

Chapter 1

Uniquely Agricultural

The story of Thai agriculture is unique. One of the world's major agricultural exporters as a result of innovative political strategies and bounteous natural resources, Thailand continues to rely on agriculture as it experiments with lost traditions which appear compatible with modern environmental management. Within this context, the following is a mean attempt to unify the fields which coalesce as Thai agriculture - history, technology, science, politics, culture, religion, and economics. This chapter introduces Thailand's global agricultural importance and responsibilities, its resources, and the history which lead to this unique position, as a prelude to the specific chapters which follow.

From a religious and trading region to a united Kingdom through sophisticated political and social integration strategies, the peoples who emerged as Thai have exemplified a relationship between man and nature in the development of an agriculture which fuelled wider political and industrial development. Today, agriculture remains critical to the Thai nation for social, environmental, and economic development. As an introduction to Thai agriculture and its role, it is appropriate to first introduce the underlying resources which have created a reality from the legend of an agricultural golden cradle.

Golden Cradle

The golden cradle of agriculture which nursed and nourished a nation's development, at least partly with southward migration of Tai peoples over the past millennium, continues to be the envy of the neighbours and the minority of the Tai diaspora which did not become part of Thailand. Thailand's \$2,200 in GNP per capita compared to the world average of \$4,890 hides its relative wealth, which is

better indicated from comparisons on a purchasing price parity basis which lifts it to 95 percent of the \$6,200 world average and raises its global ranking from 102 to 91.¹ Agriculture as a proportion of Thailand's GDP fell from over 30 percent in the 1970s to around 10 percent in the 1990s reflecting both the country's wider economic base, and the global decline in agricultural prices. However, these figures omit the contribution of agriculture through agribusiness, agro-industry, and social support such as rural employment and even environmental management. In terms of the Human Development Index which considers life expectancy, education and GDP, Thailand ranks as 52 against its neighbours' rankings of; Myanmar 133, Lao-PDR 138, Cambodia 148, Malaysia 53, and for example, Indonesia 102.²

Agriculture is important to Thailand, and Thai agriculture is important to the world. It can be briefly characterised in the following terms:

- As the world's largest rice exporter, and high ranking exporter of other food stuffs, Thailand feeds³ some four times its population; that is something around 250 million people.
- As the world's largest rubber producer and exporter, Thailand supports global industries particularly in more developed countries, and influences rubber marketing policies.
- As the world's largest producer and exporter of Black Tiger Prawn, Thailand dominates one of the few agricultural sectors which continues to experience rising prices.
- One Thai multi-national group, Charoen Pokaphand, has grown to become the region's largest agribusiness conglomerate, ranking in the world's ten largest such firms.
- Thailand is the region's largest exporter of chicken meat and heavily influences the Japanese market.
- An estimated 80 percent of Thai persons are engaged in agriculture and its industries.
- Overwhelmingly, the managers of the natural environment of Thailand are farmers and fishers.
- The national identity has developed around symbols of agricultural bounty

¹ World Bank (1999b)

² Alpha Research (1997)

³ FAO (1999)

consumed responsibly through images of abundant rice and fish in a benign environment.

- Irrigated rice production has symbolised an approach to sustainable production.
- Thailand has enjoyed foreign investment and relative political stability which has supported development of an infrastructure oriented to agricultural production for export.
- Over-production of fish, timber, and agricultural commodities has recently degraded the natural environment in which the majority of the population live, necessitating informed adaptation of agricultural practices to meet social and environmental needs.

Thailand's top five trade surplus products in recent years have been; natural rubber products, crustaceans and seafood, cereals particularly rice, garments, and canned fish. The top five trade deficit products in 1996 were; mineral fuel, mechanical equipment, vehicles and parts, iron and steel, and electrical equipment. Countries with which Thailand maintains large trade surplus have been; Singapore, Hong Kong, the Netherlands, and the USA; trade deficits have been with Japan, Germany, Taiwan, and South Korea. Non-agricultural manufacturing industry has relied mainly on inexpensive labour and attractive foreign investment conditions, contributing less to the economy than official statistics may suggest.⁴

Thailand is one of the world's seven major agricultural exporters which separates it from its neighbours and allows an interpretation of; its economic responses to world and regional events, cultural associations with agriculture and rice in particular, and the types of manufacturing industry which underpin further industrial development. However, agriculture has declined in economic importance worldwide, and agricultural commodity prices indicate a long term trend of decline. In terms of share of gross world product, agriculture has fallen from around 90 percent at the end of the eighteenth century to around eight percent at the end of the twentieth century. The relationship between decline in contribution of agriculture to a country's economy and its economic growth has spawned a view that agriculture should be of declining importance if the country is to develop. This view may be wrong in many cases, especially for Thailand.

⁴ Alpha Research (1997)

Table 1.1 *Export Values of Major Thai Agricultural Products (million baht)*⁵

	1990	1992	1994	1996	1998
Crops	90,894	109,082	114,622	152,595	186,344
Rice	27,770	36,214	39,187	50,735	86,806
Maize	4,130	510	544	279	622
Cassava Pellet	20,257	24,100	12,159	12,359	11,456
Cassava Flour	2,862	3,382	4,320	4,584	5,213
Other Tapioca Products	1,346	2,131	2,294	3,707	5,464
Rubber	23,557	28,925	41,824	63,373	55,413
Fishery Products	33,047	49,288	68,353	63,972	90,047
Shrimp	20,865	32,154	49,847	43,978	58,807
Cuttlefish, Squids	6,230	7,123	7,926	7,671	12,811
Livestock	8,896	12,566	13,031	14,092	28,096
Poultry	7,718	11,128	31,704	12,457	25,293
Agro-Industrial Products	73,521	91,325	107,465	142,030	202,642
Prepared Airtight Fish, etc	24,762	28,809	37,083	40,461	76,454
Cane Sugar, Molasses	18,831	20,057	18,311	34,058	28,057
Prepared Airtight Fruits	9,699	13,995	12,840	15,059	15,453
Canned Pineapple	5,524	8,274	6,608	6,510	6,925
Pineapple Juices	1,592	2,007	1,681	2,988	2,445
Vegetable Canned	2,650	3,460	3,878	5,126	6,353

