FINANCIAL ANALYSIS OF FRESHWATER PRAWN IN MIXED FARMS IN SELECTED PROVINCES OF THAILAND

by

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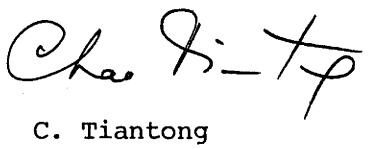
August, 1981

DECLARATION

Except where otherwise indicated, this sub-thesis is my own work.



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บทคัดย่อ

แนวความคิดริเริ่มในการทำวิทยานิพนธ์ฉบับนี้ ถือกำเนิดมาจากนโยบายของรัฐบาลไทยที่จะเร่งส่งเสริมการผลิตกุ้งก้ามกรามเพื่อสนองอุปสงค์ภายในประเทศ ส่งส่วนเกินของอุปสงค์ภายในประเทศเป็นสินค้าออกและช่วยเหลือเกษตรกรรายย่อยในการยกระดับมาตรฐานการครองชีพ แนวการศึกษาจึงมุ่งถึงปัจจัยต่างๆ ที่มีอิทธิพลต่อการตัดสินใจของเกษตรกรที่จะหันมาเริ่มเลี้ยงกุ้งก้ามกรามเป็นอาชีพ โดยพิจารณาจากแนวความคิดของเกษตรกรเอง

กำไรจากการผลิตกุ้งก้ามกรามควรจะเป็นสิ่งแรกที่เกษตรกรนำมาพิจารณาก่อนที่จะตัดสินใจเลี้ยง การศึกษาจึงเน้นหนักไปในการเปรียบเทียบผลกำไรจากกิจการเกษตร ๓ กิจการคือ การทำนา การปลูกมันสำปะหลัง และการเลี้ยงกุ้งก้ามกราม โดยการทำงบประมาณกิจการแต่ละกิจการของฟาร์มตัวอย่าง ๓๕ ฟาร์ม ใน ๓ จังหวัดของประเทศไทย วิเคราะห์หาต้นทุนและผลตอบแทนของแต่ละกิจการในขั้นต้น หลังจากนั้นได้ทำการวิเคราะห์ความอ่อนไหวของผลจากการวิเคราะห์ในขั้นแรก เพื่อศึกษาว่าผลกำไรในการผลิตกุ้งก้ามกรามจะถูกกระทบกระเทือนจากการที่ต้นทุนการผลิต ราคากุ้งที่เกษตรกรได้รับเปลี่ยนแปลงหรือจากการที่รัฐบาลงดการช่วยเหลือในด้านการสร้างบ่อเลี้ยงกุ้งอย่างไร นอกจากนี้ได้ทำการวิเคราะห์หาความสัมพันธ์แนวตรงระหว่างรายได้และต้นทุนผันแปรของกิจการการเกษตรทั้งสามเพื่อแสดงผลของการค้นพบในขั้นแรก

จากการศึกษาพบว่า กุ้งก้ามกรามให้ผลกำไรมากกว่ากิจการอื่นทั้งสองกิจการในทุกเขตพื้นที่ที่ทำการศึกษา ถึงกระนั้นก็ตาม มีเกษตรกรจำนวนน้อยที่รวมกิจการกุ้งไว้ในฟาร์ม สาเหตุที่คิดว่าจะเป็นไปได้อาจจะเกี่ยวกับข้อจำกัดต่างๆ เช่น พื้นที่ที่เหมาะสม การเข้าถึงแหล่งน้ำและงานส่งเสริมการเลี้ยงกุ้ง ทำให้ในบางพื้นที่ยังไม่มีการเลี้ยงกุ้งเลย นอกจากนี้ การขาดแคลนพันธุ์ลูกกุ้งและสินเชื่อน่าจะเป็นเหตุผลที่ทำให้เกษตรกรซึ่งเลี้ยงกุ้งอยู่ในปัจจุบันยังทำกิจการการเกษตรอื่นควบคู่ไปด้วยในอัตราส่วนพื้นที่ที่สูงกว่าการเลี้ยงกุ้งมาก

อย่างไรก็ตาม เกษตรกรเองอาจจะสมัครใจที่จะไม่เสี่ยงเลี้ยงกุ้งเป็นอาชีพ ปัญหาเกี่ยวกับการเสี่ยงได้ถูกนำมาพิจารณาโดยเฉพาะในแง่ที่ว่า หาก

การผลิตกุ้งล้มแหลวโดยสิ้นเชิง เกษตรกรจะประสบการสูญเสียอย่างไร ท่าทีของเกษตรกรต่อภาระหนี้สินและประเพณีได้นำมาพิจารณาด้วย และมีการอภิปรายข้อเสนอแนะในบทสรุปของวิทยานิพนธ์

ABSTRACT

This thesis was undertaken in the light of the Thai Government's policy of promoting the production of the giant freshwater prawns. It is primarily concerned with factors affecting the adoption of this aquatic animal and the problem is approached from the farmer's point of view. It is argued that profitability is an important determinant of whether farmers switch to prawns, and the profitability of prawns is compared to that of rice and cassava. Activity budgeting is used, and is based on detailed costs and returns of the three activities derived from a sample of farms in three provinces of Thailand. Sensitivity analysis was applied to the results in order to see whether prawn profitability was seriously affected by changes in prawn prices, costs of production, and the removal of a government subsidy on pond construction. Simple regressions showing the relationship between returns and variable inputs for the three crops were used to illustrate some of the findings.

The results show that prawns were much more profitable than the other crops in all locations yet the adoption rate for prawns is fairly low. Possible explanations for this are considered. The physical constraints of suitable land, access to water supplies and extension services are possible reasons why prawns have not been introduced in some areas. Moreover, a serious undersupply of prawn juveniles and the difficulties of obtaining adequate credit may partly explain why the farmers

who do grow prawns still grow other crops on a relatively high proportion of their land.

However, farmers may have voluntarily chosen not to grow prawns for reasons other than the physical constraints. The problem of risk and uncertainty is discussed especially in relation to the high cost of failure involved in prawn production. Attitudes toward debt and tradition are also considered. A number of recommendations for the government's policy of promoting prawns emerge and are discussed at the conclusion of the thesis.

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GLOSSARY

1 rai = 1,600 m^2
1 rai = 0.4 acre
1 rai = 0.16 ha
1 rai = 4 ngan
1 ngan = 400 m^2
1 ngan = 100 WA^2
1 WA = 2 m
1 WA^2 = 4 m^2

฿ = Baht
$ = US$
฿ 20 = $1
m. = million

RTG = Royal Thai Government
DOF = Department of Fisheries
OAE = Office of Agricultural Economics
MOAC = Ministry of Agriculture and Co-operatives

rice unless otherwise specified, means paddy

CHAPTER 1

INTRODUCTION

It has been widely recognized and accepted that development activities and efforts in developing countries must be directed to the improvement of the income, security and standard of living of small low-income farmers who generally represent the majority of the population. Means are being sought and developed to find activities which will make the best possible use of the resources presently available to small farmers so as to maximize their production of foodstuffs and other agricultural output both for household consumption and for sale on the market to provide cash income for their needs. It is also recognized that diversification of farming activities can lessen the negative effects from the economic insecurity that may result from the large price changes affecting many agricultural commodities especially where only one crop is grown. In addition, means are being sought to improve the quantity, nutritional quality and variety of small farmers' subsistence food production with particular attention to protein supplies.

1.1 Economic Problems in Thailand

Thailand, similar to other developing countries, is also seeking to improve the standard of living of its small farmers. Thai agriculture (excluding forestry) occupies an area of approximately 113.8 million rai (18.2 million hectares), representing about 35 per cent of total land area (321.25 million rai or 51.4 million

hectares). Current population is 46 million out of which 30 million (65 per cent) are engaged in agricultural production.

Thai farm households have been recognized as the poor majority whose average cash income in 1976 was 12,224 baht ($611) per annum. The farmers in the north eastern region are the poorest group among the four regions earning approximately ฿ 5,424 ($271) per agricultural households per year (THAILAND, OAE, 1979a).

Apart from the problems of farmers' poverty, the Royal Thai Government (RTG) has been faced with the problems of continued trade deficits. The Thai economy has been dependent on the exports of a small number of agricultural commodities such as rice, cassava, rubber, sugar, maize, shrimps and tobacco. Export prices of these agricultural commodities have been unstable due to the variability of agricultural production and the highly competitive nature of international commodity markets. At the same time, the trade deficit has worsened through the increasing prices of capital goods and energy. In 1971, the trade deficit was ฿ 9,513 m. ($476 m.) and by 1979 it had become ฿ 39,730 m. ($ 1,987 m.) (THAILAND, OAE, 1979b).

1.2 The Importance of Prawns in the Thai Economy

Prawns have traditionally been an important agricultural commodity to the Thai economy and the Thai people. Firstly, prawns have been an important agricultural export where ranking 7th by value after rice, cassava products, sugar, rubber, tin and maize. Prawn exports in 1978 amounted to ฿ 1,500 m. ($75 m.) out of a total value of agricultural export of ฿ 51,851 m.

Secondly, the prawn industry gives rise to other related industries which include:

(1) Ice producing industries in a number of provinces of Thailand to keep the prawns fresh after harvesting.

(2) Freezing and processing industries to process and freeze the prawns for export. This industry creates job opportunities for a large number of workers in processes involving chill-killing, cleaning, removing unwanted parts, shelling etc.

(3) Packaging and printing industries for packaging the product to the importing countries.

Thirdly, prawns are an agricultural commodity which can increase earnings for fishermen, prawn growers, marketing agents, processors and exporters due to their high price which in turn yields good incomes for those involved.

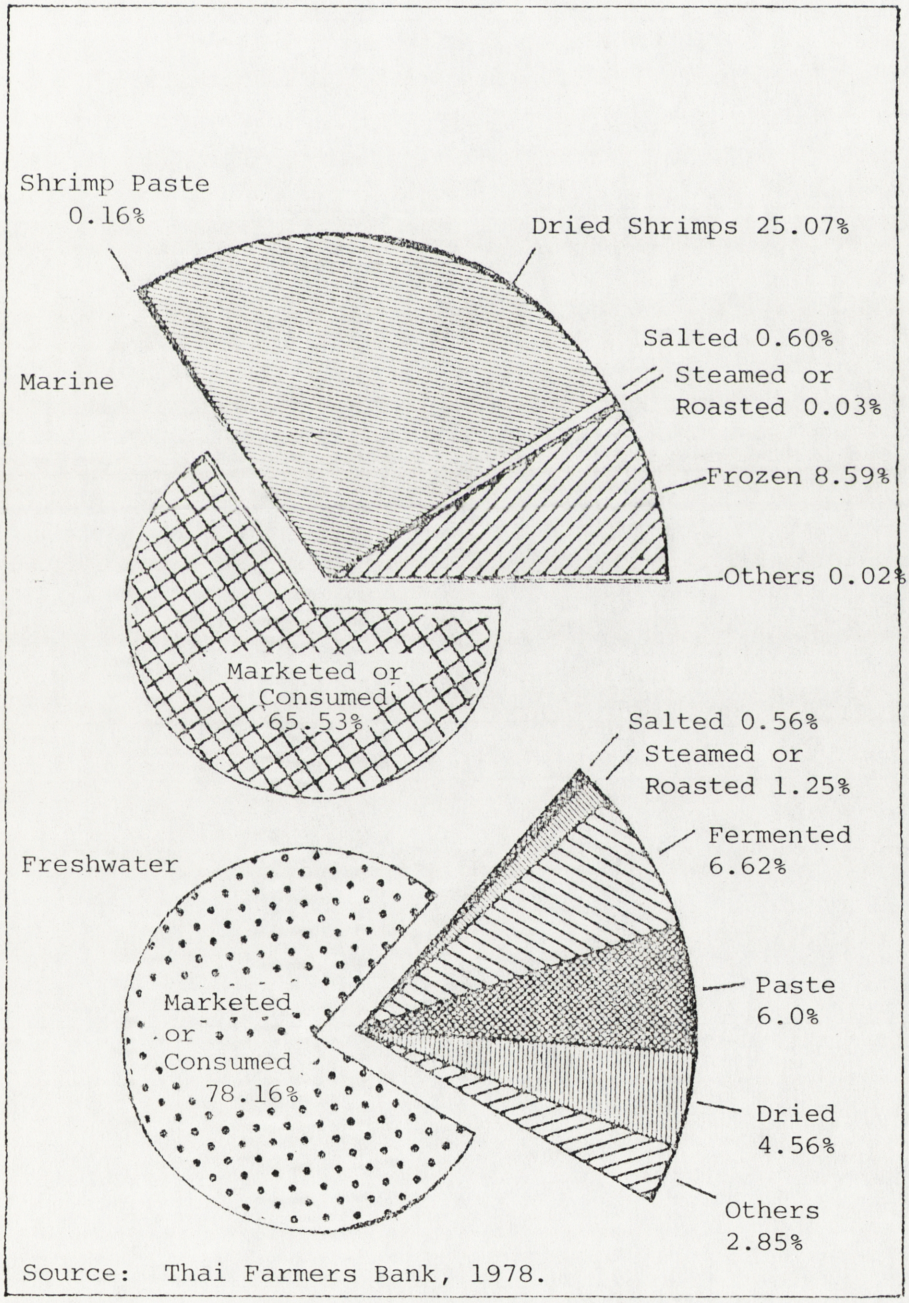
Fourthly, prawns are a good source of protein. Increased prawn production increases domestic food supply and, to the extent that they are eaten by prawn farming families, they are a beneficial addition to their diet.

Approximately 90 per cent of prawns (both marine and fresh-water) produced each year are consumed domestically. Large prawns are mostly consumed as restaurant dishes while smaller ones are consumed as home dishes. Small shrimps are generally converted to different products, such as shrimp paste, dried shrimps, salted

shrimps, steamed shrimps and fermented shrimps. A very small amount is cooked and sold as fried shrimps at different spots on the footpath in towns where a large number of people pass by. The traditional use of prawns in 1976 is illustrated in Figure 1.1.

FIGURE 1.1

TRADITIONAL USE OF PRAWNS IN 1976



Source: Thai Farmers Bank, 1978.

1.3 Government's Role in Promoting Prawn Culture

In view of both the farmers' poverty and the trade deficit the RTG has aimed at introducing farmers to new and more profitable farm activities which also have good export potential. The government considers both marine and freshwater prawn to have good prospects on both grounds.

A policy of promoting prawn production was first initiated by the RTG after the Third National Economic and Development Plan (1972-76). Marine prawn production was promoted in coastal areas. The types of prawn commonly grown were *Penaeus merguiensis* (White Shrimp), *Metapenaeus monoceros* (Pink Shrimp), *Penaeus monodon* (Jumbo, Brown Shrimp), *P. semisulcatus* (Green Tiger) and *P. latisulcatus* (King Shrimp). The freshwater prawn, *Macrobrachium rosenbergii*, was also harvested in many areas of the country. However, during this period (1972-76) there was very little pond production of prawns. In 1976, 94 per cent of the total prawn harvest consisted of marine prawns and almost 96 per cent of these were derived from deep sea fishing.

