

[13] The Committee for the Management of Cultural Land, Fallow Land, and Waste Land, which is under the Ministry of Agriculture and Irrigation, allows investors to cultivate or utilize up to a maximum of 20,000 hectares for a thirty-year period.

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