Agricultural exports rely on domestically produced raw materials, and while now less than manufactures, involve a larger proportion of the economy by virtue of their employment capability, net export value, and lifestyle support. Table 1.1 indicates the relative contributions of major Thai agricultural exports, and the benefit of the 40 percent currency devaluation of 1997 on agricultural export earnings.

Agriculture is the main natural resource export sector, and in terms of providing the livelihood of the populace is overwhelmingly the most important sector. It is the most international sector of the Thai economy⁶ and contains the elements of continued comparative advantage in broad social and economic terms, and probably most environmental terms for a country of its population density.

⁵ Poapongsakorn, Nipon (1999)

⁶ Siamwalla, Ammar., Setboonsarng, Suthad., and Patmasiriwat, Direk. (1989)

With a population of around 65 million people, Thailand's population density of 120 people per square kilometre compares with a global figure of 45; other low-middle income countries average 25, and the East Asia and Pacific region averages 114. Itself an indicator of the high agricultural productivity of the country rather than over-population, Thailand's relative wealth is also clear in terms of a Purchasing Power Parity GDP average of some \$5,840 per capita, compared to 4,080 and 3,400 for other low-middle income countries and the region respectively.⁷

Thailand maintains a high proportion of arable land compared to other lower-middle income countries, and the East Asia and Pacific region, resulting in deforested areas increasing at the equal second highest level with Paraguay after first-ranking Malaysia.⁸ Social development in terms of infant mortalities improved from 73 per 100 live births in 1970 to only 33 by 1997, by which time 89 percent of the total population had access to safe drinking water.⁹

Such a significant agricultural nation has emerged from specific human and natural resources. Thailand can therefore be considered in terms of its natural environment, its modified agricultural environment, and its people and their development of an agricultural nation. The golden cradle of this civilisation includes the essential ingredients of a sustainable agriculture, which have been apparently abundant natural resources of land and water, and a favourable climate.

The Land of the Thai

Located between 5°40' and 20°30' North latitude and 97°70' and 105°45' East longitude with a total area of some 513,112 square kilometres (approximately 320,697,000 rai), Thailand borders Lao-PDR to the north and east, Myanmar to the north and west, Cambodia to the southeast, and Malaysia to the south. It has some 2,614 kilometres of coastline and a maximum length north to south of some 1,620 kilometres.¹⁰

⁷ World Bank (1999)

⁸ World Bank (1999)

⁹ World Bank (1999)

¹⁰ Arbhahharama, Anat. et al (1987)

The country's natural assets are defined by the Central Cordillera, the Annam Cordillera and the Arakam Yoma, three mountain ranges which are linked in geotectonic terms to the mountains of the Tibetan Plateau. These ranges have affected soil types, continue to affect rainfall, and determine the major drainage patterns which in turn create the agricultural environment.

Administratively, the country is often divided into four regions plus Bangkok, although a six way physiographic division provides a more convenient basis for some discussions.¹¹ The six divisions are the Central Plain, Southeast Coast, Northeast Plateau, Central Highlands, North and West Continental Highlands, and Peninsula Thailand as indicated in Figure 1.1. The Central Plain is the large alluvial delta of the Chaophraya system comprising quaternary alluvial deposits which exceed 300 meters in depth. The Southeast coast is comprised of quaternary terraces predominantly of marine origin interspersed with alluvial deposits and also contains a minor volcanic plateau. The Northeast plateau comprises wide river terraces of the Mekong River and tributaries and is commonly separated into low, middle and high terraces, the latter of which has largely disappeared. The Central Highlands is a complex region comprising hills plateaux, peneplains, and valleys across altitudes of 300 to 1,200 meters.

The north and west Continental Highlands is commonly separated into the western mountains of the Central Cordillera, and the northern hills and valleys which is a series of north-south mountains and plateau interspersed with long flat river basins. Peninsular Thailand comprises several distinct mountain ranges and low hills and undulating terraces of fluvial origin.

¹¹ Moormann, F.R. and Rojanasoonthon, S. (1968)

