



**UNIVERSITI PUTRA MALAYSIA**

**AN ECONOMIC ANALYSIS OF GIANT FRESHWATER PRAWN  
POND CULTURE IN THAILAND**

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AN ECONOMIC ANALYSIS OF GIANT FRESHWATER PRAWN  
POND CULTURE IN THAILAND

by  
Piti Kantangkul

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requirements for the degree of Master of Science  
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Productivity of Giant Freshwater Prawn (GFWP) pond culture in Thailand is considered to be relatively low compared to its potential productivity which leads to high per unit cost of production. One measure by which productivity and profit can be raised is to make an adjustment of resource use in cases where the resources are used inefficiently. If the resources use are price efficient, another way to raise their productivity is to increase their technical efficiency. This study explores the issue of relative economic efficiency (technical coupled with price efficiency) among small, medium, and large farms; between farms with and without juveniles nursery practices (JNP and non-JNP); and between farms facing diseases and/or water pollution (DWP) and farms facing none (non-DWP) within the framework of



normalized restricted profit function. This was accomplished by statistically testing various hypotheses from the joint estimation of the normalized restricted profit function and four factor share equations. Further, production elasticities, output supply and input demands elasticities were subsequently derived from these estimators. The normalized restricted profit was specified as a function of four normalized prices of variable inputs (juveniles, feeds, labour and fuel), two quantities of fixed inputs (farm asset and pond area), experience and four dummy variables to categorise the three different farm sizes, two juveniles practices (JNP and non-JNP farms) and two natural conditions (DWP and non-DWP farms).

The results of this study indicate that the variable inputs use in GFWP pond culture was price efficient and constant returns to scale existed in this type of farming. Medium farms were found to attain the highest economic efficiency followed by small and large farms while JNP and non-DWP farms obtained higher economic efficiency than those non-JNP and DWP farms. The existence of differences in economic efficiency among groups of farms was due to their differences in technical efficiency.

The productivity and profit of GFWP pond culture can be increased through improving the technical efficiency of this farming. It is recommended that operating GFWP pond culture within medium scale farming with juveniles nursery together with proper water management, disease prevention and treatment should be encouraged.



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ANALISIS EKONOMI PENGELUARAN UDANG

GALAH AIR TAWAR DI THAILAND

oleh

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Produktiviti Udang Galah air tawar (GFWP) yang di ternak dalam kolam di Thailand dikatakan adalah lebih rendah secara relatif jika dibandingkan dengan potensi produktiviti yang membawa kepada kos pengeluaran yang lebih bagi setiap unit. Satu cara untuk menambahkan produktiviti dan keuntungan ialah untuk menyesuaikan penggunaan-penggunaan sumber-sumber di mana sumber-sumber itu tidak digunakan secara cekap. Sekiranya sumber kewangan digunakan dengan cekap, cara lain untuk meningkatkan produktiviti ialah untuk meningkatkan kecekapan dari segi teknikal. Kajian ini cuba mengkaji isu kecekapan ekonomi relatif (teknikal dan narga) di kalangan ladang-ladang yang kecil, sederhana dan besar di antara ladang-ladang yg mempunyai 'juveniles nursery practices' (JNP) dan tidak mempunyai 'JNP' dan



di antara ladang-ladang yang menghadapi penyakit dan/atau pencemaran air dan ladang-ladang yang tidak menghadapi keadaan ini, di dalam rangka kerja 'normalized restricted profit function'. Ini telah didapati dengan menjalankan ujian-ujian statistik ke atas berbagai hipotesis daripada kaitan di antara anggaran 'normalized restricted profit function' dan empat 'factor share equations'. Seterusnya, keanjalan pengeluaran, penawaran output dan 'keanjalan permintaan 'input' telah didapati dari anggaran-anggaran ini. Keuntungan 'normalized restricted' telah ditentukan sebagai satu fungsi kepada empat 'normalized prices' input-input pembolehubah ('juveniles', makanan, tenaga buruh dan kuasa), 2 kuantiti input yang ditetapkan (kawasan ladang dan kawasan kolam), pengalaman dan empat pembolehubah 'dummy' untuk meng kategorikan 3 saiz ladang yg berlainan, 2 'juveniles practices'(JNP and non-JNP farms) dan 2 keadaan semulajadi (ladang-ladang yang menghadapi penyakit dan pencemaran air dan ladang-ladang yang tidak menghadapi keadaan ini).

Keputusan kajian ini telah menunjukkan bahawa pembolehubah-pembolehubah input yang telah digunakan dalam penternakan GFWP adalah berkecekapan 'price efficiency' yang mempunyai 'constant returns' kepada skala yg memang sedia ada dalam perladangan ini. Ladang-ladang yang bersaiz sederhana didapati mempunyai kecekapan ekonomi yang paling tinggi diikuti oleh ladang-ladang kecil dan besar sementara ladang-ladang 'JNP' dan 'non-DWP' mendapat kecekapan ekonomi yang lebih tinggi daripada ladang-ladang 'non-JNP' dan 'DWP'. Keadaan kecekapan ekonomi yang berbeza-beza di



kalangan kumpulan-kumpulan ladang ialah kerana perbezaan kecekapan teknikal yang wujud.

