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AN ECONOMIC ANALYSIS OF THE COCKLE CULTURE INDUSTRY IN THAILAND

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by

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Abstract of the thesis presented to the Senate of Universiti Pertanian Malaysia in partial fulfilment of the requirements for the degree of Master of Science.

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Faculty : Economics and Management

This study provides a comparison of the economic performance and the socio-economic profile of cockle farmers of different farm sizes and locations in Thailand. The areas selected for the study are the northern and southern part of the Gulf of Thailand and the Andaman Sea region. Three different farm sizes, small (1-10 rai), medium (11-50 rai) and large (over 50 rai) farms are studied.

Analysis of the socio-economic profile of the cockle farmers reveals that most farmers are 30 to 50 years old, and operate their farms as a family enterprise with their own fund. Majority of them have had only primary education, but they have very long experiences in cockle culture.

Cost and return analysis indicate that cockle culture is a profitable vocation with the small farms being the most profitable. In terms of location, farms in the northern part of the Gulf of Thailand are the most profitable. The rate of return to investment of the larger farm is higher than the smaller ones.

Estimation of the cost function reveals that cost economies is at farm production level of 625 mt. But the average cockle output of the sample farm is 312 mt, or only 50 percent of the optimum output.

Based on the findings, it is found that to increase cockle production from the small and medium size farms is possible since all of them are at present not yet operated at the minimum efficient scale of production. The production per unit area could be increased by reducing the mortality rate and utilizing more seed in cultivation.

To ensure the constant supply of low cost of cockle seed to farmers, the Government would need to enforce all necessary administrative measures to conserve the natural seed bed and to negotiate with neighbouring countries such as Malaysia for additional supply of seeds to farmers.

Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia sabagai memenuhi sebahagian daripada keperluan bagi penganugerahan ijazah Master Sains.

ANALISIS EKONOMI INDUSTRI PENTERNAKAN KERANG DI THAILAND

Oleh

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Kajian ini adalah perbandingan prestasi dan latar belakang sosioekonomi penternak kerang bagi saiz ladang dan kawasan yang berbeza di Thailand. Kawasan yang dipilih untuk kajian adalah kawasan Teluk Utara, Teluk Selatan dan kawasan laut Andaman. Tiga saiz ladang yang dikaji adalah kecil, 1-10 rai, sederhana, 11-50 rai, dan besar, lebih dari 50 rai.

Analisis sosioekonomi penternak menunjukkan kebanyakan mereka berumur antara 30 hingga 50 tahun dan mengusahakan ternakan secara keluarga dengan sumber kewangan sendiri. Walaupun kebanyakan mereka mempunyai pelajaran rendah mereka juga mempunyai pengalaman yang banyak di dalam penternakan kerang.

Analisis kos dan pulangan menunjukkan penternakan kerang adalah menguntungkan dengan ladang dari saiz kecil mendapat keuntungan terbesar. Dari segi lokasi, ladang di Teluk Utara Thailand mendapat keuntungan tertinggi. Kadar pulangan pelaburan adalah sangat tinggi bagi ladang saiz besar.

Anggaran fungsi kos menunjukkan ekonomi bidangan berlaku sehingga saiz output mencapai 625 mt. Di dalam operasi sebenar purata output kerang dari ladang kajian adalah 312 mt. Ini bermakna hanya 50 peratus dari output optima dihasilkan.

Berdasarkan temuan kajian ini penternak kecil dan sederhana masih boleh menambah keluaran mereka kerana semua ladang-ladang kecil dan sederhana tidak mencapai pengeluaran bidangan yang minimum. Kajian ini juga menyatakan pengeluaran kerang setiap unit kawasan boleh ditingkatkan melalui pengurangan kadar mortaliti dan menambah benih kerang. Untuk mempastikan pembekalan benih kerang murah yang berterusan pihak kerajaan perlulah menguatkuasakan semua tindakan pentadbiran untuk mengekalkan tapak benih asal dan berbincang dengan negara jiran seperti Malaysia untuk mendapatkan benih tambahan.

CHAPTER I

INTRODUCTION

General Background

Mollusc (shellfish)[1] is an aquatic animal which is of economic importance to the fisheries sector of Thailand. In 1986, mollusc production accounted for 6.5% of the total annual fishery production, contributed about 2% of the total value of fishery production (Table 1). Although its quantity and value are relatively low in relation to the total fisheries output, it remains a suitable economic activity for the small-scale fishermen. Mollusc production requires low initial capital investment and the culture method is simple and traditional which farmers could take it as a part-time job to earn an additional family income. Mollusc has shown a good export potentials, hence, it could be another major foreign exchange earner (Rientrirat, 1984).

There are three major species of mollusc cultured in Thailand namely, cockle (*Anadara granosa*); oyster (*Crassostres* commercialis and *C.lugubris*); and green mussel (*Perna viridis*).