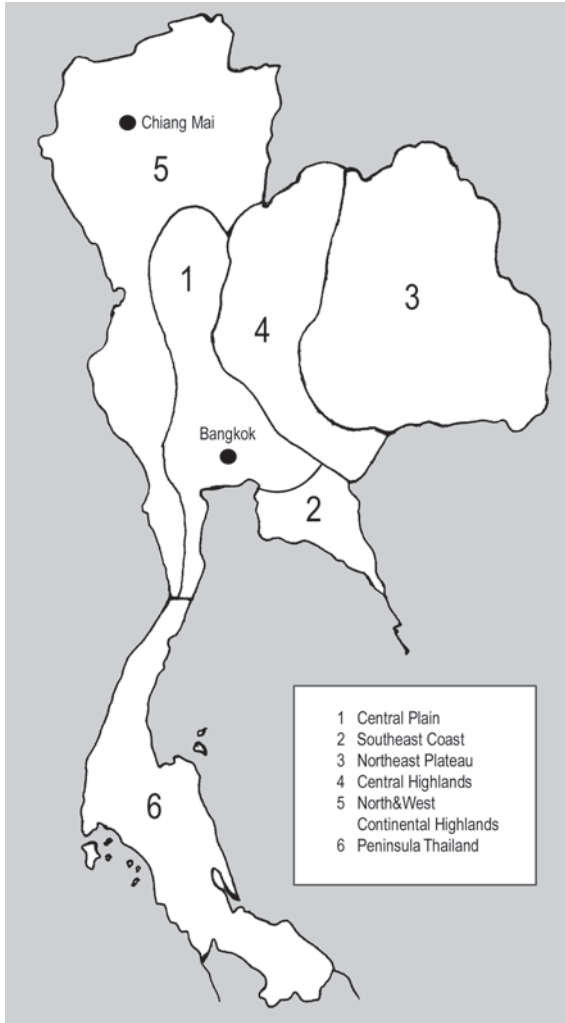


Figure 1.1 Six Physiographic Divisions of Thailand¹²

¹² Moormann, F.R. and Rojanasoonthon, S. (1968)

Soils

Landforms of Thailand can be divided into; beach and dune formations, low and high alluvial terraces, dissected erosion surfaces, hills and mountains, and depressions¹³ in a system which builds on the Pendleton Provisional Map of Soils and Surface Rocks of Siam of 1935. Detailed land capability maps which began to emerge in the 1960s¹⁴ have usually divided Thailand into areas suited to both paddy and upland crops, upland crops, and areas not generally suited for cultivation. While useful definitions in the past, changing demands, environmental impacts of large scale developments, and a rising focus on forestry in both agricultural and conservation areas now requires more manipulable information.

The general soil map of Thailand presents ten general soil categories (Table 1.2) containing 38 groups. The proportions of agricultural land suited to various crops have been suggested as; upland crops 21 percent, paddy rice 26 percent, perennial crops five percent, special crops with appropriate soil enhancement measures 16 percent, with the remaining 31 percent being classified

Table 1.2 *Soils in Thailand*¹⁵

Soil Type	Square Kilometres	Million Rai	Percent
Entisols	16,860	10.5	3.3
Vertisols	4,156	2.6	0.8
Inceptisols	48,253	30.2	9.4
Mollisols	6,003	3.8	1.2
Spodosols	615	0.4	0.1
Alfisols	4,6991	29.4	9.2
Ultisols	21,6192	135.1	42.1
Oxisols	153	0.1	< 0.1
Histosols	718	0.4	0.1
Unclassified	173,174	108.2	33.8
Total	513,115	320.7	100

¹³ Scholten, J. and Siriphant, Chamlong. (1973)

¹⁴ FAO (1972a)

¹⁵ Land Development Department (1972)

as unsuitable for agriculture. The lack of congruence of these areas with current land use reflects population, political, and commercial pressures, and also indicates areas of environmental concern. With changes in agricultural technology and population, a gradual shift from mono-cropping of rice has occurred. For example, in 1960, 60 percent of the cultivated area was under rice, 12 percent under upland crops, and 16 percent under tree crops of which forest cover represented some 60 percent. By 1993, the area cultivated for upland crops had quadrupled representing 26 percent of cultivated land at the expense of forest land.

Water Resources

More than landforms, water has conspicuously shaped the Thai culture. The Salween and the Mekong Rivers which largely define Thailand's land borders, originate in the broad region influenced by the frozen Himalayan reservoirs where ten of the world's great river systems originate within a radius of 200 kilometres. Cultural associations with water include; religious affiliations across this region, migration of Tai people along river valleys to what is now Thailand, and the development of food production systems which assume ready availability of water.¹⁶

The Chaophraya River, wholly within Thailand, is fed by the Ping, Wang, Yom, and Nan Rivers which drain the northern highlands, and the Pa Sak River which drains the Phetchabun mountains. Around 33 percent of the Kingdom is drained by this complex, the deposition of silt from which has extended the river mouth south into the Gulf of Thailand. Siltation has reduced the functionality of various cities across Thai history, from Lopburi to Ayutthaya to Bangkok, while providing extensive lands suited to agriculture with once surplus surface water resources (Table 1.3).

In the twentieth century, the Chaophraya, and to a lesser extent the Kwae Yai and the Kwae Noi Rivers in the Mae Klong basin of the west and the Mun and Chi Rivers of the Northeast, have been viewed as irrigation, hydro-electricity and/or domestic and industrial consumption resources. The creation of dams on major rivers has significantly modified the environment, as has associated agricultural change.

¹⁶ Jumsai, Sumet. (1997)

Table 1.3 *Surface Water Resources of Thailand (million cubic metres)*¹⁷

Region	River	Reservoir	Natural Storage	Rainfall volume
Northeast	26558	6231	193	236400
North	23175	48723	34	220500
Central	29720	18781	156	76700
East	3747	333	-	91000
South	6795	6708	53000	169700
Total	89995	80775	436	794300

Underground water varies according to local hydrological conditions in the northern highlands. Alluvial and older terrace deposits yield viable and apparently sustainable sources of water, while the alluvium aquifers of the Central Plain and the Khorat aquifer of the Northeast yield salty water except from the upper aquifer which lies under highly populated areas. A 450 x 22 kilometre plain south of Nakhon Si Thammarat in the South yields viable levels of water. The eastern provinces, even in the alluvial and terrace deposits, have the least groundwater potential of the Kingdom.

Notwithstanding the significance of irrigation, rivers and underground water resources, the major water resource for agriculture continues to be rainfall.