Kadar pengeluaran dan keuntungan penternakan GFWP ini dapat dipertingkatkan lagi melalui memperbaiki lagi kecekapan teknikal dalam perladangan ini. Adalah disarankan yang operasi penternakan GFWP yang di jalankan pada tahap sederhana, mempunyai 'juveniles nursery' dan pengurusan pengairan yang sempurna serta pencegahan dan rawatan penyakit sepatutnya digalakan.

## CHAPTER 1

### INTRODUCTION

#### 1.1 THE FISHERY SECTOR OF THAILAND

The economy of Thailand is primarily agriculture based. The real gross domestic product (GDP) from agriculture has increased from 62.8 billion baht in 1975 to 85.90 billion baht in 1984<sup>1</sup>. The agricultural sector has provided employment to 18.25 million people which accounted for about 62 per cent of the total labour force in 1984. Further, it has generated 112.62 billion baht foreign exchange earnings or accounted for 64.3 per cent of total export value in 1984.

The fishery sub-sector plays an important role in the economy of Thailand and daily life of the Thai people. From 1980 to 1984, fishery products contributed a small share of about 8.2 per cent to the real agricultural GDP. However, it provides significantly to employment and income for the people in rural areas. Fishery products represent a principal source of animal protein (third important staple food after rice and vegetable) for the Thai people. From 1977 to 1982, per capita consumption of fishery products ranged between 13-23 kilograms with an average of 16.1 kilograms. Besides domestic consumption, Thailand

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1

One US\$ = 20 baht in 1975, 22 baht in 1983 and 26 baht in 1985.



also exports fishery products and the export value has increased significantly at an annual rate of 17.9 per cent from 1.55 billion baht in 1974 to about 15.08 billion baht in 1984.

Fishery products of Thailand are from inland as well as marine and coastal fishery. They are either captured or cultured. The average annual fishery production during the period of 1981-1984 was about 2.1 million tons worthing more than 18 billion baht. Marine and coastal fish contributed a large proportion of the production, that is, more than 90 per cent of total quantity and 75 per cent of the total value. The remaining 10 per cent of the production was from inland fishery worthing 25 per cent of the total value of production (see Table 1.1).

Table 1.2 shows the production of fishery products from culture and capture. The total catch from marine capture fishery declined from 1.93 million tons in 1977 to 1.58 million tons in 1980. Major causes of such decline are: (a) the limits of fish stock within the Gulf of Thailand coupled with rapid increase in the number and capacity of fishing fleets thus resulting in overfishing; (b) ineffective rules and regulations implemented by the Government of Thailand to curb overfishing; (c) reduction in fishing grounds of about 300,000 square kilometers<sup>2</sup> due to the extension of 200 miles economic zone by neighbouring countries (Rientrairut, 1983); and (d) increase in fishing costs as a result of the increase in prices of fuel and labour.

<sup>2</sup> There was a loss of 400,000 to 600,000 tons of annual catch due to the extension of 200 miles economic zone (Rientrairut, 1983).

TABLE 1.1  
 QUANTITY AND VALUE OF ANNUAL FISHERIES PRODUCTION  
 OF THAILAND, 1960-1984

Year	Marine and Coastal		Inland		Total	
	Quantity ( <sup>'000</sup> tons)	Value (100 mill. baht)	Quantity ( <sup>'000</sup> tons)	Value (100 mill. baht)	Quantity ( <sup>'000</sup> tons)	Value (100 mill. baht)
1950-1960	147.59	N.A.	57.52	N.A.	205.11	N.A.
1961	233.28	N.A.	72.33	N.A.	305.61	N.A.
1962	269.71	N.A.	70.08	N.A.	339.79	N.A.
1963	323.37	N.A.	95.31	N.A.	418.68	N.A.
1964	494.20	N.A.	82.79	N.A.	576.99	N.A.
1965	529.48	N.A.	85.64	N.A.	615.12	N.A.
1966	635.16	N.A.	85.12	N.A.	720.28	N.A.
1967	762.19	N.A.	85.25	N.A.	847.44	N.A.
1968	1,004.06	N.A.	85.24	N.A.	1,089.30	N.A.
1969	1,179.59	N.A.	90.44	N.A.	1,270.03	N.A.
1970	1,335.69	40.97	112.71	9.06	1,448.40	50.03
1971	1,470.29	45.54	116.79	9.74	1,587.08	55.28
1972	1,548.16	49.36	131.38	13.71	1,679.54	63.07
1973	1,538.02	65.62	140.88	16.47	1,678.90	82.09
1974	1,351.59	40.93	158.88	18.90	1,510.47	59.83
1975	1,394.61	51.02	160.69	20.92	1,555.30	71.94
1976	1,551.79	59.69	147.29	21.52	1,609.09	81.21
1977	2,067.53	86.22	122.37	20.38	2,189.91	106.60
1978	1,957.79	114.59	141.49	23.69	2,099.28	138.28
1979	1,813.16	113.19	133.17	26.85	1,946.33	140.04
1980	1,647.95	105.07	145.00	35.60	1,792.95	140.67
1981	1,824.44	132.13	164.58	39.20	1,898.02	171.34
1982	1,986.57	142.46	133.56	46.85	2,120.13	189.31
1983	2,099.98	152.36	155.45	40.02	2,255.43	192.38
1984	1,973.02	145.41	161.82	37.96	2,134.84	183.37