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[1] The major mollusc species in Southeast Asia namely; carpet shell or short necked clam or baby clam (*Paphia undulata*); cockle (*Anadara granosa*); green mussel (*Perna viridis*); horse mussel (*Modiolus senhausenii*); oyster (*Crassostrea* commercialis).

Table 1

Quantity and Value of Fisheries Production of Thailand by Species group in 1986

Item	Quantity (tons)	Value (1,000 Baht)[a]
Total	2,539,967	22,888,000
Sub-total: Marine Fisheries	2,352,204	18,883,117
Fishes	1,798,930	8,947,152
Shrimps	141,174	5,188,804
Crabs	35,606	906,455
Squid & Cuttle Fish	134,915	3,344,469
Molluscs	164,323	454,008
Others[b]	77,256	42,229
Sub-total: Freshwater Fisheries	187,763	4,004,900
Fishes	175,266	N.A.[c]
Shrimps	8,499	N.A.
Others[d]	3,998	N.A.

[a] One US$ = 26 Baht in 1985-86, and 25 Baht in 1989
[b] Include jelly fishes, turtle eggs, seaweeds and sea cucumber
[c] N.A. = Not available
[d] Include frog and turtles
Source: Department of Fisheries, Bangkok, Thailand.

In 1987, the cockle culture dominated in term of cultivated area while oyster culture on number of farms (Table 2). Table 3 shows culture production accounted for approximately 16% of the total mollusc production. The contribution of the cultivated species to the total annual production differ from species to species; i.e. cockles contribute 82%; oyster contribute 59%; green mussels contribute 51% and horse mussels contribute only 5%.

Table 2

Number of Farm and Area of Mollusc Culture by Species,1980-1987

Species	1980		1981		1982		1983		1984		1985		1986		1987	
	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)
Total	2,223	19,180	2,207	15,555	2,455	16,512	2,562	19,290	2,530	18,284	2,494	21,454	2,372	20,069	2,354	20,707
Blood cockle	52	7,842	132	6,173	94	7,006	104	9,585	148	9,205	146	11,944	173	9,930	164	10,409
Green mussel	238	5,081	216	2,768	345	2,455	426	2,426	406	2,284	412	2,627	330	3,114	279	3,067
Oysters	1,666	5,299	1,704	5,894	1,864	6,331	1,895	6,653	1,841	6,173	1,875	6,053	1,817	6,218	1,859	6,424
Horse mussel	262	564	150	326	147	326	133	294	131	290	56	564	47	541	47	541
Pearl shell	5	394	5	394	5	394	4	332	4	332	5	266	5	266	5	266

One rai = 0.16 hectare

Source: Department of Fisheries, Bangkok, Thailand

Table 3

Mollusc

unit = mt

Species	1980	1981	1982	1983	1984	1985	1986	1987
CAPTURE								
Blood cockles	5,517	14,492	4,916	9,480	4,048	7,552	3,665	2,170
Green mussels	31,386[a]	36,746[a]	49,419	24,414	36,009	35,113	20,647	22,834
Oysters	700	839	2,127	1,861	880	1,725	859	1,049
Horse mussels	5,636	17,224	32,381	12,582	12,673	7,584	8,134	14,877
Short - necked clams	35,131	62,220	38,859	31,813	50,507	83,726	101,232	131,230
Others	2,848	4,970	5,579	5,581	4,290	5,665	10,911	9,415
Total	81,218	136,491	133,281	85,741	108,407	141,365	145,448	181,575
CULTURE								
Blood cockles	12,149	8,862	3,720	7,095	12,512	12,375	6,928	9,609
Green mussels	N.A.	N.A.	16,090	18,716	26,217	25,906	11,095	23,949
Oysters	5,315	7,590	3,544	3,461	4,851	3,516	580	1,483
Horse mussels	3,429	1,338	538	569	1,608	361	272	818
Totel	20,893[b]	17,790[b]	23,892	29,841	45,188	42,158	18,875	35,859
GRAND TOTAL	102,111	154,281	157,173	115,582	153,595	183,523	164,323	217,434

[a] include capture and culture
[b] green mussels can not availlable
N.A. = not available

Source: Department of Fisheries, Bangkok, Thailand

The mollusc fishery in Thailand is fairly well established both in the capture and culture sectors. It is, however, the present production connot meet the domestic demand for consumption. So, it has to import. The annual production of mollusc had shown a steady increase with an average annual growth of over 14% from 1980 to 1987 (Table 3). Table 4 shows the balance of import and export of mollusc that the balances have been net gained since 1983, valued 74 million baht[1], 269 million baht and 194 million baht in 1983, 1985 and 1986 respectively.