Climate

Thailand's monsoonal climate is experienced as three seasons; a hot season from approximately March to May, a rainy season from approximately May to the end of October, and a sometimes less distinct cool season from approximately November through February. The two climatic classifications commonly applied to Thailand are; Tropical Rainforest, and Tropical Savanna. The rainy season is more protracted along the southeastern coast of Peninsula Thailand where average annual rainfall commonly exceeds 2,000 mm and reaches up to 4,000 mm in some areas. The majority of Thailand experiences average annual rainfalls between 1,100 and 1,500 mm, with the lowest rainfall commonly recorded in the Western Continental Highland rain shadow where average annual rainfall is less than 1,100 mm. Rainfall is influenced by monsoons, cyclones, and convection from all directions except the protected northwest.

¹⁷ Kiravanich, Pakit (1983)

Temperature variations between seasons are mainly small. Cool season temperatures in January range from around 26°C to 28°C for most of the Kingdom. During the hot season, April temperatures range from 28°C to 32°C. Altitude reduces minimum temperatures in the highlands in the North and Northeast rarely to near 0°C, while in southern Thailand variations are the lowest, between 26°C and 30°C all year.

Weather variations in Thailand attract speculation, as elsewhere. Current knowledge can only suggest that these are a result of:

- inter-annual variations in which climate varies between years and which is most commonly depicted to the public in terms of droughts, floods, and temperature changes
- decade-scale climate variations in rainfall and temperatures
- long-term changes which may have 200 year or other cycles.

Green House Gas effects remain difficult to detect among these natural variations.¹⁸ Anthropogenic environmental changes in Thailand are clearer in terms of forest and soil losses which affect native habitats as part of a continuous modification of the natural environment.

Other Natural Resources

The flora, fauna, and people of the Kingdom form part of the natural resource base. The natural fauna is linked, to a large extent, to the natural environment being preserved which, in this era relates predominantly to conservation of remaining forest resources. The wide ecological diversity of the Kingdom includes more than 170 endangered animal fauna species.¹⁹ Forests are less than 50 percent evergreen, which includes tropical evergreen forest that is the most bio-diverse. Other evergreen forest types comprise typical evergreen, coniferous, and mangrove forests which are believed to provide habitat for some 40 endangered fauna species, 20 of which are found exclusively in such forests. Deciduous forests which occupy the drier, inland, and steep slopes include mixed deciduous and dry *Dipterocarpus* species, and particularly in the past, have included large teak (*Tectona grandis*) dominant forests.²⁰

¹⁸ Falvey, L. (1996)

¹⁹ MIDAS (1991)

²⁰ Sadoff (1992)

However, it is the resource of humans that has created a sophisticated agriculture. From a population within what is now Thailand of around four million in 1700, growing to some six million towards the end of the 1900's, today's some 61 million has both been created by, and created a challenge for, Thai agriculture. Individual small-holdings necessitated by high rural populations allows for intensive cultivation and attention to crops which can, for example, maximise the effectiveness of chemicals used in agriculture. However, balanced against this are lower levels of education, higher levels of monetary poverty, and entrenched ideas about agriculture of both rural dwellers engaged in agriculture and the powerful urban elite.

For a society grounded in agriculture, its art, culture, and tradition reflect associations with the soil. Just as a broad view of Thai art is necessary to understand this axiom through, for example, considering more than temple art derived from an Indian city and jungle based religion,²¹ so a broad view of agriculture and the environment is necessary to understand the special characteristics of Thai agriculture. Thus an appreciation of Thai agriculture requires consideration of historical, political, scientific, social, environmental, and economic changes.

Regional Origins

Thai agriculture originated in what is now China, which supported several distinct types of agriculture and appears to have the oldest of all agricultures as Vavilov first suggested.²² The agriculture of the Tai people, who probably originated in what is now China, is but one of these. The rice agriculture of Thailand built on that of the Tai and borrowed from other neighbouring and indigenous forms of agriculture. While millet was an adaptable upland crop and a staple in early Asian civilisations, its production by shifting cultivation utilising a pointed planting stick did not allow development of large population concentrations. Rice usurped millet as the preferred cereal for dominant cultures by its adaptability to agriculture which produced cities and states across Asia, where eventually more than 90 percent of the world's rice would be produced.

²¹ Gordon, A.C. (1998)

²² Bray, F. (1989)

Rice seed could be broadcasted into wet areas and with minimal labour produce a viable crop. Over time, variations in yields were reduced by bunds which initially impeded natural drainage, and domesticated buffalo which puddled soil to reduce water infiltration. Buffalo were subsequently utilised in ploughing, and their supplementary benefit of fertilising the fields while performing work provides an early glimpse of the integrated nature of rice cultivation. By about the eighth century, a wet rice production system including fish and coconuts seemed to be preferred across suitable areas of Southeast Asia, with taro, yam, sago, and vegetables maintained as standby reserves.

Control of water and land was essential to the development of this agriculture, aspects of which appear to emerge with the Tai ethnic group.²³ However, such Tai innovations were not introduced into a technological vacuum; rather they blended with technologies of earlier regional powers, in particular the Mon-Khmer, and independent agriculturists. The latter may have retained elements of the prehistoric agriculture of Ban Chiang in the Northeast, where domestication of pigs, cattle, chickens, and rice may have occurred some 4000 years ago.²⁴ The advance from a hunting and gathering economy to agriculture was the first step in intensification of food production; a later step in intensification which became the hallmark of civilised societies, occurred from the Ayuthaya period.