However, during the Fourth National Economic and Development Plan (1977-81), more emphasis has been placed on the expansion of freshwater prawn production in ponds. Marine fisheries have been considered less productive and requiring higher costs of production. Pollution and over fishing in the Gulf of Thailand has reduced the amount of marine prawn in the area. Thai fishermen have had to sail much further away from the country to obtain a sufficient amount of marine products. More expenditure is therefore required at each fishing trip. This trend has been intensified by the greatly increased price of the fuel used by the fishing boats.

A reduced emphasis on marine fisheries is also the result of the extension of the exclusive economic zones of neighbouring countries. The international economic zone has been narrowed and access to this zone is possible only at higher cost. Legal conflicts have been common. During the last three years, 116 Thai fishing boats worth more than ฿ 400 m. were caught violating the exclusive economic zones belonging to the neighbouring countries. Burma, for example, caught about 120 Thai fishing boats worth more than ฿ 420 m. during the past eight years (THAILAND, DOF, 1981).

The RTG therefore, during the Fourth National Economic and Development Plan, started to promote pond culture of the giant freshwater in 1980. The main government agency concerned has been the Department of Fisheries (DOF, MOAC). Other government agencies and institutions namely, the Office of Agricultural Economics (OAE, MOAC), the Department of Co-operative Extension (DCE, MOAC), the Bank for Agriculture and Agricultural Co-operatives (BAAC), the Office of Rural Development Acceleration (ORDA) and the Freezing Industry Organization (FIO) have joined the program. Under this program, the government aims at reaching an annual production of 250 m. post-larvae and 5,000 tonnes marketable giant freshwater prawns within five years commencing from year 1980. The Thai government is interested in prawn production in order to reduce imports (and eventually to increase exports), to provide employment opportunity and to help the poorer farmers.

The decision to promote freshwater prawns was based on considerable research conducted by the Department of Fisheries (DOF). Research on both prawn hatching and post-larval rearing has been

carried out since 1956. Most of this research has been conducted at the Songkhla Fisheries Station where Thailand first succeeded in larval hatching of *M. rosenbergii* in 1966 (Bromanonda and Pongsuwanna 1966-67). The Bangkhen Fisheries Station in Bangkok has also been conducting research on the improvement of larval hatching and culture of this species after the success of the Songkhla Fisheries Station. Research on pond post-larval rearing has been and is being done at the Chainat Fisheries Station and the Bangkhen Fisheries Station. Studies have been made on feeds and feeding, optimum stocking rate, and the culture of prawns in combination with fish but so far only two economic analyses of production have been undertaken. Some of the studies have been undertaken in co-operation with local farmers.

The Chachoengsao Fisheries Station, which produces and distributes post-larvae of *M. rosenbergii*, was established in 1976 and became fully operational in 1977. Apart from being devoted to the production and distribution of post-larval of *M. rosenbergii*, it also provides training and extension services in larval and post-larval rearing. Currently, about 12 million post-larvae are produced at this station each year while its full potential production is around 20 million post-larvae annually.

1.4 Objectives of the Study

In the last section it was shown that the government has been promoting pond production of the giant freshwater prawn. Early emphasis has been put on the promotion of this species in the two north eastern provinces, Kalasin and Roi Et and one province in the

central region, Chachoengsao. Assistance is being offered to farmers in terms of extension services, subsidies and credits. As yet it appears that the government's enthusiasm has not been shared by farmers.

The objectives of the present study are:

(a) to compare the profitability of prawn pond production with existing farm activities, in this case, rice and cassava;

(b) to compare prawn profitability in Kalasin and Roi Et (north eastern region) with that of Chachoengsao (central region); the first two areas where the government promoted prawn production.

(c) On the basis of (a) and (b) identify other factors which may influence the decision about whether to grow prawns. This could be related to some of the problems existing farmers have had with prawn production. From this, policy implications for the introduction of prawns in other parts of Thailand will be derived.

CHAPTER 2

AN OVERVIEW OF THE GIANT FRESHWATER PRAWN

2.1 General Information on the Giant Freshwater Prawn

The giant freshwater prawn (*Macrobrachium rosenbergii* de Man) is the largest of the eleven Macrobrachium species found in Thailand (Table 2.1).

TABLE 2.1

LIST OF *MACROBRACHIUM spp.* FOUND IN NATURAL WATERS IN THAILAND

Scientific Name	Local Name	English Name
Macrobrachium elegans	-	-
M. equidens	Koong Katom	-
M. lar	-	-
M. lampropos	-	-
M. lanchesteri	Koong Foi	Small Prawn
	Koong Na	Rice Field Prawn
	Koong Katom	-
M. mirabilis	Koong Huachook	Top-knot Prawn
M. neglectus	-	-
M. panchesteri	-	-
M. pilimanus	-	-
M. rosenbergii	Koong Yai	Giant Prawn
	Koong Nang	Mother Prawn
	Koong Luang	Regal Prawn
	Koong Gamgram	Large-clawed Prawn
M. sundaicus	-	-

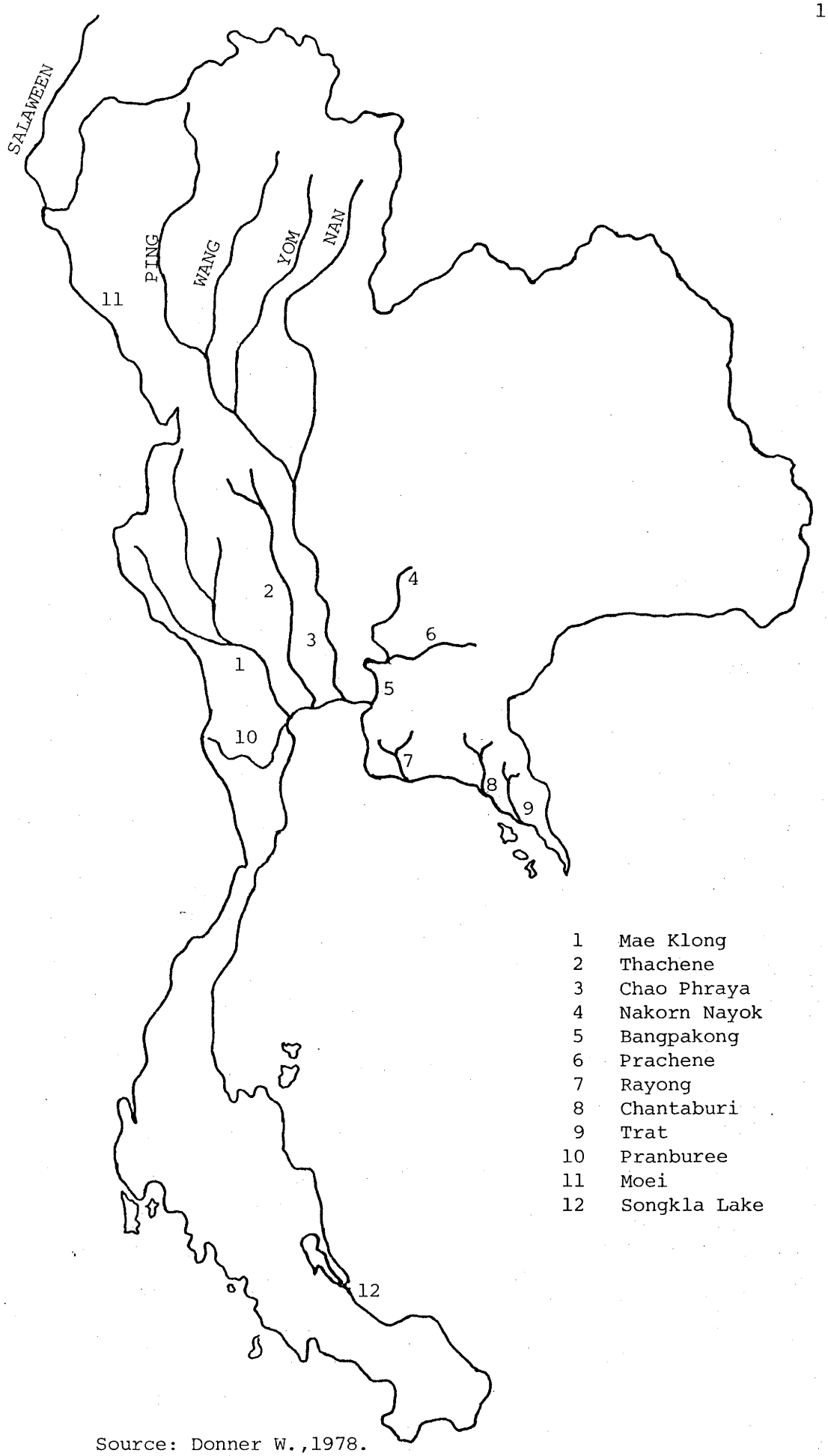
Source: THAILAND, DOF, 1971.

The two most common species in Thailand are *M. lanchesteri* and *M. rosenbergii*. The former are small shrimps found in all parts of Thailand where natural water exists and are caught and consumed in considerable quantities for local consumption. Prices are much lower than *M. rosenbergii* and there are no plans for commercial production.

M. rosenbergii is native to Thailand and other countries in South East Asia, including Vietnam, Cambodia, Malaysia, Burma, Bangladesh, India, Sri Lanka, Indonesia and the Philippines. In Thailand, this species inhabits waters where there is a run-off to the sea. In the central region, they are found in the Moei, Chao Phraya, Thachene, Maeklong, Pranburi, Bangpakong and Nakhon Nayok Rivers. In the eastern region, they are found in the rivers of Chanthaburi, Rayong and Trat provinces. They are also found through out the southern region especially at Songkhla Lake (See Map 1).

2.2 Economic Importance of M. rosenbergii

M. rosenbergii has been a favoured traditional source of protein for the Thai people. Supplies of the giant freshwater prawn caught in Thailand were sufficient to supply local demand about 20 years ago (Singholka, 1978). In fact, Thailand used to export *M. rosenbergii* to Malaysia, Hong Kong, Singapore, Japan, USA, Italy and France (Rabanal, 1975). However, due to the growth in population and change in agricultural technology which led to more fishing, the construction of dams which prevented the completion of the prawn's life cycle, the use of chemicals in agricultural crop production and the pollution created by factories, the production



1 Mae Klong
2 Thachene
3 Chao Phraya
4 Nakorn Nayok
5 Bangpakong
6 Prachene
7 Rayong
8 Chantaburi
9 Trat
10 Pranburee
11 Moei
12 Songkla Lake

Source: Donner W.,1978.
(Modified)

MAP 1

MAP OF THAILAND SHOWING THE RIVERS WHERE NATURAL FRESHWATER PRAWNS ARE FOUND

of *M. rosenbergii* fell to 300 tons in 1979 while domestic consumption in the same year was about 847 tons (New et al, 1980). Thailand, thus, had to begin importing the giant freshwater prawn. For example, in 1979 300 tonnes of *M. rosenbergii* were imported from Burma at the cost of about 30 million Baht (Bangkok Post, May 22, 1979). This has had a negative impact on the trade deficit which the country is now confronting.

2.2.1 Marketing of the Giant Freshwater Prawn in Thailand

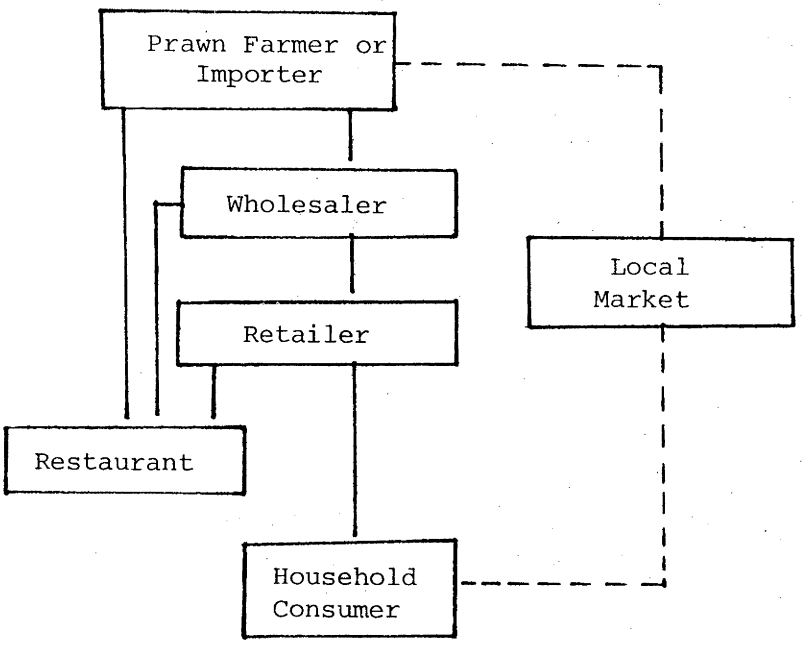
Harvested giant freshwater prawn grown in Thailand are normally marketed whole (shell on) in selected market places in town, particularly in Bangkok, and through direct and indirect sales to restaurants and hotels, where most of them are now consumed. They are normally transported and displayed for sale on ice. Farmers may transport them to the point of sale or sell at the farm gate. The distribution channel of giant freshwater prawn is relatively simple, with three levels between producer or importer and restaurant outlets and household consumers (Figure 2.1). *M. rosenbergii* is primarily a restaurant item with over 80 per cent of all distribution being consumed as menu selections rather than household preparation. Nearly 75 per cent of all restaurants secured supplies from either a wholesaler or from a retailer. Direct sales between producer and restaurant accounted for about two per cent (DOF and UNDP/FAO,1980). Sales by prawn producers through local markets are negligible or small.