The government through the Fisheries Department has been well aware of the necessity to develop cockle culture. During the past 11 years, 23 major research have been conducted. Research has resulted in the improvements of seed stock in suitable beds and the transplantation to create the natural beds. Hatchery techinque is still on the development process due to the high cost of seed production. The government has also supported the small scale fishermen in coastal villages through extension services. The training courses on cockle culture for the farmers and government officials are also conducted[2]

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[1] 25 baht = US$ 1

[2] Details on various government activities pertaining to aquaculture are reported in Brohmanonda (1985), Thailand (1985 and 1987), and Thanomkiat (1986).

Table 4

Balance of Imports and Exports of Molluscs, 1980 - 1986

Year	Imports		Exports		Net Imports/Exports
	Quantity (mt)	Value (1000 baht)	Quantity (mt)	Value (1000 baht)	Value (1000 baht)
1980	22961	85835	123	4502	-81333
1981	25823	98433	183	6256	-92177
1982	19985	79090	387	12142	-66948
1983	13753	54557	2784	129436	+74879
1984	N.A.	N.A.	N.A.	N.A.	N.A.
1985	12732	56035	8978	325874	+269839
1986	22414	92433	9310	286730	+194297

One US$ = 26 baht in 1985-86, and 25 baht in 1989
N.A. = Not available
Source: Department of Fisheries, Bangkok, Thailand

The Cockle Culture Industry in Thailand : An Overview

Cockle Culture Background

It is believed that cockle culture in Thailand have been started about 100 years ago in Phetchaburi province, the northern part of the Gulf of Thailand. During that period, the size of the farm was about 5 to 10 rai[1] (Tookwinas, 1983). The seed was collected from the wild within the vicinity of the culture bed. Such practices had been continued until

[1] One rai = 0.16 hectare

1972, when the cockle beds were no longer suitable for cockle production due to the pollution. Cockle production decreased and subsequently could not met the domestic demand. Thus, in 1973 cockle seed was imported from Malaysia to cultivate in Satul province, along the coast of the Andaman sea. The culture beds were expanded up to 900 rai per farm for commercial operations and using the same culture method as in Malaysia (Tookwinas, 1983). As the cockle culture could make a vary high return of about 5 to 10 times (Tookwinas, 1983), cockle farming then spread rapidly throughout the southern part of the Gulf of Thailand and the Andaman Sea coast such as Trang, Ranong, Nakhon Si Thammarat and Surat Thani province. However, the major problem still persisted within the commercial farms. This related to the gradual deterioration of culture beds after 5-6 years in operation that the growth rate would finally decreases while the mortality rate would increased. Tookwinas (1983) reported that this problem was caused by the hardening of the bottom surface which resulted from the deposition of small size cockle left over after continuous harvesting practices.

Cultivation of Cockle

During 1981 to 1987, cockle culture area fluctuated from year to year. Table 5 shows that culture area increased from 6,173 rai in 1981 to the maximun of 11,944 rai in 1985 then fluctuated around 10,000 rai thereafter. These cultivated areas

Table. 5

Number of Farm and Area of Blood Cockle Culture by Province, 1981 - 1987

Province	1981		1982		1983		1984		1985		1986		1987	
	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)	Farms	Area (rai)
Total	132	6,173	94	7,006	104	9,585	148	9,205	146	11,944	173	9,930	164	10,409
Samut Song Khram	14	400	29	834	32	607	39	665	43	730	49	741	24	447
Phetchaburi	9	137	9	136	46	472	84	730	80	633	104	686	125	1,579
Surat Thani	2	2,425	2	2,425	2	2,725	1	2,425	1	2,425	2	2,725	2	2,725
Nakhon Si Thammarat	1	234	1	234	1	234	1	234	3	1,634	3	1,634	1	800
Satun	2	1,163	4	1,763	7	2,953	6	2,542	4	1,980	6	1,448	6	2,432
Trang	1	1,341	1	1,341	2	100	2	100	2	100	2	100	-	-
Ranong	2	223	1	23	2	223	3	238	2	215	2	215	3	295
Phangnga	101	250	47	250	10	1,586	10	1,586	7	1,350	2	250	-	-
Phuket	-	-	-	-	1	200	1	200	2	2,031	2	2,031	2	2,031
Krabi	-	-	-	-	1	485	1	485	2	841	-	-	-	-
Pattani	-	-	-	-	-	-	-	-	-	-	1	100	1	100

One rai = 0.16 hectare

Source: Department of Fisheries, Bangkok, Thailand

were established both along the Gulf of Thailand and the Andaman Sea. The average size of farm was 74.70 rai, while the largest size was 2,425 rai and the smallest size was one rai. Cockle culture along the northern part of the Gulf of Thailand, Samut Song Kharm and Phetchaburi province were small scale operation with average farm size of 12.69 rai. The southern part of the Gulf of Thailand from Chumphon to Narathiwat province (Figure 1) and on the Andaman Sea coast, the cockle culture were mostly commercial operation with the average farm size of 647.50 rai for the southern part of the Gulf of Thailand and 344.15 rai for the Andaman Sea coast, respectively (Thailand, 1987).