Intensification

Agricultural intensification has usually been associated with large scale irrigation, low levels of labour productivity, and severe population pressure.²⁵ However, in the case of early Thailand, the human population does not seem to have been sufficiently large to place any significant pressure on its fortuitously productive land and efficient farming systems. Even in recent times up to the 1960s, the majority of Thai farmers in irrigated areas elected to produce only one rice crop per year. Central Thailand populations during the Dvaravati and Lopburi periods, while high by contemporary regional standards, appear to have produced a surplus of food.²⁶ This historical export capacity provides a clue to understanding Thai

²³ Hall, K.R. (1992)

²⁴ Wyatt, D. (1984)

²⁵ Boserup, E. (1965)

²⁶ Bronson, B. (1989)

agriculture today.

A culture of adequacy of food production continues to pervade Thai decision making concerning agriculture and its development. The ability to expand agricultural production without a large decrease in the output per unit of labour, and a cultural attitude to share community tasks, has allowed Thai agriculture to largely escape a widespread association of agricultural labour with drudgery. It also ensured integration of the very persons who fed the nation with cultural activities. Off-season and part-time farmers of early Thai Kingdoms were valued craftsmen. Production of one's family needs for food could be a first priority with surplus to meet community, tax, religious or other obligations, or one's spare time could be allocated to cultural and other pursuits. These characteristic links between culture and agriculture remain evident in the role of food and its presentation within Thai culture, and possibly provide some understanding for slow acceptance of some labour and capital intensive agriculture.

Even in, or perhaps resulting from, this agricultural Eden, the impacts of war, variable seasons, and periodic social decline have been evident through the centuries. The first publication about Thai agriculture in a western language records drought, famine, green water, and poisoned fish in the early 1700s, which was the beginning of the agricultural export economy.²⁷

Thailand has increased its food production through the usual means of:

- increasing the area of cultivated land
- increasing the yield per hectare
- increasing the number of crops per year
- replacing lower yielding with higher yielding crops and varieties
- reducing post harvest losses.

Modern, as ancient, developments in Thai agriculture have been associated with irrigation. Expected returns from rice have been used to justify large irrigation investments this century, and domestic rice prices have been manipulated to reflect these intentions, notwithstanding the influence of the less easily controlled export price. However, the early selection of superior sites for development of irrigation facilities may also be seen in terms of aristocrats gaining

²⁷ Turpin, F.H. (1771)

control of land which would benefit from slow implementation of an intricate and far reaching irrigation plan developed on behalf of King Chulalongkorn by van der Heide (1904).²⁸ In retrospect, one could suggest that Thailand's irrigation has been implemented in a piecemeal fashion, often long after demand for the water was established, and as having been relegated a less important role than industrial and communication infrastructure.

Industrialisation

Increased agricultural production resulting from population increase and irrigation provided surplus wealth for national economic development. Agriculture shrank in relative terms while growing and funding growth in other sectors. In 1960 and 1970 the sector of agriculture, forestry, hunting, and fishing engaged 82 percent and 79 percent of the active population respectively.²⁹ Between 1970 and 1990, the growth of the agricultural sector was approximately four percent per annum compared with 8.5 percent and 7.3 percent for the industrial and service sectors respectively. The continued growth of the agricultural economy albeit at a slower rate than other sectors continues as an essential underpinning of the economy of agriculture, as is particularly evident in periods of large scale correction in the industrial and service sectors, such as during the 1990s. If social factors are ignored, agriculture's fall from the largest sector to only 14 percent of the 1981 economy in value added terms compared to manufacturing's rise to 22 percent, appears to indicate decreased reliance on agriculture.³⁰ By 1993, the agricultural sector represented about one third of total exports by value, and more than 38 percent of land use within the Kingdom - 60 percent of which was paddy rice production, 23 percent field crops, and nine percent fruit and perennial crops.³¹

The rising contribution of manufacturing industries was observed rather than caused by economic planners, incidentally leading to poor agricultural policies in the late 1970s and early 1980s. Subsequently, maize export was liberalised in 1982, the centuries'-old rice export taxes were removed in 1986, and taxes on rubber were reduced, while cassava and sugar continued to be protected. Restrictive

²⁸ Siamwalla, Ammar. (c.1986)

²⁹ Donner, W. (1978)

³⁰ Siamwalla, Ammar., et al (1992)

³¹ Chomchalow, N. (1993)

regulations for licensing, cross-province transport, and slaughterhouse ownership continued to stifle livestock development through this period. Liberalisation was interpreted as an emerging economic maturity and allowed more open communication in international trade and development.³²

Critically, the era of policy shifts away from agriculture towards industry was associated with rising agricultural impact on the environment. Thailand ranked ahead of Myanmar, Indonesia, the Philippines, Korea and Japan in terms of; increases in cultivated area, reductions in forest area, increases in agricultural production, increases in the percentage of the labour force engaged in agriculture, and variability of agricultural production. Increases in irrigated area, in the use of tractors, and fertilisers were exceeded by some neighbours. Of particular interest, is the mere maintenance of paddy and cereal yields in Thailand compared to all of the other countries.³³ The potential for further production increases from Thai agriculture through water management, efficient fertiliser usage, and mechanisation have remained technologically achievable goals since that time. The difference between Thailand and its neighbours, and most countries of the world, remains its significant contribution to global food production from a less environmentally stressful form of agriculture.

Notwithstanding an emphasis on industrialisation, agriculture contributed around 50 percent of Thai exports from 1980 through 1985, with the absolute value of these agricultural exports increasing from some 73 to 95 billion baht. Major contributions from employment which reduced the cost of social services, and from export income which repaid foreign development debt, were not publicly reported as of special significance. Underestimation of such benefits from agriculture parallel the underestimation of benefits from forests in watershed management, habitat preservation, and general environmental improvement³⁴ where social and natural resource economic analyses have yet to be applied. For a major agricultural country such as Thailand, consideration of the social and environmental benefits of agriculture is probably more important than it is to the majority of the world's countries engaged in such industrialisation comparisons.