2.2.2 Price Movements of the Giant Freshwater Prawns in Thailand

The giant freshwater prawn has always gained a higher price

FIGURE 2.1

DISTRIBUTION CHANNEL FOR FRESHWATER PRAWNS IN THAILAND



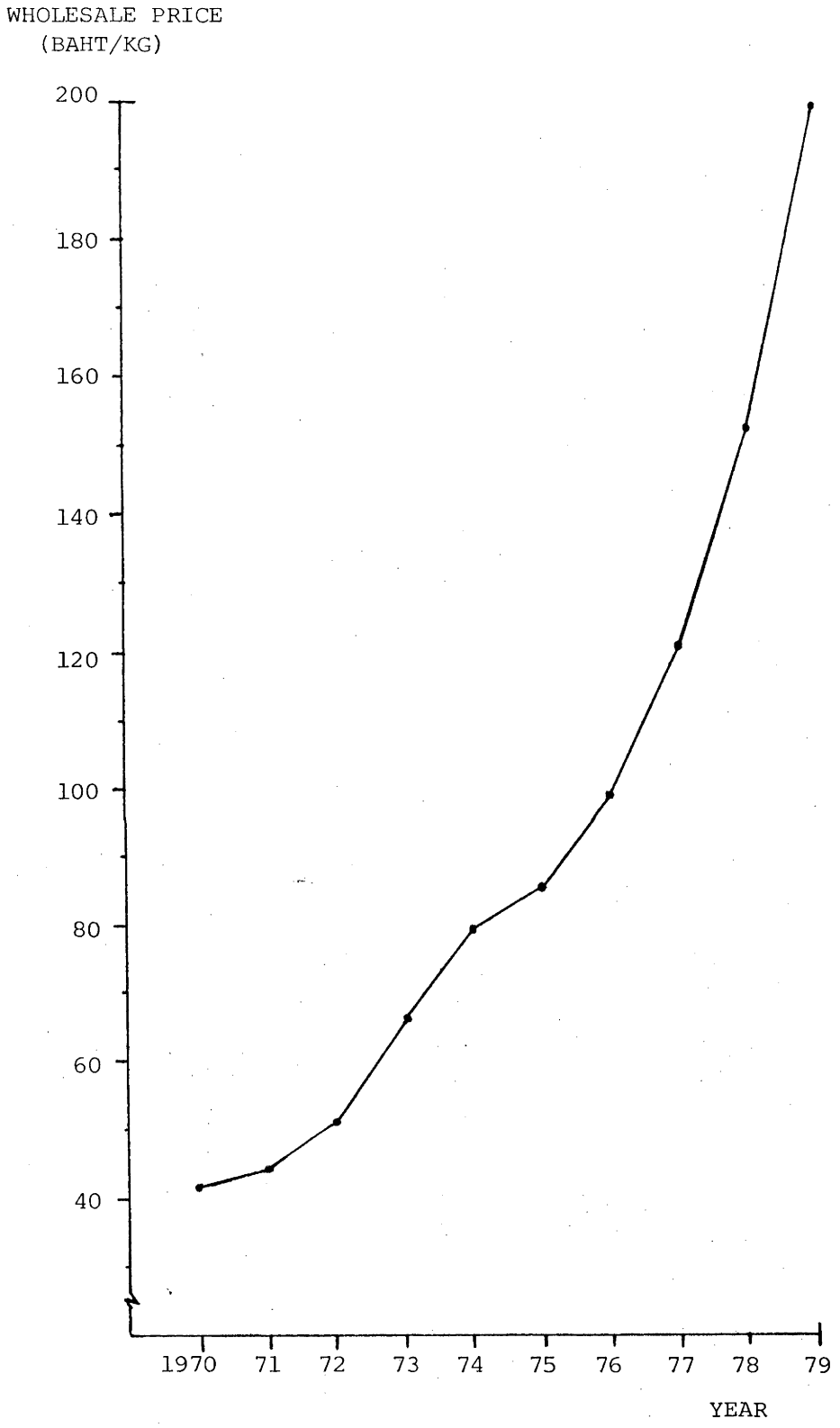
Source: DOF and UNDP/FAO, 1980.

than other commonly marketed aquatic animals in Thailand. The price depends largely on size, the degree of freshness and seasonal factors. Larger prawns, in fact, command a higher price per kilogram than smaller ones and prices are generally highest between the months of March and August when supply is low.

Data for monthly wholesale prices of the giant freshwater prawn in Bangkok (1970-79) are set out in Appendix A and yearly averages in Figure 2.2. Prices rose by an average of 10.75 per cent

FIGURE 2.2

WHOLESALE PRICES OF GIANT
FRESHWATER PRAWNS, BANGKOK METROPOLITAN MARKET



Annual averages of monthly data

Note: Most giant freshwater prawns marketed over this period were caught in natural freshwater areas such as rivers and streams. Aquaculture introduction of the giant freshwater prawns became significant in 1977-78.

Source: Puttikorn et al, 1980.

yearly up to 1972. Since 1973, when prawn exports increased, prawn prices became influenced by overseas demand and prices. Although Thailand mainly exports marine prawns the price relationship between marine and freshwater prawn is fairly close. The freshwater prawn prices in the Bangkok wholesale market have increased from an annual average of 51 Baht/kg to 199 ฿/kg in 1979, an average annual increase of 21.5 per cent. Over the period 1970-79 wholesale prices have increased approximately five times. The strong upward price trend has tended to hide seasonal or short-term price fluctuations.

2.2.3 Status of Freshwater Prawn Farming in Thailand

Freshwater prawn is a fast growing industry in Thailand. The number of freshwater prawn hatcheries in the country increased from about 12 in 1978 to 59 in 1980. Pond culture for market prawns is also widespread and found in more than 30 provinces of Thailand. A recent report (DOF and UNDP/FAO, 1980) indicated that there are at least 455 farms utilizing about 2,346 rai (375 ha) of farm land.

Hatchery production in 1980 amounted to about 26 million post-larvae with a potential production of over 100 million per annum. Two of the 59 hatcheries, Chachoengsao and Songkhla, are owned by the government. Chachoengsao Fisheries Station plays a major role in stimulating the expansion of the industry by producing and distributing post-larvae and also providing training and extension services in larval and post-larval rearing. The Songkhla

Fisheries Station produces post-larvae which are mainly stocked in the Songkhla Lake and in ponds in the surrounding area.

The rapid growth of the prawn industry directly increases the demand for brine shrimp or *Artemia* which is the most important prawn larval feed (both fresh and marine water). Brine shrimp is also an essential larval feed for other crustaceans such as crabs and lobsters and fish fry. It is a tiny worm-like animal which can be produced in salt fields and is sold in five forms; live, frozen, freeze dried, flakes and cysts. Cysts are the most commercially important product for aquacultural use.

The brine shrimps used in hatchery production are at present imported at the cost of ฿ 350-฿ 970/kg from the United States and Canada. The DOF, therefore, has started to encourage farmers to produce Thai cysts with the technological assistance of the Chachoengsao Fisheries Station. Profitability of this related activity is about ฿ 1,400 per rai per month (DOF and UNDP/FAO, 1980). It is expected that Thai cyst production will meet local demand in the next few years and there would be a good prospect for export. Brine shrimp farming is, however, only a side effect of the cultivation of giant freshwater prawns. Therefore analysis in the rest of the thesis will focus on the latter crop.

2.3 Pond Culture of the Giant Freshwater Prawn

The giant freshwater prawn can be cultivated under a number of different aquaculture systems (Shang, 1981). However, in Thailand a particular form of pond cultivation is used. The major characteristics are:

(a) pond culture where prawns are confined in earthen ponds of fresh water;

(b) juvenile stocks are obtained through artificial breeding which involves growing "gravid female prawns" (brood stocks) in rearing ponds. After the eggs are hatched the larvae are reared in some kind of enclosure until they are large enough to be stocked in grow-out ponds; and

(c) it is designed to be an intensive form of cultivation. Stocking rates are supposed to be high and intensive use should be made of feed and fertilizer. Under these conditions production per unit area should be high.

This type of system requires high management skills. These are discussed in the following sections.

2.3.1 Site Selection and Pond Construction

Site selection and pond construction are the most critical factors in prawn farming. Soil for earthen ponds must be relatively impermeable to water and pond bottoms should be fertile and productive. Land should not be too low so as to be susceptible to floods or too high which could result in water shortages. It should be relatively flat for ease and economy of construction. It is of paramount importance that ponds should be located near natural water resources where water supply can be guaranteed all year round. Water quality

is highly important and must be free from toxic substances, from agricultural chemicals or being polluted by the waste or sewerage from factories. Water from tube wells is most suitable but this increases the initial investment and cost of production which may not be practical for small farmers. In addition, prawn farms should be located not too far from the prawn larval hatcheries, feed suppliers, cold storage and market.

Consideration should be given to ease of harvesting and water control when constructing ponds. It has been recommended by the DOF (THAILAND, DOF, 1980) that the size of pond should be more than one-half rai (800 square meters). Construction of ponds may be done by digging up the soil which is then used to make the dikes or berms. In most cases, the ponds are constructed by pushing excavated materials to the sides to form bunds. In Thailand, most ponds in the smaller farms are of simple construction with sieved pipe inlets and outlets while a very few farms have concrete sluice gates (outflow systems). Water supply is normally from irrigation canals, river, lakes or wells and is normally filtered by sieves. Depth of water in the pond should be maintained at 1.0-1.5 meters (THAILAND, DOF, 1980) while the pond berm should be about 0.30-0.45 meters above the water level and wide enough for ease of management (Shang and Fujimura, 1977). Ponds are generally protected from predators by low fences of nylon netting around their perimeters.

2.3.2 Preparation and Stocking of Ponds

The bottom of the pond should be dried prior to restocking with prawns to eradicate predators which include various fishes, such

as, catfish (*Clarias spp.*), *Eleutheronema tetradactylum*, *Lates calcarifer*, *Therapon jabua*, the gobies (*Acentrogobius caninus*, *A. simulans*, *Stimatogobius sadanundia* and *Vaimasa piapensis*) (Terazaki et al, 1980). Ponds can also be treated with rotenone (0.5 kg per 200 $m.^2$) of similar chemicals for the same purpose before restocking. For the eradication of predatory fishes, Terazaki et al (1980) also reported the effective usage of crude saponin extracted from Thai tea seed which is lethal for fishes but not prawns.

Newly constructed ponds should also be treated with lime (1 kg per 10 $m.^2$) to neutralize soil acidity. Ponds treated with either rotenone, saponin or lime should be left idle for about seven days to ensure that no residual effects remain in the ponds. The pond bottom should then be fertilized with dry organic fertilizers.

The ponds are then filled with sieved water to a depth of 1.0-1.5 meters. Transported juveniles from plastic bags should not be released into the ponds right away. Techniques designed to allow the prawn juveniles to adapt to the pond water must be practised in order to reduce the mortality rate due to the sudden shock of a change in environment.

The stocking rate for 5-8 centimeter long prawn juveniles (being transferred from nursery ponds at the age of around four months) is recommended to be 5-7 juveniles per square meter. Post-larvae of 1.5-2.0 centimeter long are stocked at the rate of 20 post-larvae per square meter of water surface (THAILAND, DOF, 1980). Thus, for a pond with an area of one rai, somewhere between 8,000 - 32,000 juveniles are stocked, depending on the age and size of the prawn juveniles. While a lower stocking density achieves a greater

proportion of market size prawns, too low a stocking density may result in the inefficient use of the pond.

2.3.3 Feeds and Feeding

In its natural environment, *M. rosenbergii* feeds on leaves, grains and the roots of various aquatic plants and on small aquatic animals such as insect larvae, plankton and nematodes as well as dead animal flesh such as fish and snails. Efficient feeds for pond culture of *M. rosenbergii* is still a matter of experimentation.

M. rosenbergii are slow at feeding. They grasp food particles with their first pair of pereiopod (walking legs) and put them in their mouth. It is therefore important that food remains as particles for as long as 3-4 hours when soaked in water. Dissolved food is unavailable to the prawn and will result in high levels of food wastage. Prepared food must therefore contain some glutinous substance as an ingredient. One per cent of Guar gum (extracted from the legume seed, *Cyanopsis psoralioides*) in prawn feed allows the feed to remain in its natural state for about six hours (Boonyaratpalin and New, 1980).

Unconsumed or dissolved feed will normally result in an increase of algae and zooplankton which will be eaten by the prawns. But this is an inefficient form of feeding since the growth of such micro-organisms can also be encouraged by the use of organic fertilizers at much lower cost than the unconsumed feed. If there is too great an accumulation of unconsumed feed, algae growth may be encouraged and oxygen levels reduced to the detriment of the prawns, even resulting in high prawn mortality. Although this can be

avoided through careful water management, there is still food wastage.

The optimum nutrient composition of the feed for the giant freshwater prawn has not yet been determined. It is generally considered that a diet of at least 30 per cent protein should be fed. However, Boonyaratpalin and New (1980) have reported that during the first four months of stocking, the difference between the growth of prawns fed on a 15 per cent, 25 per cent and 35 per cent protein diets was not statistically significant. Since the protein concentration is the major determinant of feed cost it is important that more experimentation and field trials are undertaken to determine the most profitable protein concentration.

At present, most prawn feeds consist mainly of animal protein. Since plant protein is invariably cheaper, the substitution of part of the animal protein by plant protein could considerably lower feed costs. A study reported by Aquacop (1976) indicated that a diet of 40 per cent acacia meal or 40 per cent copra meal was suitable as a prawn feed. Since these two products are of tropical origin and abundantly produced in Thailand, their introduction into prawn diets is strongly recommended.

In Thailand, broiler chicken starter pellets are commonly used during the first two months of rearing post-larvae, following which a wide variety of feeds are used. These include chicken feed or fish meal mixed with cooked broken rice, chopped fish with broken rice and rice bran and fish meal mixtures with or without vitamin premixes. Feeds containing rice or rice bran must be cooked each day to gelatinize the starch and improve the stability of the feed in water.

Broiler chicken starter pellets are also widely used in Hawaii in prawn culture. But they are highly unstable in water, breaking up in about five minutes. This results in waste and feeding costs are therefore higher.

In Thailand, where available, the bones of such animals as calves with some flesh adhering are given as a source of additional feed. Where there is an associated poultry enterprise, dead chickens are also used.

Prawns in the natural habitat normally search for food in the late afternoon or at night. Feed should therefore be given once a day in the late afternoon or evening. It is normally given in a sieved tray staked in the pond. Theoretically 3-5 per cent of prawn weight of feed should be given daily, but in practice, farmers normally estimate feed requirements by noticing how much is left over in the trays. Some growers also feed in the morning, but this is an inefficient use of feed and labour.

Prawn feeding is therefore reasonably straight forward provided a number of rules are carefully observed. However, underfeeding or overfeeding could severely affect profitability through slower growth or prawn mortality.

2.3.4 Harvesting of Prawns

The interaction between stocking rates, feed, rearing period and yields appears to be complex. All prawns in a pond do not grow at the same rate and will reach marketable size at different times. Since the price per kilogram of prawns varies with the number of prawns per kilogram, (i.e., their size) the decision of when to harvest can be a difficult one.

The rearing period in Thailand ranges from 8-12 months, but farmers commonly do an initial harvest after six months, remove marketable animals (10-15 prawns/kg including head and shell) and return the remainder to the pond. Further cullings may be done until the prawns are totally harvested. The decision to harvest may sometimes be made because of the presence of a prawn buyer in the area. A stretched monofilament net (3-5 cm. mesh) may be used for harvesting in trawl fashion, or the common round fish cast-net may be used.

Singholka and Worasayan (1978) studied the relationship between stocking rate and growth rate, but I believe their results are inconclusive. Two farms were stocked at the same rate of six per square meter of water surface area. One farm was harvested after 7½ months and reported that 81 per cent of its prawn were "large". The other farm harvested at eight months and reported 96 per cent of the catch consisted of "large" prawns. However, the size of the "large" prawns varied between the two farms - from 18 prawns per kg on the first to 31 per kg on the second.

Two other farms were stocked at the lower rates of $3/m.^2$ and $2/m.^2$. They were harvested after seven months and seven and a half months respectively. They reported that 95 per cent and 76 per cent respectively were "large" prawns, 18/kg for the first and 15/kg for the second farm.

The raw figures seem to suggest that there is no relationship between yield and either rearing period or stocking rate, but there are so many problems with the study as to make the results unreliable.

For example soils, water quality, feeding rates and management skills varied significantly but no information of this nature is provided. In their absence further study on the interaction between stocking rates, rearing periods and yields is necessary.