In small scale farm operation, farmers surround the grow-out area with bamboo strips, 50 cm in height, to indicate the farm boundary and to retain the cockles within the cultivated ares. Commercial farms are constructed differently from the others. Fences are made of mangrove stakes. These stakes are also served as points for observing density of small cockle in the farm and also as a mark point during harvesting. Farmers build a watch-house in the production area and hired a full-time guard to watch the poaching and other fishing activities such as trawling and push netting that would intrude into the farms which would kill the newly set cockle seeds.

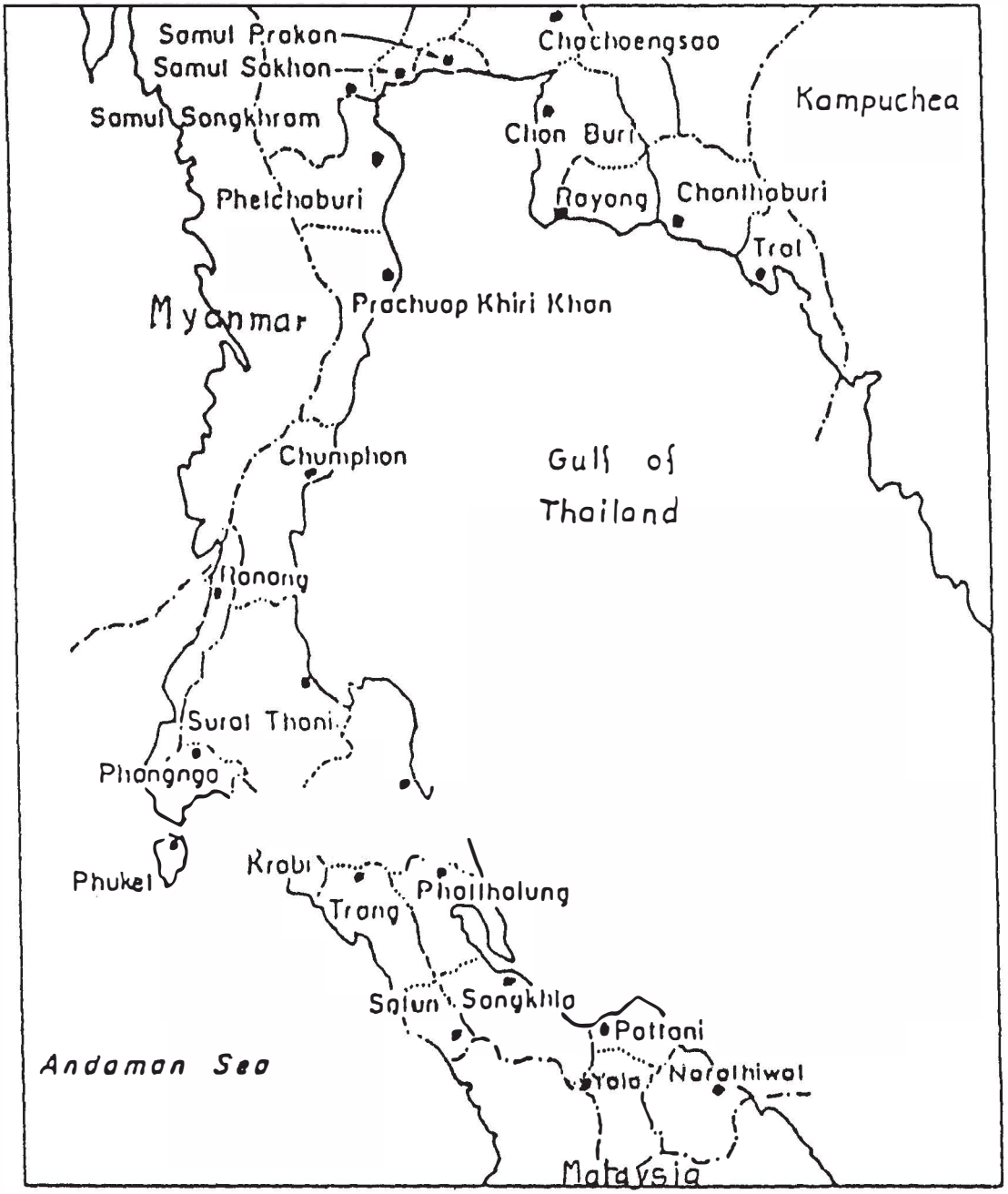

Figure 1 Map Showing 23 Coastal Provinces of Thailand