³² Siamwalla, Ammar. (c.1986)

³³ World Bank (1983a)

³⁴ Arbhahirama, Anat. (1987)

National and Global Responsibilities

Agriculture has created Thailand and continues to shape the Thai identity, support Thai lifestyles, and portray the Kingdom to the world. The very association between food and rice in the Thai language, and the tenacity with which Thai farmers have clung to planting at least enough rice for their own family before engaging in cash crops, testify to the deep association of wet rice culture and the peoples who are Thai.³⁵ Lapses from this central element have been highlighted by His Majesty the King *Thailand derives income from many sources but we must remember that we survive from agriculture and therefore we must nurture each aspect of the industry including farmers of all types to continually develop in order to increase the quality of production in a manner that does not reduce the natural resource base*³⁶

Modern agriculture is the main form of terrestrial natural resource management, meeting rising food demands as it impacts on the environment in a manner which we are only beginning to understand. Historically, an essential foundation of civilisation, the world's six billion people could not today survive without productive agriculture. Humans could move from an exhausted to a new site until recently, as our behaviour continues to reflect. Now agricultural technologies are increasingly assessed against their ability to continually produce the required output while maintaining the underpinning natural resource base.³⁷ Practically, this is interpreted as optimising production and its sustainability within the controlled agricultural environment, as distinct from the original natural environment which has largely disappeared.³⁸ Unfortunately food production to meet global demands, or even Thailand's current debt and lifestyle demands, is not yet possible from low input systems alone; nevertheless, co-existing self-sufficient and commercial agricultural systems may be the best future approach for Thailand.

World population shows an exponential rise, which should decline as birth rates fall with rising levels of health and affluence. However, under the best

³⁵ Silcock, T.H. (1970)

³⁶ Chantalakhana, Charan. (1999)

³⁷ Wilken, G.C. (1991)

³⁸ Hillel, D.J. (1991)

scenario, population continues to rise through most of our lifetimes. The Green Revolution of the late 1960s and early 1970s enabled Asia in particular, to feed itself; new varieties of rice with doubled yields covered 33 percent of rice areas, and maize yields quadrupled.³⁹ Feeding that global population of 3.7 billion, twice that of fifty years earlier, was thus accomplished. By 1990, 1.5 billion more people were being fed, and economic progress was evident, particularly in Southeast and East Asia. Such rising affluence increased demand for food per person and of special foods often produced with lower resource-use efficiencies. Total food production requirements therefore rose further, causing greater environmental pressures in a country such as Thailand which relies on food exports for national wealth. With such environmental pressure, and the frequent prospect of famine in many nations of Africa and Asia,⁴⁰ Thailand faces the dilemma of feeding fellow human beings as a good global citizen while preserving its underlying resource base.

Modern agriculture has preserved the maximum possible space for nature and wildlife through its high efficiency of production on productive land.⁴¹ The areas of land saved by the introduction of modern cereal varieties to China, calculated from expected yield increases without modern varieties compared to actual use, indicate wide-scale protection of sensitive land. In this way, agricultural research forms part of natural resource management research; it also highlights the anachronistic position of Thailand in effectively subsidising food importing countries though low agricultural prices and uncoded environmental impacts. Thailand is faced with the options of:

- continuing to subsidise the development of other nations for minimal benefit
- reducing exports, and hence income, where environmental conflicts are clear
- rationalising investments; in research to ensure responsible agricultural practise, in education to ensure a widespread ability to apply improved technologies, in industry to build on national strengths in agriculture.

As an efficient major agricultural exporter in a price environment that neither reflects social nor environmental costs of production, Thailand assists the

³⁹ Gutmang, G.(1995)

⁴⁰ Orr, D W (1992)

⁴¹ Bourlaug, N. (1995)

world to meet higher ends. Global responsibilities must balance management of the natural resource environment with the ambitious declaration of the World Food Conference that (by 1984!) ... *no child will go to bed hungry, that no family will fear for its next day's bread and that no human being's future and capacity be stunted by malnutrition* ... Subsequent famines in Africa, South Asia, and elsewhere are now understood in political and exploitation terms which echo reconsideration of policies which reduce the rights of any citizens to produce their own food.⁴² In the case of Thailand, a rising association of agricultural production with poverty suggests disenfranchisement of the many in the population who have contributed to the national well-being and global demands.

Current Situation

From a land fortunate in its natural resources, and the infusion of rice into the culture of the peoples who have created Thailand, sustaining the resource base for agriculture is a new challenge. Modern Thai agriculture embodies new technologies which have built on traditional technologies developed over its 5,000 year rice farming history.⁴³ However, the harmony between culture,⁴⁴ economy, history, and religion which agriculture provided, was noted as failing even in the 1970s.⁴⁴ Historical governance approaches were beginning to show their weaknesses in a new economic system.

Thailand has met economic demands from export income which traditionally relied on expansion of the agricultural area and moderate intensification. Modern mechanisation and chemical pesticides and fertilisers in association with large scale irrigation facilities have allowed regularity of agricultural production for export. Other simultaneous changes in Thai society have created apparent labour shortages and oriented agriculture to a global system.⁴⁵ The current agricultural situation derives particularly from such developments of the past three decades.