CHAPTER 3

THE STUDY OF FRESHWATER PRAWN PRODUCTION IN COMPARISON WITH RICE AND CASSAVA

3.1 Background of the Study

The Fourth Economic and Social Development Plan (1977-81) included a policy for promoting freshwater prawn production in Thailand. The DOF was responsible for the program with the help of the five government and non-government institutes listed earlier. The main aim of the RTG was to reduce imports of freshwater prawns in the short-term, and in the long-term to increase production so that some prawns can be exported. Under this policy, the government aims to expand the area devoted to freshwater prawn production to at least 30,000 rai (4,800 ha).

A further aim was to help the small farmers. The government considered prawns to be a very profitable crop and felt they could raise the standard of living of the poorer farmers if they encouraged them to grow this crop. It was planned to offer various types of assistance to small farmers including credit, subsidies for pond construction and for juveniles and extension services.

Initially the program began in three provinces, namely Kalasin, Roi Et and Chachoengsao. Similar efforts are planned for other areas in the future. The present study is therefore conducted in the light of the government's interest in promoting prawns.

3.2 Description of Study Location

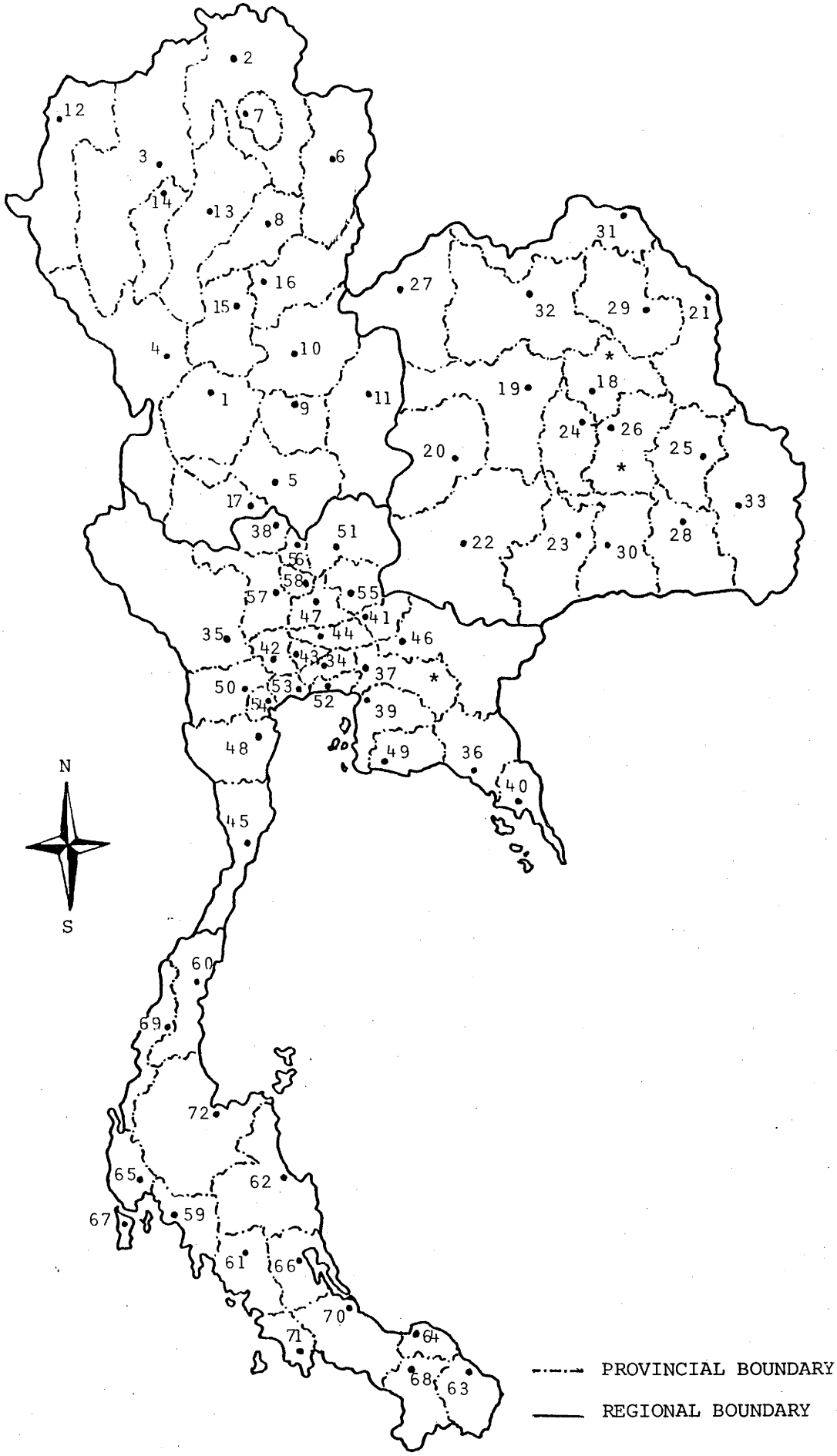
The study was made in three provinces of Thailand: two in the north east, Kalasin and Roi Et and one in the central region, Chachoengsao (see Map of Thailand No.2). Farmers in the two former provinces have just started prawn farming while those in Chachoengsao have been growing prawns for some years.

3.2.1 Kalasin

This is one of the sixteen provinces in the north east where farmers are very poor. Major crops in this area include cattle, buffalo, kenaf, silk and cassava. Rice is also grown but mainly for subsistence. Rice yields have been relatively low, averaging 218 kilograms per rai for the crop years between 1974/75 - 1978/79 (THAILAND, OAE, 1979). The area devoted to major rice crops fluctuated from year to year ranging from 830,905 rai in crop year 1977/78 to 1,548,870 rai in 1978/79 (Table 3.1). Although less land has been planted to cassava than rice, cassava is more important as a source of cash income since much of the rice is consumed on the farm. During crop year 1974/75 the area planted to cassava was 60,585 rai, rising to 385,380 rai in 1977/78 but falling to 288,611 rai in 1978/79 (Table 3.2). Average yield per rai during the five year period was 2,341 kilograms.

In 1978, an area of 62,980 rai of the province could be irrigated through natural canals, dam irrigation and water reservoirs. A large proportion of this was provided by the Lam Pao Dike and Ditch Project which was completed in 1974. The only farmers who have started prawn farming are those who could get access to irrigated water from one of the three sources.

MAP OF THAILAND SHOWING PROVINCES AND STUDY AREAS



SOURCE: MANOMAIPHAN, 1975

* STUDY AREAS

Key to Province Numbers on following page

EXPLANATION OF MAP 2.

1. Northern
(17 provinces)

1. Kamphaeng Phet
2. Chiang Rai
3. Chiang Mai
4. Tak
5. Nakhon Sawan
6. Nan
7. Payao
8. Phrae
9. Phichit
10. Phitsanulok
11. Phetchabun
12. Mae Hong Son
13. Lampang
14. Lamphun
15. Sukhothai
16. Uttaradit
17. Uthai Thani

2. North-Eastern
(16 provinces)

18. Kalasin*
19. Khon Kean
20. Chaiyaphum
21. Nakhon Phanom
22. Nakhon Ratchasima
23. Buri Ram
24. Maha Sarakham
25. Yasothon
26. Roi Et*
27. Loei
28. Si Sa Ket
29. Sakon Nakhon
30. Surin
31. Nong Khai
32. Udon Thani
33. Ubon Ratchathani

3. Central Plain
(25 provinces)

34. Bangkok Metropolis
35. Kanchanaburi
36. Chanthaburi
37. Chachoengsao*
38. Chai Nat
39. Chon Buri
40. Trat
41. Nakhon Nayok
42. Nakhon Pathom
43. Nonthaburi
44. Pathum Thani
45. Prachuap Khiri Khan
46. Prachin Buri
47. Ayutthaya
48. Phetchaburi
49. Rayong
50. Ratchaburi
51. Lop Buri
52. Samut Prakan
53. Samut Sakhon
54. Samut Songkhram
55. Saraburi
56. Sing Buri
57. Suphan Buri
58. Ang Thong

4. Southern
(14 provinces)

59. Krabi
60. Chumphon
61. Trang
62. Nakhon Si Thammarat
63. Narathiwat
64. Pattani
65. Phangnga
66. Phatthalung
67. Phuket
68. Yala
69. Ranong
70. Songkhla
71. Satun
72. Surat Thani

TABLE 3.1

MAJOR RICE CROPS: PLANTED AREA, PRODUCTION (PADDY) AND AVERAGE YIELD BY PROVINCE UNDER INVESTIGATION, CROP YEAR 1974/75-1978/79

Province	Planted Area (rai)					Production (tonnes)					Yield per rai (kg)				
	1974/75	1975/76	1976/77	1977/78	1978/79	1974/75	1975/76	1976/77	1977/78	1978/79	1974/75	1975/76	1976/77	1977/78	1978/79
Kalasin	1,244,000	1,504,524	1,123,758	830,905	1,548,870	208,000	366,566	276,557	180,847	337,654	167	244	246	218	218
Roi Et	1,648,000	1,926,136	2,262,406	1,631,109	2,095,088	252,000	332,801	389,850	76,514	289,122	153	173	172	47	138
Chachoengsao	1,094,000	938,598	1,085,222	1,080,600	1,097,446	313,000	255,974	370,863	358,751	415,932	286	273	342	332	379

Source: THAILAND, OAE (1979).

TABLE 3.2

CASSAVA: PLANTED AREA, PRODUCTION AND AVERAGE YIELD
BY PROVINCE UNDER INVESTIGATION, CROP YEAR 1974/75-1978/79

Province	Planted Area (rai)					Production (tonnes)					Yield per rai (kg)				
	1974/75	1975/76	1976/77	1977/78	1978/79	1974/75	1975/76	1976/77	1977/78	1978/79	1974/75	1975/76	1976/77	1977/78	1978/79
Kalasin	60,585	133,672	183,599	385,380	288,611	146,896	326,594	436,056	764,775	715,755	2,425	2,443	2,375	1,984	2,480
Roi Et	19,072	50,276	72,004	96,607	118,275	33,078	114,418	129,391	181,488	260,087	1,734	2,276	1,797	1,879	2,199
Chachoengsao	159,742	190,633	276,273	77,418	247,835	286,104	366,672	588,185	146,709	714,756	1,791	1,923	2,129	1,895	2,884

Source: THAILAND, OAE (1979).

3.2.2 Roi Et

This province is also in the north east and major crops are the same as those of Kalasin. Rice is grown more in this province and in some years the area devoted to the major rice crop is approximately double that of Kalasin. However, rice yield in this area is much lower than Kalasin and very variable (Table 3.1) although 256,270 rai of land was irrigated in 1978. This may be because the area often has been subject to flooding which damages the rice crop. During the five year period (1974-78) average yields ranged from 47 kilograms per rai in 1977 to 173 kilograms per rai in 1975. Farmers grow both glutinous and non-glutinous rice but prefer the former. Cassava occupied an area of 19,072 rai in 1974 and 118,275 rai in 1978. The area devoted to cassava is somewhat less than half of that of Kalasin. Yield of cassava is rather low averaging 1,971 kilograms per rai each year during the period 1974-78.

3.2.3 Chachoengsao

This province is situated about 60 kilometers east of Bangkok and is close to the sea. The Bangpakong river with its canals serves as the main source of supply of water for the farmers all through the year. Problems can arise for a few months during the year when sea water flows into the river.

The major crops of Chachoengsao are rice, cassava and buffalo. Poultry and swine enterprises are also common in this area. An area of approximately one million rai is devoted to rice with average yearly yields during 1974-78 of around 323 kilograms

per rai. Chachoengsao is reknowned for the quality of rice produced in the area. Horm Mali, the best rice variety grown in Chachoengsao always attracts the highest price for rice paddy. The area planted to cassava varied during 1974-78 and the yields fluctuated markedly. However, the average yearly yield for this five year period was around 2,000 kgs per rai.

3.3 The Sample

The Office of Agricultural Economics was responsible for designing the survey. The real purpose of the survey was to conduct a feasibility study of prawn production in the three provinces and to estimate credit requirement of those farmers in the project area. Not all farms in the project area were involved in prawn production. Other farm activities included the cultivation of rice, cassava, peanuts, fruit trees, fish and livestock. Initial selection of the farms to include in the survey was thus purposive. A list of those farms involved in prawn production in the three provinces, a total of 70, was provided by the Department of Fisheries (DOF). A sample of 35 farms or 50 per cent of this group of farms was then selected using random sampling. Details of the final sample are shown in Table 3.3.

The random sampling method is simple and time saving but it is appropriate for gathering information of a broad nature. It fails to stratify the population into subgroups. Even if the sample size is large in relation to the population, it may not include a sufficient number of cases from a particular subgroup to allow meaningful statistical tests.

TABLE 3.3

NUMBER OF FARMS IN THE SAMPLE BY PROVINCE

Province	No. of Farms in the Sample	No. of Farms in Population	%	Area for Prawn (rai)		
				Sample	Population	%
Kalasin	18 (#1-18)	28	64	50.13	91.5	55
Roi Et	7 (#19-25)	13	54	71.25	105.45	68
Chachoengsao	10 (#26-35)	29	34	28.75	175.25	16
Total	35	70	50	150.13	372.20	40

To illustrate, in this study, the population of farms which produced prawns was not stratified before random sampling. The result was that the farms that were included from Chachoengsao accounted for only 16 per cent of the total area under prawns in the province. Moreover, only one large farm is in the sample. This means that while the 50 per cent of farms were included, these farms accounted for only 40 per cent of the area devoted to prawns in the three provinces.

3.4 The Survey Methodology

The survey methodology of the OAE should also be criticized. It appeared that it took the five technicians from OAE only six days (August-September, 1980) to complete the interviewing while they had to visit 35 farms in three different locations. Although it is understood that travelling allowances might be a constraint on longer visits, very short visits can easily result in inaccurate data being obtained. This is especially true in the case of prawns which are relatively new to both the interviewers and the farmers.

In order to increase the accuracy of the data it is important that a sound rapport between the farmers and the interviewers be established. Rapport is "an amalgum of trust, openness and friendliness between two individuals" (Bhati, U.N., 1979). It determines the quality of communication between the interviewer and the respondent which in turn affects the accuracy of responses. With such short visits, it is doubtful that sufficient rapport could have been established.

However, rapport alone cannot ensure the accuracy of the data as this can also be affected by the quality of research tools which include "the selection and training of interviewers, designing and pre-testing of questionnaire, interviewing of farmers, guarding against biases, and verification of the responses" (Bhati, U.N., 1979). In the present study, the questionnaire needs some clarification.

3.5 The Questionnaire

The questionnaire was very long and consisted of 10 full pages with more than 500 questions listed. The portion of the questionnaire relevant to the present study is included in Appendix B. In spite of its lengthiness, each farmer was visited only once because of the short duration of the survey. Since there were a lot of questions to be answered by the farmers in a short time, the degree of accuracy of the data that was obtained must be questioned.

The design of the questionnaire is also open to criticism.

(1) Questions about inputs and outputs were often put in monetary terms and no details about

prices were obtained. This meant that it is at times impossible to estimate the physical quantities involved.