(Source: Adapted from Annual Fisheries Statistics, Department of Fisheries, Bangkok, Thailand)

N.A. = Not available

TABLE 1.2

## FISHERIES PRODUCTION OF THAILAND FROM CULTURE AND CAPTURE, 1975-1984

Year	Culture			Capture			% of Production from Culture
	Coastal ( '000 tons)	Inland ( '000 tons)	Total ( '000 tons)	Marine ( '000 tons)	Inland ( '000 tons)	Total ( '000 tons)	
1975	90.79	29.84	120.63	1,303.82	130.85	1,434.67	7.8
1976	162.51	32.36	194.87	1,389.28	114.94	1,504.22	11.5
1977	133.27	33.14	166.41	1,934.27	89.23	2,023.50	7.6
1978	108.02	39.37	147.39	1,849.77	102.12	1,951.89	7.0
1979	100.57	29.46	130.03	1,712.59	103.71	1,786.30	6.7
1980	66.27	34.51	100.78	1,581.68	110.49	1,692.17	5.6
1981	100.67	48.02	148.69	1,723.77	116.56	1,840.33	7.5
1982	125.58	45.83	171.41	1,860.99	87.73	1,948.72	8.1
1983	121.04	46.97	168.01	1,978.94	108.48	2,087.42	7.4
1984	132.25	50.41	182.66	1,840.77	111.41	1,952.18	8.6
Average	114.97	38.99	153.09	1,717.59	107.55	1,825.14	7.7

(Source: Adapted from Fisheries Statistics, Department of Fisheries, Bangkok, Thailand)

Contrary to the decreasing trend in production, both the domestic and export demands for fishery products are increasing due to increases in population and income. In order to meet these increasing demands, the Government of Thailand has implemented several programmes to develop aquaculture since the third National Economic and Social Development Plan (1972-1976). This emphasis on aquaculture is due to the recognition by the Government of Thailand that aquaculture production process can be controlled and enhanced through proper use of inputs as opposed to fishery production from capture which depends solely on natural stocks and environment. In addition, the programmes attempt to utilize more fully the available natural resources of the country.

Thailand has plentiful natural water resources which can be utilized for coastal and inland aquacultural development. She has a long coastline of 2,600 km and inland water resources of about 370,000 hectares (Marr and Hongsakul, 1976). Table 1.2 shows that aquaculture production accounted for about 8 per cent of total fishery production during the period between 1975 to 1984. The production from aquaculture increased from 120,630 tons in 1975 to 182,660 tons in 1984. Average production from aquaculture during this period was 153,090 tons, of this, the average production from inland aquaculture accounted for about 25 per cent.

As shown in Table 1.3, the number of farms, culture area, production and value of inland aquaculture have increased during



TABLE 1.3  
 NUMBER OF FARMS, AREA, PRODUCTION AND VALUE OF  
 INLAND AQUACULTURE IN THAILAND, 1975-1984

Year	No. of Farms	Area Under Culture (1,000 Rai)	Production (tons)	1	
				Production Per Area (kg/Rai)	Value (Million Baht)
1975	24,095	144.35	29,835.5	206.7	297.00
1976	22,086	143.44	32,358.4	225.6	337.00
1977	23,427	147.59	33,141.4	224.5	415.75
1978	23,663	151.82	39,336.7	259.1	426.50
1979	25,280	152.89	29,461.7	192.7	236.25
1980	29,484	157.43	34,504.6	219.2	598.92
1981	31,676	163.69	48,023.1	293.4	1,006.04
1982	34,154	173.72	45,828.4	263.8	880.03
1983	35,751	233.73	46,966.4	200.9	1,005.58
1984	38,235	200.77	50,410.9	251.1	1,226.36

(Source: Annual Fisheries Statistics, Department of Fisheries,  
 Bangkok, Thailand)

1 Computed by dividing production with area under culture.