Five characteristics arising from developments of the past 30 years, are:

- An orientation to export markets with domestic prices in the main being strongly

⁴² Sen, A. (1982)

⁴³ Sriwatanapongse, Sutat. (1997)

⁴⁴ Donner, W. (1978)

⁴⁵ Kunstadter, P. (1989b)

influenced by international prices - some 77 percent of the value-added in crop agriculture arises in the production of traded goods.

- Expansion of the crop sector in the past has been mainly based on conversion of forest land to cultivated area - availability of such new land is extremely limited and hence increases in production must arise from increases in yield.
- Rice, once the epitome of Thai agriculture, has been progressively replaced by field crops including maize, kenaf, cassava, and sugar cane - from 1961 to 1985, the area cultivated for field crops expanded 3.3 percent per annum compared with 1.8 percent for rice.
- Governmental involvement in the agricultural sector includes regulation of foreign trade, taxation, exchange rates, and trade restrictions, and also public resources for infrastructure and support services for agriculture.
- Institutional changes, such as the emergence of large food processing agribusiness, have affected farming systems, for example in the pineapple, tobacco, and some livestock and vegetable industries - tractor costs have reduced through the development of secondary industry, biotechnology has accelerated the production of new crop varieties, and usage of fertiliser, pesticides and herbicides has increased significantly.⁴⁶

Having largely achieved the 1930s' political objective of stability and global respect, at least partly through following the common approach of natural resource exploitation, Thailand has reached a barrier. Apparently locked into the need for high levels of agricultural exports to repay international debts of other sectors, a higher intensity of production using Green Revolution technologies seems inevitable. One benefit of the late adopter in this case is the luxury of learning from the experience of other countries. It is therefore critical that appropriate legislation and action following attitudinal changes reflect a commitment to, and knowledge of, environmental management. Shifts in policy may already be reflected in such mechanisms as the unique nationwide ban on logging⁴⁷ and rising agreement that land and water are no longer free or abundant resources.

Total land availability in 1985 was assessed at some 321 million rai (51.4 million ha) of which 136 million (21.8 million ha) was designated as national

⁴⁶ TDRI (1988)

⁴⁷ Sadoff, C.W. (1992)

forest reserves, 93 million rai (14.9 million ha) of which remained intact. Some 26 million rai (4.2 million ha) had been abandoned or was used only for grazing, and the cultivated area represented some 152 million rai (24.3 million ha) planted to rice, (84 million rai) upland crops (52 million rai), and perennial crops (70 million rai).⁴⁸ In addition to the limitations on land, the 1994 drought refocused attention on earlier advice that harvested water was declining in quantum while demands from agricultural, and in particular urban and industrial use, were increasing.⁴⁹

At the same time, FAO reported declining crop yields due to:

- physical, chemical and biological deterioration
- cultivation on steep sloping land without soil conservation practices
- inappropriate farming systems for increasingly intensive agriculture
- poorly defined land ownership with associated restrictions of access to fair credit
- a poorly developed farm credit sector
- poorly developed agricultural infrastructure
- irregular rainy seasons.⁵⁰

However, any analysis of the cropping sector requires a separate discussion of rice which can statistically dominate other trends. The average yield per rai of rice in the early 1980s was estimated to be approximately 300 kg per rai (1,875 kg per ha) which is about one third of that achieved in such countries as Japan, Taiwan and the USA. In contrast, yields of rubber have increased rapidly over the past 30 years from some 30 kilograms to more than 90 kilograms per rai (563 kg per ha), and similarly maize yields have been maintained or risen. Cassava, increasingly grown on marginal land with marginal economic returns, and possessing an ability to produce a yield under a wide range of environmental circumstances, shows a declining yield trend and remains indicative of poverty. Forestry, variously included or excluded in agricultural assessments as a function of its overriding harvest orientation, typifies the current paradigm shift concerning agriculture and the environment.

With a decline in the official forest reserves, which themselves are overestimates, an environmental and production focus is required, with cognisance

⁴⁸ Arbhahirama, Anat et. al. (1987)

⁴⁹ United Nations (1991)

⁵⁰ FAO (1984)

of its economic contribution through employment of some 130,000.⁵¹ A strategy for sustainable extraction of forest products should help preserve the forest areas which are recorded as; tropical evergreen - 42 million rai (6.7 million ha), mixed deciduous - 21 million rai (3.4 million ha), dry *Dipterocarp* - 30 million rai (4.8 million ha), mangrove - 1.7 million rai (0.3 million ha), pine - 1.3 million rai (0.2 million ha) and scrub - 0.5 million rai (0.08 million ha). Timber plantations and agroforestry which meet continuing strong demand for timber products within the domestic market will also be required. An overlap with perennial fruit trees, even in steep mountainous areas, now links forestry to horticulture.

In a manner similar to Thai lowland and upland agriculture, the shifting cultivators of the highlands have exceeded the limits of sustainability as a result of population pressure. These Thai shifting cultivators have long practiced cyclical field rotation,⁵² in some cases in conjunction with small-scale irrigated agriculture in narrow valley floors. Future highland agriculture, notwithstanding its special social and political issues, is likely to emphasise perennial fruit crops, and to borrow from Chinese experience.

Government leadership is paramount in such a country, yet its influence on agricultural practices is limited to incentives which must compete with those of market prices. Apparent influence through water allocation in the central Chaophraya system is constrained by political pressure, and policy initiatives directed via field extension officers are typically of short term impact, due to officers' competing responsibilities and frequent changes in policy.⁵³ Now globally oriented, Thai agriculture requires a global policy perspective in more than fiscal terms; agriculturally-linked poverty requires enlightened social policy, and international political influence depends on sound environmental practice.