(2) Questions on labour were poorly designed. Farmers were asked to estimate total labour inputs applied to the previous crops during the previous season. Errors would have resulted not only from poor memories, but also from mistakes in calculation by farmers who did not have a good knowledge of mathematics. For example, the estimate of total labour involved in harvesting prawns required them to remember the number of times they harvested, the number of people involved each time and the number of hours spent at each harvest. Even if these figures could be remembered reasonably accurately, mistakes could have been made in calculating the final total of labour input.

(3) No questions on animal labour or machinery usage were asked.

(4) Although emphasis was put on prawns, insufficient details were asked. For example, no information on the method of rearing prawns was obtained, including feeds and feeding, water management and harvesting. This made the analysis of

prawn activity more difficult especially when unlikely answers were observed.

(5) As the survey was concerned largely with prawn farming, few details of activities other than prawns were sought. This meant that insufficient data on a number of farm activities were obtained, including livestock, peanuts, vegetables, horticulture and fish rearing. The analysis in the remainder of this thesis has therefore had to concentrate on only three activities, namely prawn, rice and cassava cultivation. In addition, because of insufficient information on prawns, four farms (23, 27, 30 and 31) were omitted in the analysis of prawn activity. Total number of the farms included are 31 for prawns, 23 for rice and seven for cassava.

CHAPTER 4

FINANCIAL ANALYSIS OF PRAWN, RICE PADDY AND CASSAVA AS FARM ACTIVITIES - METHODOLOGY

Since the government via the DOF is encouraging farmers to grow prawns, an important question from the farmers' point of view is whether prawn cultivation is profitable. Farmers also want to know whether prawns are more profitable than other farm activities, particularly rice. However, before they make the decision to adopt prawns, they will also wish to know how much cash is required for the initial investment and the likely annual operating costs for prawns. These costs may be too high to be financed out of the farmers' own resources and a loan may be required. Farmers must therefore discover if finance is available, and how long loans will take to repay. These are the type of questions that are of primary concern to farmers considering a change to prawn production. In this chapter, a method of analysis which enables prawn production to be considered from the farmers' point of view is developed. It is then applied to the data that was described earlier.

4.1 The Production Function

Agricultural economic analysis has tended to be dominated by the use of production functions. Theoretically, a production function tells us the relationship between physical inputs and products. Various forms of production function are used at different times. These include input-output analysis used commonly by farm management specialists and the fertilizer response curves employed

by agronomists. One of the first published uses of a production function was by E.O. Heady (1952).

A general specification for a production function is:

$$Y = F\ (X_1, X_2, \ldots, X_n) \qquad (4.1)$$

where Y is the quantity of output or product; and

X_i are the quantities of different variable inputs

and i = 1,2,3,...n.

In general, it is impossible to list all the input factors involved in producing a particular product. The production function is therefore sometimes written as:

$$Y = F\ (X_1, X_2, \ldots, X_n; Z_1, \ldots, Z_m) \qquad (4.2)$$

where Z_1 to Z_m refer to fixed input factors and/or those having so little influence on the amount produced.

An alternative general specification is:

$$Y = Af\ (X_1, X_2, \ldots, X_n) \qquad (4.3)$$

where A can be interpreted as an indicator of technical efficiency determined by the levels of the fixed factors of production (Yotopoulos and Nugent, 1976).

Many different functional forms have been employed in empirical analysis, for example the Cobb-Douglas, linear, polynomial and exponential. They all allow the average product (AP), the marginal product (MP), the maximum level of output that can be obtained for given inputs, and elasticities of production to be derived. One of the most important uses however, has been to develop

indicators of relative technical efficiency between farms, i.e., variations in output from a given set of measured inputs of production (Yotopoulos and Nugent, 1976). Although, Yotopoulos and Nugent (1976) show how an "economic rationality" test can be derived using the production function as a base, this type of analysis does not allow an overall indicator of economic efficiency to be developed.

4.2 The Profit Function

Recent developments in production economics have concentrated on the Dual of the production function. Under the profit function approach, farms are also assumed to behave according to certain decision rules, which include profit-maximization for given prices of outputs and variable inputs, and for given quantities of the fixed factors of production (Yotopoulos and Nugent, 1976). Based on the earlier specification of the production function (equation 4.2), a general specification of a profit function can be written as:

$$P = pF(X_1, X_2, \ldots, X_n; Z_1, \ldots, Z_m) - \sum_{i=1}^{n} q_i X_i \qquad (4.4)$$

or, more simply:

$$P = pY - \sum_{i=1}^{n} q_i X_i \qquad (4.5)$$

where P = restricted profit, i.e., current revenues less current total variable costs;

p = unit price of the output; and

q_i = unit price of the ith variable input.

Assuming the farm maximizes profit, the marginal productivity

conditions for input usage are:

$$p \frac{\partial F(X;Z)}{\partial X_i} = q_i \qquad i=1,\ldots, n \tag{4.6}$$

Dividing both sides by p and defining $q_i^* \equiv q_i/p$ as the normalized price of input i, equation 4.6 becomes:

$$\frac{\partial F}{\partial X_i} = q_i^* \qquad i=1,\ldots, n \tag{4.7}$$

Similarly normalized restricted profit (P^*) (defined as $\frac{P}{p}$) can be derived from equation 4.4;

$$P^* = F(X_1,\ldots, X_n; Z_1,\ldots, Z_m) - \sum_{i=1}^{n} q_i^* X_i \tag{4.8}$$

If equation 4.7 is solved for the optimal quantities of variable inputs, denoted X_i^*'s, as functions of the normalized prices of the variable inputs, and of the quantities of the fixed inputs, then:

$$X_i^* = f_i(q^*, Z) \qquad i=1,\ldots, n \tag{4.9}$$

where q^* and Z are the vectors of normalized input prices and quantities of fixed inputs respectively.

By substitution of equation (4.9) into equation (4.4), the normalized restricted profit function emerges:

$$\Pi' = p \left[F(X_1^*,\ldots, X_n^*; Z_1,\ldots, Z_m) - \sum_{i=1}^{n} q_i^* X_i^*\right] \tag{4.10}$$

where Π' = maximum possible normalized restricted profit and the term within square brackets on the right hand side of equation (4.10) is a function only of q^* and Z (see 4.9), i.e.

$$\Pi' = G(p, q_1,\ldots, q_n; Z_1,\ldots, Z_m) \tag{4.11}$$

By using p as a numeraire, as earlier, equation (4.11) can be transformed into:

$$\Pi = G^{*} (q_1, \ldots, q_n; Z_1, \ldots, Z_m) \qquad (4.12)$$

which reads profit is a function of the prices of the variable factors of production and the quantities of the fixed factors of production.

This treatment of the profit function is based on that of Yotopoulos and Nugent (1976). They proceed to show how this general function can be made group specific to derive an indicator of relative economic efficiency between groups of farms. This indicator can be separated into the two components of price and technical efficiency.

To summarize their findings, they claim three major advantages of the profit function approach. It allows simultaneously:

(a) differences in outputs from a given set of inputs to be compared, i.e., a technical efficiency measure;

(b) differences in the ability of farmers to maximize profits to be compared, i.e., a measure of price efficiency;

The final advantage is that these components of overall economic efficiency can be calculated even if farms face differing market prices. Thus the profit function can be a more powerful tool for analyzing economic efficiency than the production function.

In the present study, however, we are not interested in measuring economic efficiency. What we are really concerned about

is whether farmers perceive prawns to be more attractive than other competing crops. An important component of this attractiveness is profit, so it is necessary to find a tool of analysis which enables us to compare the relative profitability of the competing crops from the farmers' viewpoint.

4.3 Financial Analysis

The ability to make correct decisions is of crucial importance in running a farm. As a business, a farm requires expertise in many fields such as agronomy, animal nutrition, engineering and finance. In order that a farm be run efficiently, this specialist knowledge must be integrated in formulating a farm plan. From a farm plan, the farm manager decides how to allocate his scarce farm resources among production alternatives to maximize profits. Tools to help better planning were proposed by various authors such as Rickards and McConnell (1968), Upton and Anthonio (1971), Stanton (1973) and Brown (1979). The analysis in this study was made in accordance with the method suggested by Brown (1979), as this was considered most appropriate to the objectives of the present study.

4.3.1 Activity Budgeting and Gross Margins Analysis

Brown (1979) defines a budget as "a plan coordinating the inflows and outflows of resources to achieve one or more of a given set of objectives. Farm budgeting is concerned with the organization of resources on a farm to maximize profits, or, sometimes, family satisfaction. It is traditionally treated as a branch of farm management economics -- a hybrid of accounting, agriculture and economics".

Budgets can be prepared for each farm activity and these "activity budgets" can be used as a basis for a whole farm budget. The advantage of the activity budgets is that they show the relative profitability of each activity. They can then be used to examine what would happen to total farm profit if a unit of a scarce resource (may be land) was transferred from one activity to another. Budgeting can therefore be a valuable tool in helping farmers decide how to alter resource allocations on their farms at the margin so as to maximize profit.

Because it concentrates on profitability from the farmer's viewpoint, farm budgeting appears to be a particularly appropriate means of examining the questions raised earlier in this chapter. It will therefore be applied to the data that was collected.

In the analysis, the following terms are used:

Farm Activity (FA) specifies a particular method of producing a crop or operating a livestock enterprise. For example, wet season and dry season rice crops are considered as different activities but as the same enterprise. The term "enterprise" generally implies the production and sale of a crop but do not specify the method of production (Rickards and McDonnell, 1968).

Gross Revenue (GR) is a preliminary measure of income. It assesses the performance of an activity purely in terms of the benefits it yields without the costs to produce it and is calculated by multiplying the total volume of the final marketable production by its average farm gate price. It can also be calculated by summing up the value from the sale of all commodities produced by the activity. If the commodities are not sold, their values are imputed and summed up.

Variable Costs (VC) are those which change according to the size of the activity, e.g. seeds, fertilizer and insecticides are some of the variable costs applicable to rice activity.

Fixed Costs (FC) are those which are not affected by the size of activities in the farm plan. They apply to the farm as a whole. But it is possible under a set of assumptions outlined later, to allocate a proportion of these costs to each activity undertaken on the farm.

Activity Gross Margin (AGM) is the difference between gross revenue of an activity and its variable costs. The gross margin provides a useful first approximation of the relative contribution of each activity to the profitability of the farm. Gross margin per unit of land or other limiting resource is a useful measure for comparing the productivity of the different activities on the farm. By adding gross margins of all activities in the farm plan we obtain total gross margin (TGM). Since, in this study, analysis can not be done on the whole farm basis and only rice, cassava and prawn are included, adding up gross margins from the three (or two in some case) activities results in activity mix gross margin (AMGM). The further usefulness of gross margin analysis is that the gross margin can then be used, in partial budgeting and linear programming analysis, as a basis for the rational selection of activities subject to fixed resources and technical constraints.

Activity Profit (AP) is obtained by subtracting the estimated total cost of production (variable plus fixed costs) for the activity from its gross revenue. For the purpose of calculating

farm activity profit costs can be roughly divided into three categories: labour, material and other charges. Labour is treated as though it were all hired no matter if it is family or employed labour.

Net Activity Income (NAI) is obtained by subtracting total cost for the activity except imputed value for farm family labour from the gross revenue of the activity. Thus it is the reward for the labour and management contributed by the farm family during the year.

4.3.2 An Illustration of Activity Budgeting

The method of financial analysis used closely follows that of Brown (1979). As an illustration of the method the data of Farm 25, which engaged in the three activities of rice, cassava and prawn, is presented in Table 4.1. Similar data on all sample farms is included in Appendix C.

Where the actual sales of a commodity were known, the sales comprised the gross revenue (GR) for the activity. In other cases GR was calculated by multiplying the total output of each activity by its average farm gate price.

The farmer produced 10,330 kgs of paddy out of which 4,160 kgs are valued at ฿ 2.90/kg and 6,170 kgs at ฿ 2.50/kg giving a total gross revenue from rice activity of ฿ 27,489 while 32,800 kg of cassava was sold at ฿ 0.92/kg giving a gross revenue from cassava of ฿ 30,176. Output from prawn was 500 kgs in total and sold at different times at ฿ 160-170/kg. The value from different sales were summed up to be ฿ 95,200. Final column (activity mix) is the sum of the gross revenues from the three activities.

TABLE 4.1

ACTIVITY BUDGET FARM 25

Item	Paddy	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	32-0-0	25-0-0	4-0-0	61-0-0
(Rai)	32	25	4	61
Output (kgs)	10,330	32,800	560	43,690
A. Gross Revenue (GR) (฿)	27,489	30,176	95,200	152,865
Variable Costs (฿)				
Seed	889	N/A	11,200	12,089
Lime	-	-	90	90
Fertilizer	80	-	150	230
Feed	-	-	17,486	17,486
Fuel	150	-	2,000	2,150
Lub. and Grease	-	-	201	201
Electricity	-	-	-	-
Repairs and Maintenance	-	-	-	-
Insecticides	75	-	-	75
Selling Cost	120	3,836	-	3,956
Transportation	-	-	-	-
Service Hired	-	-	-	-
Hired Labour	-	9,150	-	9,150
Family Labour Charge	6,960	3,750	775	11,485
Others	500	-	-	500
Contingencies	439	837	1,595	2,871
TVC	9,213	17,573	33,497	60,283
B. Gross Margin (GM) (฿)	18,276	12,603	61,703	92,582
Gross Margin/Rai (฿)	571	504	15,426	1,518
Fixed Cost (฿)				
Rent	6,400	5,000	800	12,200
Depreciation I	343	268	43	654
Depreciation II	152	119	691	962
Interest (Investment)			484	484
Interest (Borrowing)	1,106	2,109	4,020	7,235
TFC	8,001	7,496	6,038	21,535
C. Total Cost (TC) (฿)	17,214	25,069	39,535	81,818
D. Activity Profit (฿)	10,275	5,107	55,665	71,047
Activity Profit/Rai (฿)	321	204	13,916	1,341
E. Net Activity Income (฿)	18,460	9,517	56,576	84,553
Family Labour (Manday)	232	125	31	388
Net Activity Income/Manday (฿)	80	76	1,825	218

The activity gross margin (AGM) is obtained by subtracting the total variable cost (TVC) from the GR. GM for rice was ฿ 18,276 and is obtained by subtracting TVC (฿ 9,213) from the GR (฿ 27,489). For cassava, GM was ฿ 12,063 and for prawns ฿ 61,703. GM for the activity mix of rice, cassava and prawns is therefore ฿ 92,582. The GM/rai for rice was ฿ 571 while that for cassava and prawns was ฿ 504 and ฿ 15,426 respectively.

The list of the variable costs for each activity needs some clarification. Since the three activities need different variable inputs, the items listed are not necessarily required for each activity. Also some farmers did not use some expected inputs such as fertilizer and insecticides.

Family labour for rice and cassava was assumed to cost ฿ 30/day and ฿ 25/day for prawns, the going rate for the different types of agricultural labour normally used in each activity. The official minimum rate for agricultural labour (฿ 45) was not used because it is rarely paid, and therefore does not reflect the actual wage.

The "Others" item includes expenditure on food for exchanged labour, chemicals for predators and the like. Contingencies were calculated at five per cent out of the total value of variable inputs. For example, in the rice case from seed item down to others amounted to 8,774 multiplied by 0.05 we obtained 439. The same calculation was applied to cassava and prawns for contingencies and the figures were then added up to be the final column (2,871).

The total cost of each activity was the sum of the total variable cost and the total fixed costs. For example, a total cost of ฿ 17,214 for rice was obtained by adding up ฿ 9,213 (TVC) and

฿ 8,001. Total fixed costs can be roughly divided to three items, namely rent, depreciation and interest. Since the analysis cannot be done on a whole farm basis, fixed costs are allocated to the various activities and in proportion to the area devoted to each activity.

Rent was assumed to cost ฿ 200/rai, the ongoing rate for agricultural land.

Fixed assets were divided into those of relatively long life with some scrap value and those of shorter life which would need earlier replacement and likely to have no scrap value.

Assets with a longer life such as pumps and associated pipes come under the heading Depreciation I in Table 4.1. These were assumed to last 10 years on average with a scrap value of 20 per cent of initial cost. Annual depreciation was then estimated by the straight line method.

$$\text{Depreciation I} = \frac{\text{Initial cost - Scrap value}}{10}$$

Depreciation II refers to shorter-life assets such as hand tools and nets which are assumed to last 3.5 years and to have no scrap value. A straight line method was used to estimate annual depreciation.

$$\text{Depreciation II} = \frac{\text{Initial cost}}{3.5}$$

The average life of 10 years and 3.5 years for each type of asset are those recommended by OAE.

Both the interest on investment and borrowing were set at the rate of 12 per cent, the set rate for the agricultural loans made by the BAAC.

The activity profit (AP) was obtained by taking out the total cost (TC) from the gross revenue (GR). In the rice case, this is calculated by subtracting ฿ 17,214 from ฿ 27,489 resulting in rice activity profit of ฿ 10,275. Activity profit/rai was obtained by dividing activity profit by the area under the activity. In the same case, ฿ 321 was obtained by dividing 10,275 by 32.

The net activity income (NAI) for each column is obtained by including the imputed value of the family labour charge from the activity profit. But since the activity profit incorporated the calculation of the family labour charge and five per cent contingencies and 12 per cent interest on borrowing, this has to be calculated backwards and then the five per cent and 12 per cent charges on family labour expenditure together with the family labour charge itself added to the activity profit to obtain the net activity income.

The calculation of this for each column can be illustrated through the rice activity.

Family labour charge = ฿ 6,960

Family labour charge plus 5% on contingencies

$$= \frac{6,960 \times 105}{100} = 7,308$$

Family labour charge plus 5% contingencies with 12 per cent interest on borrowing $= \frac{7,308 \times 112}{100} = 8,185$

Activity profit = ฿ 10,725

Net activity income = ฿ 10,275 + 8,185

= ฿ 18,460

The net activity income (NAI) was then divided by the number of mandays of farm family labour on the activity. The result is the

NAI/manday which gives the return per day of family labour. It has already been suggested that labour inputs for prawns, especially for family labour, were considerably understated. As a result, NAI/manday for prawns is probably considerably overstated, while that for rice and cassava appears more realistic.

4.4 Summary

In this chapter a method for considering the relative profitability of prawns from the farmers' viewpoint was derived. The results which emerge from this analysis are considered in the next chapter.

CHAPTER 5

FINANCIAL ANALYSIS OF PRAWNS, RICE AND CASSAVA - RESULTS

A summary of results on farm budgeting are shown in Tables 5.1, 5.2 and 5.3. Table 5.1 shows the estimated average costs and returns per rai of giant freshwater prawn production by farm size. Table 5.2 and Table 5.3 show the estimated average costs and returns per rai of rice and cassava production respectively.

5.1 Explanation of the Tables - Prawns

5.1.1 Initial Investment - Pond Construction

Initial investment in pond production of prawns for the small farms in Kalasin and Roi Et averages ฿ 4,199/rai ($1,312/ha) while in Chachoengsao this is about ฿ 9,103/rai ($2,845/ha). Pond construction costs in Chachoengsao are much higher than in the north east provinces as farmers in Chachoengsao received no government assistance with pond construction. The average costs of pond construction in Chachoengsao reflect the earlier construction costs since farmers there have been growing prawns for a few years. The current estimated cost of pond construction with no government subsidy would be about ฿ 10,000 per rai for a simply constructed pond with pipe inlets and outlets. A well-designed pond with a concrete sluice gate and drainage system will cost about ฿ 20,000 per rai or $6,250/ha (DOF and FAO/UNDP, 1980).

TABLE 5.1

ESTIMATED AVERAGE COSTS AND RETURNS PER RAI OF GIANT FRESHWATER PRAWN PRODUCTION BY FARM SIZE

	SMALL (<10 RAI)				LARGE (>50 RAI)		TOTAL FARMS	
	KALASIN AND CHACHOENGSAO ROI ET				ROI ET		3 PROVINCES	
SAMPLE SIZE	23		7		1		31	
INITIAL COSTS (฿)								
Pond Construction	2,855		7,266		137		2,731	
Other Facilities and Equipment	1,344		1,747		413		1,089	
Total	4,199		9,013		550		3,820	
PRODUCTION AND REVENUE								
Production (kg)	126		106		166		136	
Price (฿/kg)	160-180		143(100-200)		160-180		168	
Gross Revenue (฿)	21,638		15,351		28,250		22,790	
ANNUAL OPERATING COSTS (฿)								
Variable Costs								
Post-Larvae Stocking Rate/m^2	4		4		5		4	
Cost	2,590	31	1,621	25	3,003	34	2,552	31
Feed	2,909	35	1,746	27	2,243	25	2,449	30
Labour	371	4	274	4	1,495	17	753	9
Electricity	9	<1	10	<1	-	-	6	<1
Fuel and Oil	241	3	438	7	516	6	377	5
Maintenance	12	<1	139	2	-	-	32	<1
Others	442	5	401	6	363	4	406	5
Total	6,574		4,629		7,620		6,575	
Fixed Costs								
Land Rent	200	2	200	3	200	2	200	2
Depreciation	190	2	137	2	60	1	134	2
Interest	1,385	17	1,499	23	932	11	1,245	15
Total	1,775		1,836		1,192		1,579	
Total Cost	8,349	100	6,465	100	8,812	100	8,154	100
GROSS MARGIN (฿)	15,064		10,722		20,630		16,215	
PROFIT (฿)	12,652		8,886		19,438		14,636	
RATE OF RETURN TO INITIAL INVESTMENT(%)	301		99		3,534		383	
RATE OF RETURN TO ANNUAL OPERATING COST (%)	152		137		221		179	
COST OF PRODUCTION PER KG OF PRAWN (฿)	66		61		53		60	

TABLE 5.2

ESTIMATED AVERAGE COSTS AND RETURNS PER RAI OF RICE PRODUCTION

SAMPLE SIZE	23	
PRODUCTION AND REVENUE		
Production (kg)	378	
Price (฿/kg)	2.34	
Gross Revenue	885	
SEASON OPERATING COSTS (฿)		
Variable Costs		%
Seed	25	3
Fertilizer	32	4
Fuel and Oil	3	<1
Insecticides	2	<1
Transportation	7	1
Serviced Hired	36	4
Labour	249	31
Others	25	3
Total	379	
Fixed Costs		
Land Rent	200	25
Depreciation	21	3
Interest	212	26
Total	433	
Total Cost	812	100
GROSS MARGIN (฿)	506	
PROFIT (฿)	73	
RATE OF RETURN TO SEASON OPERATING COST (%)	9	
COST OF PRODUCTION PER KG OF PADDY (฿)	2.15	

TABLE 5.3

ESTIMATED AVERAGE COSTS AND RETURNS PER RAI OF CASSAVA PRODUCTION

SAMPLE SIZE	7	
PRODUCTION AND REVENUE		
Production (kg)	1,766	
Price (฿/kg)	0.66	
Gross Revenue (฿)	1,054	
ANNUAL OPERATING COSTS (฿)		
Variable Costs		%
Seed	2	<1
Fertilizer	2	<1
Fuel and Oil	21	2
Selling Cost	45	5
Transportation	67	8
Serviced Hired	98	12
Labour	295	35
Others	27	3
Total	557	
Fixed Costs		
Land Rent	200	24
Depreciation	19	2
Interest	67	8
Total	286	
Total Cost	843	100
GROSS MARGIN (฿)	497	
PROFIT (฿)	211	
RATE OF RETURN TO ANNUAL OPERATING COST (%)	25	
COST OF PRODUCTION PER KG OF CASSAVA ROOT (฿)	0.48	

Under government assistance for pond construction, the farmers in Kalasin and Roi Et only had to pay for the cost of fuel for heavy machineries, operator allowance and, in some cases, food. Larger ponds can be constructed at a lower cost per rai because of economies of scale, but the ฿ 137/rai paid by the largest farm, Farm 19, seems too low. This could be due to misreported or preferential treatment by government officials.

Overall average pond construction cost is ฿ 2,731/rai and this is because most areas where ponds were constructed were subsidized by government agencies. Only one large farm represents about 34 per cent of area investigated and thus bring the cost of construction down.

5.1.2 Initial Investment - Other Facilities and Equipment

Each prawn farmer must normally have access to the following facilities and equipment:

- nylon netting for pond perimeter.
- a water pump and the associated pipes.
- nets (cast net and/or trawl net).
- cooking equipment for prawn feed (some farms only).

Many prawn growers particularly small ones, understandably prefer not to buy equipment in the initial stages but to borrow or hire it, or use traditional methods for moving water. Some are able to utilise government-owned equipment.

For many farms initial costs are therefore low, and to the extent equipment is borrowed or hired at low cost, profitability is

probably slightly overstated. Out of 24 prawn farms in the north east, only eight farms possess water pumps while six out of seven farms in Chachoengsao possess the facility. Average initial cost per rai on facilities and equipment is therefore higher in Chachoengsao but lowest in the large farm due to economies of scale.

5.1.3 Production and Price - Revenue

Average yield per rai was highest for the large farm (19) and lowest for the small farms in Chachoengsao. The yield of 166 kilograms/rai attained on the large farm is not really high considering the farm had been growing prawns for a few years. However, it is the belief of the interviewers that the large farm understated yield in the mistaken belief that the taxation authorities may have had access to the questionnaires.

One possible reason for the low yields in Chachoengsao is the difficulty experienced obtaining a regular supply of fresh water throughout the year in that area. For about 3-4 months each year sea water flows into the Bangpakong River. Although the prawns can survive under such an environment growth is retarded and yields lower. The average price received by farmers in Chachoengsao is thus lower and the number of market size prawns is also small.

The highest yield on a farm in the sample was less than 170 kg/rai. This is low compared to the yield the DOF thinks farmers could have obtained. One possible explanation is that mortality rates were higher than expected at between 50 and 70 per cent. Another possibility is that the ponds were understocked because small farmers had difficulties obtaining prawn juveniles. This is discussed further in Chapter 6.

5.1.4 Annual Operating Costs

Feed, juvenile prawns and interest are the most important operating costs for small farms in both the north east and Chachoengsao. Feed and post-larvae alone account for more than 65 per cent of total operating expenses in the northeastern farms and about 52 per cent in Chachoengsao. In the large farm (19), most important operating costs are post-larvae, feed, labour and interest. The four components make up about 87 per cent of total operating expenses.

On average, expenditure on post-larvae and feed are roughly equal and together account for about 60 per cent of the total operating cost. Interest is the third major cost component accounting for about 15 per cent while labour accounts for about nine per cent of operating cost and ranks fourth.

Both family and hired labour was assumed to cost ฿ 25/day, the going rate for light agricultural labour, even though the official minimum for agricultural labour is ฿ 45.

Although data on labour used throughout the cycle from preparation to harvesting prawns was collected in the survey, the results suggest there may be a considerable understatement for most farms. Farm 19 had a labour cost of 17 per cent of total operating cost which appears reasonable, while other farms averaged around four per cent. In Hawaii, where wage rates are higher, labour accounts for about 42 per cent of the total annual operating expenses for a 1-acre (2.5 rai) farm and about 23 per cent for a 100-acre farm (Shang and Fujimura, 1977).

It is well known that it is very difficult to get accurate labour input estimates for each activity on a small mixed activity

family farm using recall survey techniques. Further, interviewers were often relatively unfamiliar with prawn raising techniques and probably did not ask searching questions as they would have for better known crops such as rice and cassava.

Labour costs for prawn production on most farms are almost certainly underestimated. Harvesting and feeding are time-consuming jobs. Feeding has to be done on a daily basis although not much time is required at each feeding. Harvesting needs a number of people to perform and there may be several harvested each year. More time will be required if ponds are drained and prawns caught.

5.2 Explanation of the Tables - Rice

Table 5.2 was derived from the 23 farms that grew rice in the three provinces. Since the farmers under survey have been growing rice for a number of decades and since, in general, the initial investment in this activity was low, no attempts has been made to calculate the initial investment cost.

Moreover, no reliable information was obtained on whether the figures reported for each farm referred to dry or wet season rice. However, most of the farmers, especially those in the north east, grew rice only in the wet season, and it is therefore likely that the figures refer to wet season rice. Another difficulty is that most farmers in the north east (Kalasin and Roi Et) grew both glutinous and non-glutinous rice. There is insufficient information in the questionnaires to allow the different types of rice to be treated separately, and figures relating to both varieties are of necessity included in the table.

Only 12 of the 23 rice farmers applied fertilizers to their rice fields while nine used insecticides. Thus, rice yield varied considerably from farm to farm ranging from 128 to 650 kg/rai in Kalasin, 231 to 552 kg/rai in Roi Et and 205 to 820 kg/rai in Chachoengsao. Average yields in the three provinces were 355, 384 and 470 kg/rai in turn making an overall average of 378 kg/rai. The higher average yields in Chachoengsao can perhaps be explained by a greater availability of water and fertile land, and a greater use of high yielding varieties.

The price paid for rice varied with the quality of rice paddy from B 1.5/kg to ฿ 3.20/kg. Most farms, however, received about ฿ 2.30/kg.

The average operating cost for the whole season was about ฿ 800/rai and this consisted mainly of labour charges, interest and rent. Interest charges on fixed costs are high because three farms (24, 29, 33) had particularly large storage areas for rice. Farms with smaller storage facilities therefore would expect higher profits.

If fixed costs and the imputed charges for family labour are ignored, rice activity profit was almost ฿ 755/rai on average. Including these costs reduces profit to ฿ 73/rai. These results clearly indicate that land devoted to prawns produces a far greater monetary return than land planted to rice. In fact, 222 rai would have to be planted to rice to earn as much as one rai under prawns.

5.3 Explanation of the Tables - Cassava

Table 5.3 was based on the results of the activity budgeting in only seven farms, six from Kalasin and one from Roi Et. These

were the only farms in the sample that grew cassava. The average yield was 1,766 kg/rai which is low compared to an estimate of a maximum potential yield for the area of 5,000 kg/rai (Rojanaritphichet, 1976). This low yield probably was the result of not applying fertilizer to the crop. The only farm (Farm 8) that applied fertilizer to cassava obtained the highest yield of 3,455 kg/rai. The lowest yield was 744 kg/rai in farm 10.