At the cross roads, Thai agriculture includes forestry and comprises the majority of land managers whose own relative poverty may necessitate their taking a short term focus on cash, and in some cases, food production. The current situation of Thai agriculture varies markedly from its traditional role in ensuring abundant food from a bounteous environment. The late 1990s financial crisis

⁵¹ RFD (1982)

⁵² Kunstadter, P. et al (1978)

⁵³ TDRI (1998)

provided an opportunity to reconsider social and environmental policies relating to agriculture and rural development in a bifurcated production environment with self-sufficient and commercial agriculture coexisting.

Policy responses to environmental degradation from over-extraction of resources, unregulated resource use, and privileged access to resource exploitation, have been political bargaining points rather than attempts at, for example, full cost resource pricing. The Office of Environmental Policy and Planning is developing new economic instruments to improve sector management,⁵⁴ which may benefit from consideration of an emerging revival of traditional practices and Buddhist teachings.⁵⁵

The current situation for Thai agriculture derives from traditional practices and integration with global production. Traditions which allowed the transition from river valley agriculture to one of the world's important agricultural centres can be traced through the history of Tai and other ethnic groups as they absorbed new technologies and cultures in creating the Thai nation.

Ingredients of Thai Agriculture

Thai agriculture has been an amalgam of the cultures absorbed into the Thai nationality. Prehistorical agriculture of Thailand matches other ancient dates, and was most probably absorbed into the agriculture which had evolved in the Mon-Khmer culture by the time migrating Tai peoples added their unique technologies. Each borrowed from the cultures with whom they came in contact through religion, trade, and later, colonial interests. From the eulogised Sukhothai agriculture and institutions to the politically successful Ayutthaya and Ratanakosin period, Thai agriculture has introduced new technologies from innovation, migration, and adaptation. Some of the civilisations which have contributed to its agriculture are indicated through the periods commonly termed:

- Ban Chiang c.3600 BC - 300
- Funan 1-600
- Chenla 300-800

⁵⁴ Kaosaard, Mingsarn. and Pednekar, S.S. (1996)

⁵⁵ Wasi, Prawase (1988)

- Dvaravati 1-1300
- Khmer 700-1500
- Sukhothai 1240-1351
- Lanna 1200-1600
- Lang Xang 1300-1800
- Ayutthaya 1351-1767
- Ratanakosin 1767 to current⁵⁶

The adoption of new technologies, both separately and as part of cultural assimilation over the centuries, is treated in more detail in subsequent chapters. Perhaps the most easily understood aspect in modern terms relates to the large scale expansion of agriculture in central Thailand surrounding Ayutthaya during and after that city's dominance. Through the Ayutthaya period, rice was exported regularly to Malacca, Europe, and China,⁵⁷ as were aloe, camphor, and beetle nut among other commodities. While the opening of new agricultural land is usually seen as the basis of expansion, the development of water control technologies for the vast Chaophraya delta required innovative adaptation of current technologies. Irrigation-based, and recently rain-fed land expansion, particularly between 1850 and 1980 when some 150 million rai (24 million ha) of new land was cleared and settled in some five million farm holdings, allowed the rural population to expand from a few hundreds of thousand to around 40 million. By the late 1800s, rice had displaced forest produce as the major export, and continued to grow until around 1950. Peasants were encouraged to clear new areas and farm them with minimal initial interference from the Crown. Escaping colonial domination through this period, Thailand relied on Chinese and European middlemen and traders linked to a self-contained peasant agriculture.

As the peasant based farming system of the 1800s produced a viable if small exportable surplus, a few Chinese traders were entrusted as commission tax agents (tax farmers) on behalf of the Crown in remote areas, while the aristocracy controlled lands in accessible areas. However, seeking more revenue and control over the wealthy aristocracy, the Crown expanded taxation of the agrarian frontier

⁵⁶ Rogers, P. (1996)

⁵⁷ Yuthavong, Yongyuth and Wojcik, A.M. (1997)

economy⁵⁸ which incidentally institutionalised a selective taxing of agriculture which persisted until the 1980s.

From time immemorial, the peoples of what is today known as Thailand have been self-sufficient in food production. Current account imbalances have always been eased, even through the 1990s, by the economic underpinning provided by agriculture. When export revenues decline with prices, Thailand has been able to limit its import of other products, unlike most other countries. The history of Thailand can be interpreted in terms of immigration, assimilation, political management, and gaining control of the agrarian base in terms of producers and its produce to ensure a consistent ability to export agricultural products. Against this backdrop, the subsequent chapters consider the origins of Thai agriculture, its unique aspects, and its global role. To begin the historical discussion of the agriculture in the area now known as Thailand, the next chapter discusses its inhabitants over the centuries and the possible linkages between food production and environmental respect.

Summary

Key points pertinent to Thai agriculture which may be elicited from this introduction include:

- The fertile and well watered area which eventually became Thailand through innovative technological, social, and political management contains unique elements associated with diverse ethnic origins unified through wet rice culture developed north of Thailand, which have allowed rising exports for at least five hundred years from expansion of agricultural land, intensification of cultivation, and diversification.
- One of few major agricultural exporters, Thailand now leads the world in rice, rubber, and Black Tiger Prawn production and export, is the region's largest exporter of chicken meat, and through these and other exports, feeds more than four times its population from an agriculture less intensive than that of most of its neighbours.
- As important as agriculture is to the export income of Thailand, it is as the employer of 80 percent of the population that it is critical, and the increased

⁵⁸ Phongpaichit, Pasuk. and Baker, C. (1997)

impoverishment of marginal farmers represents a continuing challenge to Thai policy makers which is linked to domestic and international concerns for improved environmental regulation.