Cassava reaches maturity after about 12 months in the ground, about three times the time needed for rice. The price paid to farmers fluctuates from year to year but is usually around ฿ 0.40/ kg. However, the average price received by farmers in the sample was relatively high (฿ 0.60/kg). With such a good price, the average gross revenue per rai from cassava was ฿ 1,054 which is higher than that of rice mentioned earlier.

No initial investment cost was involved in cassava production since special land preparation is not needed. Moreover, cassava is relatively perishable and is generally sold soon after harvest to prevent deterioration. This avoids the need for storage facilities. Rice on the other hand must be stored for some periods, and therefore requires higher fixed costs than cassava.

Labour is the major cost of cassava production, with planting and weeding normally done by hand. Land rent is the second largest cost component followed by charges for hiring such services as tractors for land ploughing and occasionally for harvesting.

These variable costs are generally higher than those of rice. This is because tractors are used to plough cassava land more often than rice fields. Moreover, the cartage of cassava stems

for planting and the sale of the produce requires transport facilities in excess of those needed for rice which is generally consumed on the farm.

Because variable costs were higher, the GM/rai from cassava was slightly lower than that of rice, but profit/rai was higher with cassava because its fixed costs were lower than with rice. However, rice might still be considered to be more attractive than cassava because it requires a growing period of between four to six months compared with around twelve months for cassava.

The comparison of prawns with cassava is similar to that of prawns with rice. Prawns were far more profitable. On average, 77 rai would have to be planted to cassava to earn as much profit as one rai under prawns. However, both the fixed and variable costs required to earn this profit were much higher for prawns.

5.4 Sensitivity Analysis - Prawns

Agricultural production, whether it be crops, livestocks or aquaculture, is characterized by uncertainty. A very important question is what will happen if something goes wrong. Examples of questions which may arise from farmers' point of views can be given here. Would farmers still be profitable without government's subsidies? What will happen to farmers' earning capacity if cost of production increases or prawn price changes? How much yield must be obtained to cover cost of production when it increases? These type of questions may be answered by a technique called sensitivity analysis which is just a simple reworking of prior

analysis to see what happens under changed circumstances such as lower prices, higher costs, lower yields etc.

One of the objectives of this study is to derive policy implication on prawn farming. The RTG via the DOF is encouraging farmers on prawn production. The farm budgeting analysis showed that the farms under survey gained a much greater profit per rai allocated to prawns than to either rice or cassava. But most of these farms were assisted by the government with pond construction. The going rate for pond construction has been much greater than what farmers paid under government subsidies. The first question that needs an answer is whether farmers would still have made profits if they had paid the market rate for pond construction.

At times the government also subsidizes the purchase of prawn juveniles or prawn fry. The subsidized price is ฿ 250 per 1,000. However, in this study most farms did not obtain their stocks from the government hatcheries and had to pay the market rate of ฿ 300-450 per 1,000. A sensitivity analysis on this subsidy is thus not very meaningful. Instead, under the present situation in Thailand where an economic crisis is being faced, a sensitivity analysis in terms of an overall increase in the costs of production would be more appropriate. Since rice and cassava are not as profitable relative to prawns, and much work of this nature has been done previously (e.g., THAILAND, AED, 1978), this study does not intend to do any sensitivity analysis on these crops.

5.4.1 No Government Subsidy on Pond Construction

Table 5.4 shows the estimated average costs and returns per rai for giant freshwater prawns without government assistance in

TABLE 5.4

ESTIMATED AVERAGE COSTS AND RETURNS PER RAI OF GIANT FRESHWATER PRAWN PRODUCTION (WITHOUT GOVERNMENT ASSISTANCE IN POND CONSTRUCTION)

SAMPLE SIZE	31	
INITIAL COSTS (฿)		
Pond Construction	10,000	
Other Facilities and Equipment	1,089	
Total	11,089	
PRODUCTION AND REVENUE		
Production (kg)	136	
Price (฿/kg)	168	
Gross Revenue (฿)	22,790	
ANNUAL OPERATING COSTS (฿)		
Variable Costs		%
Post-larvae		
Stocking Rate/m^2	4	
Cost	2,552	29
Feed	2,449	28
Labour	753	8
Electricity	6	<1
Fuel and Oil	377	4
Maintenance	32	<1
Others	406	5
Total	6,575	
Fixed Costs		
Land Rent	200	2
Depreciation	134	2
Interest	1,989	22
Total	2,323	
Total Cost	8,898	100
GROSS MARGIN (฿)	16,215	
PROFIT (฿)	13,892	
RATE OF RETURN TO INITIAL INVESTMENT (%)	125	
RATE OF RETURN TO ANNUAL OPERATING COST (%)	156	
COST OF PRODUCTION PER KG OF PRAWN (฿)	65	

pond construction. The only difference between this table and the average activity budget for prawns derived earlier (Table 5.1) is that pond construction is priced at the assumed market rate of ฿ 10,000/rai. This increases the interest imputed on initial investment, and the cost of production of one kg of prawns rises from ฿ 60 to 65. This results in only a slight change in profit/rai from ฿ 14,636 to ฿ 13,892. The rate of return to initial investment decreases about three times to 125 per cent but farmers would still be able to pay off a loan for pond construction after their first year of prawn farming. The rate of return to annual operating cost fell from 179 per cent to 156 per cent but is still many times higher than those for rice and cassava (nine and 25 per cent) respectively.

The results from Table 5.4 indicate that without a government subsidy on pond construction, prawn activity is still far more profitable than rice and cassava. If farmers could readily obtain the finance for pond construction from other sources, this might indicate that the government subsidy is misplaced. This is discussed in more detail in Chapter 6.

5.4.2 Changes in the Price of Prawns

The other question which must be answered is what happens to the profitability of prawns if there are changes in either the price of prawns or the cost of production. In Table 5.5 the break even production per rai of prawns is estimated for different assumed output prices. The estimates for Kalasin and Roi Et, and for Chachoengsao are based on the average cost figures for the two areas

TABLE 5.5

ESTIMATED BREAK-EVEN PRODUCTION PER RAI OF PRAWNS BY FARM SIZE, FOR VARYING OUTPUT PRICES

Price of Prawns (฿/kg)	Break-even Production (kg/rai)			
	Small Farm (average) <:0 rai		Large Farm* 53.5 rai	Average for all Farms
	Kalasin and Roi Et	Chachoengsao	Roi Et	Three Provinces
80	104	81	110	102
90	93	72	98	91
100	84	65	88	82
110	76	59	80	74
120	70	54	73	68
130	64	50	68	63
140	60	46	63	58
150	56	43	59	54
160	52	40	55	51
170	49	38	52	48
180	46	36	49	45
190	44	34	46	43
200	42	32	44	41

* One observation.

identified earlier. The large farm is included for comparative purposes.

Average production in Kalasin and Roi Et was 144 kg/rai while in Chachoengsao it was 106 kg per rai. The table indicates that even if the current price of around ฿ 160/kg was halved to ฿ 80/kg, the average farm would still have made a profit on prawns. It was shown earlier that rice and cassava production yielded net

returns of ฿ 73/rai and ฿ 211/rai respectively. This information used along with Table 5.5 indicates that a yield of 106 kg per rai of prawns in Kalasin and Roi Et and 83 in Chachoengsao would be sufficient to make prawns more attractive in terms of net returns than either of the other crops. Given that average yields in both areas were higher than these figures, it can be concluded that prawns would still be the most profitable crop on the average small farm even if the price of prawns was halved.

5.4.3 Changes in the Price of Prawns and the Cost of Production

One of the most important questions in prawn farming is whether prawns are still profitable when the cost of production increases and the price of prawns decreases. A way of looking at this is to estimate the yield at which farms would break even (i.e., produce zero profit) under different price and cost assumptions.

Table 5.6 shows the estimated break-even production per rai of prawns on the average farm under increasing production costs and varying farm prices. The table indicates that if the current price of around ฿ 160/kg was halved and the cost of production doubled, none of the farms in the survey would have broken-even, i.e., no farms attained as high as 222 kg/rai.

The line KK^1 is the border at which the average farmer from Kalasin would have broken-even. At any combination of prices and cost increases to the north east of this line, the average Kalasin farmer would have made a loss. For example, a price of ฿ 100/kg combined with a 60 per cent increase in costs would have required a yield of 142 kg/rai to break-even. This was greater than

TABLE 5.6

ESTIMATED BREAK-EVEN PRODUCTION PER RAI OF PRAWNS ON THE AVERAGE FARM UNDER INCREASING PRODUCTION COSTS AND VARYING OUTPUT PRICES

Price of Prawns (฿/kg)	Break-even Production (kg) in Relation to % Increase in the Average Annual Operating Cost									
	K^1 10	20	30	40	R^1 50	60	70	80	90	100
80	122	133	145	156	169	178	189	200	211	222
90	C^1 109	119	129	138	148	158	168	178	188	198
100	98	107	116	125	133	142	151	160	169	178 R
110	89	97	105	113	121	129	138	146	154	162
120	82	89	96	104	111	119	126	133	141	148
130	75	82	89	96	103	110	116	123	130	137
140	70	76	83	89	95	102	108	114	121	127 K
150	65	71	77	83	89	95	101	107	113	119
160	61	67	72	78	83	89	95	100	106	111 C
170	58	63	68	73	79	84	89	94	99	105
180	54	59	64	69	74	79	84	89	94	99
190	52	56	61	66	70	75	80	84	89	94
200	49	53	58	62	67	71	76	80	85	89

the average yield in Kalasin of 122 kg/rai. Obviously 122 kg/rai was more than enough to break-even if the price had been ฿ 140/kg and costs were 80 per cent higher - in this case the average farmer would have broken-even with a yield of 114 kg/rai. The line RR^1 and CC^1 are similar border lines for Roi Et and Chachoengsao where average yields were 166 and 106 kg/rai respectively.

The results indicate that profits in Chachoengsao were more sensitive to price and cost fluctuations than those in the other two

areas. This was because yields in Chachoengsao were particularly low, perhaps due to the problems of water supply mentioned earlier. However, yields in all three provinces were low compared to those the DOF thought could be attained, but are likely to improve as farmers gain more experience. If this occurs, quite considerable changes in prices and costs are unlikely to reduce profits from prawn production as low as those obtained from rice or cassava.

5.5 Regression Analysis

In an attempt to clarify some of the conclusions that were reached in earlier sections, regression analysis was employed. Dillon (1968) argues that two following assumptions must be incorporated into any analysis of crop or livestock production.

(1) there is a continuous smooth causal relationship between the X's (inputs) and Y (output);

(2) Diminishing Returns prevail with respect to each input factor X_i so that the additional output from succeeding units of X_i becomes smaller and smaller; indeed, beyond some peak yield, additional units of X_i may have an increasingly deleterious effect on yield (Dillon, J.L. 1968).

In the present study, we are not dealing with output or input in physical terms, but are interested in the relationship between revenue and costs, i.e., profits. However, since these are simply outputs and inputs multiplied by their respective prices the theory of crop and livestock response is also applicable for our purpose.

However, the scatter of observations shown in Figure 5.1 suggests that few farms had reached the point of diminishing returns to scale. Thus a linear specification would appear to be a suitable approximation of the relationship between variable costs and revenue for the range of observations revealed by the sample. This does not, however, deny that if farmers increased inputs beyond that observed in the sample (and therefore increased variable costs per rai) that revenue could perhaps fall.

The results of the simple linear regressions for the three activities are found in Table 5.7 and the estimated regression lines in Figure 5.2. In all cases, the standard errors for the Y-intercept are large and T-values are thus small. The 95 per cent confidence intervals show that all of the Y-intercept values are not significantly different to zero. Large standard errors suggest that the farms under observation varied greatly in terms of variable inputs and revenue gained reflecting varying methods of production, levels of production and management. Minus signs on the parameters in the first two equations are to be expected as they reflect large fixed costs. The larger figure for prawns is appropriate as prawn activity requires more fixed inputs than rice. Cassava, on the other hand, requires very few fixed factor inputs, and this is reflected in the value of the estimated Y-intercept. The equations therefore provide weak support for the earlier finding that prawn production requires greater inputs of fixed factors than the other crops.

All variable input coefficients are highly significant indicating significant effects on gross revenue. They are highest

FIGURE 5.1a

PRAWN

REVENUE VS. VARIABLE COST (EXCLUDING FARM 19)

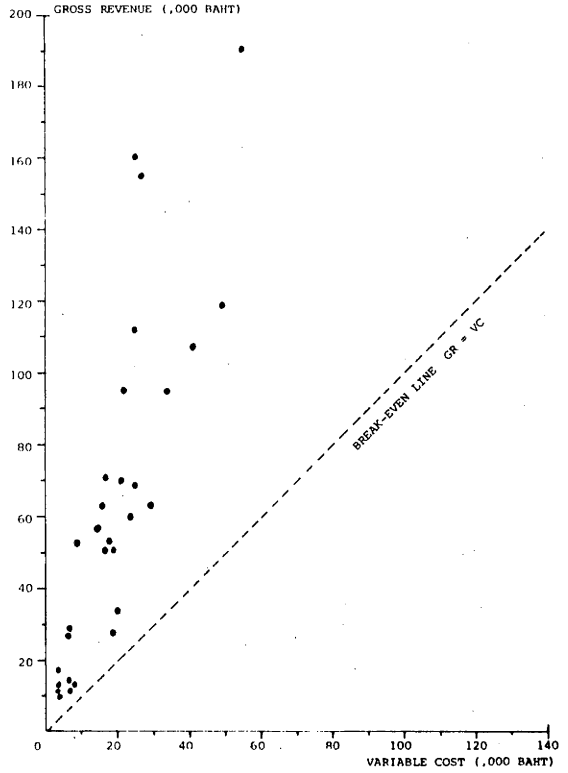


FIGURE 5.1b

RICE (PADDY)

REVENUE VS. VARIABLE COST

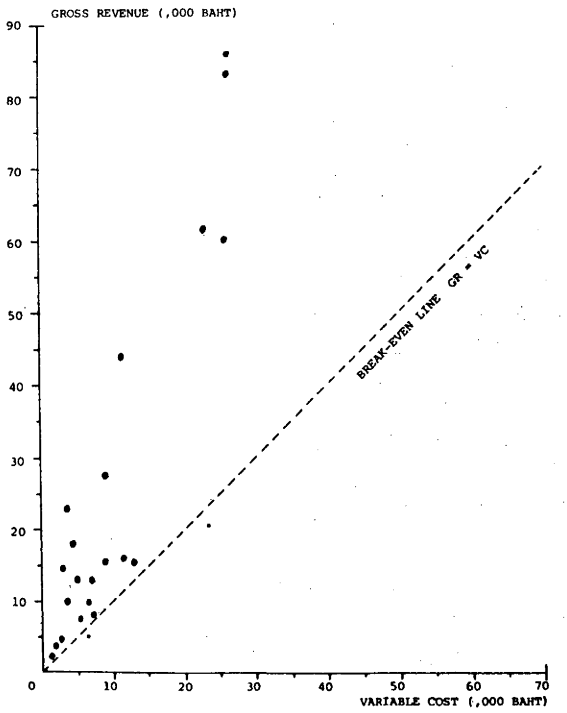


FIGURE 5.1c

CASSAVA

REVENUE VS. VARIABLE COST

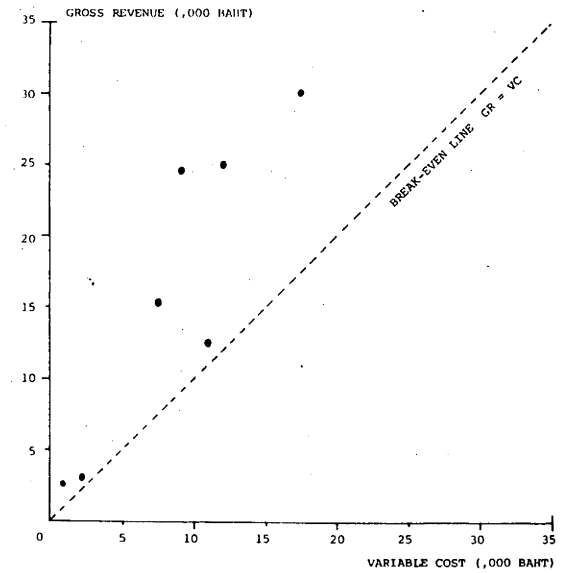


FIGURE 5.1

GROSS REVENUE VS VARIABLE COSTS FOR PRAWN, RICE AND CASSAVA

FIGURE 5.2

ESTIMATED REGRESSION LINES FOR PRAWN, RICE AND CASSAVA

(for observed range of data)

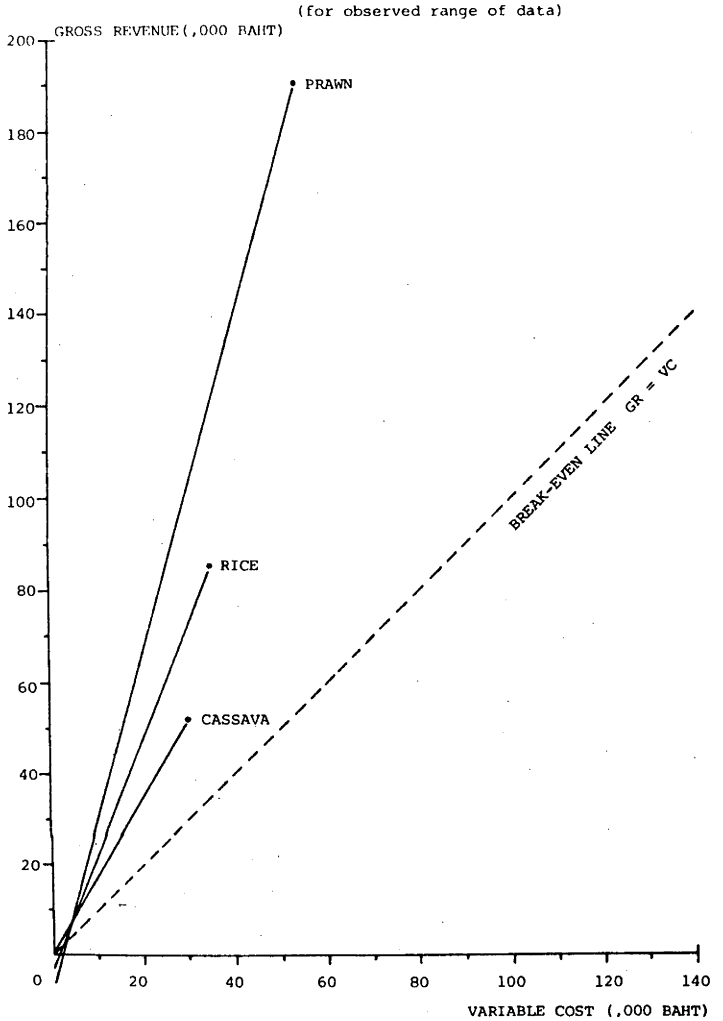


TABLE 5.7

ESTIMATED REGRESSION LINES FOR PRAWNS, RICE AND CASSAVA

Prawn (sample size n = 31)

	Y =	- 7,810.13 +	3.71 X
Standard Error		(4,991.48)	(0.07)
T-value		(1.56)	(56.99)**
95% C.I		(±9,294.33)	(±0.13)

R^2 = 0.98

Rice (n = 23)

	Y =	- 2,010.60 +	2.52 X
Standard Error		(4,338.19)	(0.32)
T-value		(0.46)	(7.95)**
95% C.I		(±5,478.10)	(±0.66)

R^2 = 0.74

Cassava (n = 7)

	Y =	1,039.76 +	1.72 X
Standard Error		(4,014.15)	(0.36)
T-value		(0.26)	(4.73)*
95% C.I		(±4,795.44)	(±0.93)

R^2 = 0.79

N.B. Y = Gross Revenue
X = Variable Costs
* denotes significant at .01 level
** denotes significant at .001 level

for prawns as would be expected from the earlier analyses, second for rice and lowest for cassava. These results also support our previous analysis on activity budgeting.

CHAPTER 6

FACTORS INFLUENCING THE ADOPTION AND EXPANSION OF PRAWNS

The results of the activity budgeting and the analysis in the last chapter indicated that prawns are much more profitable than rice and cassava. Yet most farmers in the sample used for this study grow either rice or cassava, despite having produced prawns in some cases for a number of years. In addition, only a very small percentage of the total number of farms in the provinces where the sample was drawn grew prawns. In this chapter an attempt will be made to reconcile the profitability of prawns with their apparently low acceptance in the community. Two factors will be considered. Firstly, the possibility that there may be physical constraints on the availability of inputs such as suitable land, prawn juveniles and extension service will be discussed. Secondly, attention will be focused on factors other than profitability which may influence the farmer's decision about switching to prawns. This is a particularly important question given that the government has been encouraging farmers to grow this new crop.

6.1 Physical Constraints on Prawn Production

6.1.1 Land

Some land is not suitable for prawn cultivation.

(a) Type of Soil

As mentioned in an earlier chapter, ponds should be constructed on land where the water holding capacity of the soil is high. Clay, loam, clay loam and sandy loam are suitable soils. (THAILAND, DOF, 1980).

(b) Topography

Land that is too low or too high is not suitable for rearing prawns. Low lying land is subject to flood during the rainy season while upland areas face problems of water shortages in the dry season. Land should also be relatively flat with a slope less than 5 per cent (Shang, 1981).

6.1.2 Lease Conditions

Problems of land tenure may limit a new activity such as prawns which require substantial fixed investment in ponds and other facilities. Large numbers of small farmers rent land, either on short term written contracts or by verbal agreements and this type of land tenure is traditionally insecure. These farmers may be unwilling to undertake the initial high investment when they might be required to hand back the land to the landlord within a short time. Also, tenants may be unwilling to engage in a high-profit activity, fearing the landlords may raise rental or even take back the land to farm the prawns themselves.

6.1.3 Location

This is also a very important constraint on prawn culture in terms of the availability of fresh water, water quality and the access to prawn hatcheries, feed dealers and markets.

The availability of fresh water is of crucial importance for aquaculture, especially for prawns, as rearing lasts for at least 8 months. The optimal method where prawns are reared all year round with continuous culling and stocking, requires a plentiful supply of fresh water throughout the year. Thus, ponds must be located near natural water resources or

irrigation canals otherwise wells must be constructed. Well construction is costly and farmers, especially small ones, could also face a constraint on credit. This will be discussed later.

Water quality is an important determinant of the survival and growth rates of prawns. Water polluted by factory waste or by chemicals from other agricultural crop production can kill prawns. Farmers owning land that must be serviced by polluted water sources cannot therefore cultivate prawns.

Prawn farms should also be located within easy access of prawn hatcheries. Long distances from hatcheries mean high transportation costs and high juvenile mortality rates. Moreover, prawn juveniles are in short supply as will be discussed at a later stage. Farmers close to hatcheries have more chance of ensuring supply than those who live some distance away.

Finally, farms should be situated reasonably close to input supplies and to prawn purchasing facilities. This is particularly important because prawns are highly perishable and long journeys can result in rapid product deterioration. Thus, farmers in outlying areas are less likely to begin to grow prawns than those who live closer to purchasing points.

6.1.4 Extension Services

Prawn cultivation is a new activity to Thai farmers and involves completely different techniques to those employed with the traditional crops of rice, cassava, kenaf and peanuts. Knowledge of these techniques is limited and there are very few ways that farmers can acquire the necessary information. Only the Chachoengsao Fisheries Station has been actively involved in providing extension services to farmers.

Qualified fisheries technicians are in relatively short supply in Thailand. Many are in research and administration positions and the demands from other parts of the Thai fishing industry for extension staff are considerable. It may therefore take some time to build up effective extension services for prawn farming especially if some retraining of existing staff is required. It would appear that the extension services are insufficient to provide the necessary knowledge about prawn cultivation and they therefore act as a constraint on the adoption of this new crop.

6.1.5 Credit

It was shown in Chapter 5 that both the initial investment cost and annual operating costs of prawn production are high. Despite the fact that the farmers in the sample appeared to be better off than the average farmer, 31 out of 35 farmers had to borrow to finance their prawn cultivation.

Possible sources of finance include the BAAC, commercial banks, agricultural cooperatives, merchants, private moneylenders, neighbours, saving cooperatives and relatives. Out of the 31 farmers mentioned above only 9 obtained loans from the BAAC, 7 from the commercial banks and 5 from the agricultural cooperatives. The remainder relied on other sources.

The BAAC is primarily concerned with lending to small farmers at the subsidized interest rate of 12%. Other banks charge 15%-17%. However, it has been shown that only a small percentage of the farmers in the sample received loans from this institution. The reasons may include (i) only a limited amount of credit is available from this source, (ii) farmers may not be

aware of the BAAC, and (iii) farmers' assets may not satisfy the requirements set by the Bank on releasing loan.

However, probably the more binding constraint on small farmers in their dealings with all the lending institutions is the need to lodge land holding documents as security. A large proportion of small farmers in Thailand are heavily in debt to private moneylenders who have retained their documents. These farmers therefore have no prospects of obtaining loans from banks.

Farmers with short or insecure leases will also find it very difficult to obtain institutional credit. Being a new activity lenders may often be unwilling to lend without more knowledge of the risk and profitability of prawn farming.

6.1.6 Juveniles

The availability of prawn juveniles is one of the most important constraints. As mentioned earlier, the stocking rate recommended by the DOF for prawn juveniles aged about 3 months (2.0-2.5 cm. long) is 32,000 per rai. In general, this is the age when juveniles are sold for pond rearing. Currently the government and private hatcheries together produce only 26 m. juveniles per annum which is sufficient to stock only 813 rai at a full stocking rate.

However, at present, an area of about 2,346 rai is devoted to pond rearing prawns. This implies that the average stocking rate is about one-third of the recommended level, although the sample showed that stocking rates varied considerably. Much of this can be attributed to the difficulty in obtaining an adequate quantity of juveniles at the correct time.

In the farms studied, stocking rates averaged $4/m^2$, well below the recommended rate of $20/m^2$. This is almost certainly the result of lack of juveniles.

6.1.7 Conclusion

At the beginning of this chapter two important questions were posed: why have many farms failed to become involved in prawn farming? and why do those who grow prawns continue to grow other crops at the same time while prawns are more profitable?

We have postulated that physical constraints posed by land, location, extension services, credit , and the availability of juveniles can inhibit farmers to grow prawns. But without detailed further research on the above constraints, it is difficult to come to definite conclusions about how important they are.

Land, location and extension services may explain why some farmers have not switched to prawns at all but cannot explain why those who do grow prawns still grow other crops in spite of the fact that most of them own rice land which can be converted easily to prawn ponds.

The availability of credit and juveniles, particularly the latter, may be the important answers to the last question. But still the question cannot be readily answered by the two constraints. There must be some other reason involved in farmers' decision-making.

6.2 Other Factors Affecting Farmers' Decision-Making

Recent developments in utility theory suggest that farmers take factors other than profit into account when making

decision (e.g. Anderson, Dillon and Hardaker, 1977). Some of those which may be important in the Thai case are discussed in this section.

6.2.1 Risk

Although the results of this study showed that prawns were highly profitable compared to rice and cassava, like any agricultural activity, prawns are subject to risk. Prawn production in any given season could fail for reasons such as floods, droughts, diseases and particularly poor management techniques. For example, poor control of predators or the use of contaminated water could destroy the crop. In Malaysia 45 per cent of prawns on one farm died within 3 days as a result of poor water management and over-fertilization (Green et al., 1977).

Thus unfavourable events could result in losses and it is likely that farmers would take this into account when considering prawn production. Farmers would not choose to grow prawns if they considered the expected pay-offs too low. Similarly farmers growing prawns would not expand production if they expected lower returns than obtained under present patterns of use.

Two aspects of the expected returns to prawns are considered in this section. Firstly, the range of possible returns is discussed with particular attention focussed on the costs of failure. Secondly, the likelihood of failure is considered in view of the results obtained from the sample farms.

(a) Returns and the Cost of Failure

The cost of failure must be considered in any analysis of risk. Earlier the high cash requirements for prawn production, both for fixed and variable inputs, were noted. Large sums of credit were generally necessary to meet these costs. The total failure of a prawn crop could therefore result in high cash losses and could create levels of indebtedness which might take many years to repay. In many cases these debts would result in the loss of land to the creditor. These costs are far greater than for rice and cassava which require fewer cash inputs. Thus the cost of total failure is high for prawns, and some farmers may prefer not to take the risk even if the average return is quite high.

To get an indication of the impact of any factor which might reduce yields (or gross revenue) below their 1980 levels, Figure 6.1a sets out the profits/rai and cost/rai of some of the farmers in the sample and the point to which gross revenue could be reduced before the farmer moved into a loss situation. This is shown by the intersections of the lines with the X-axis. A frequency distribution of the intercept values for all farmers is also included in Figure 6.1b and indicates that only 6 farms would make a loss if gross revenue fell to 50% of 1980, and costs remained the same.

Figure 6.1a can also be used to indicate the profit profile of the sample farms, for a fall in output. For example, if output per rai fell 30%, the profit profile is indicated by the intercepts along the dotted line marked on the figure. (Not all farms are included for clarity). Table

6.1 includes x-intercept values for all farms in the sample.

This analysis suggests that even with considerable falls in revenue, most farmers will still make a profit. However, this may not be sufficient to repay loans where these are a high proportion of costs.

The results also support the argument that the monetary cost of a total failure in the prawn activity is high. This perhaps is a reason why some farmers continue with diversified farming activities while including prawns as a source of cash.

Mixed farming is, in many ways, a strategy of reducing risk. In any one production period, exogenous factors would not normally influence the production (and therefore farmers' profitability) of various activities to the same extent. Some exogenous factors may even improve profitability for one activity and reduce it for another.

Another aspect of mixed farming at low levels of income is that much or all of one crop will be used for subsistence consumption. This would be true of most of the rice grown by the sample farmers in this study. To be reasonably certain that one has sufficient farm produce to feed the family for the year may well take a higher priority for some farmers than a lesser certainty that a cash crop will provide sufficient income to purchase food.

(b) The Probability of Failure

Before adopting prawns, the farmer would not only consider the cost of failure for prawns but also the probability that such a failure might occur. In Figure 6.2 the ranges of

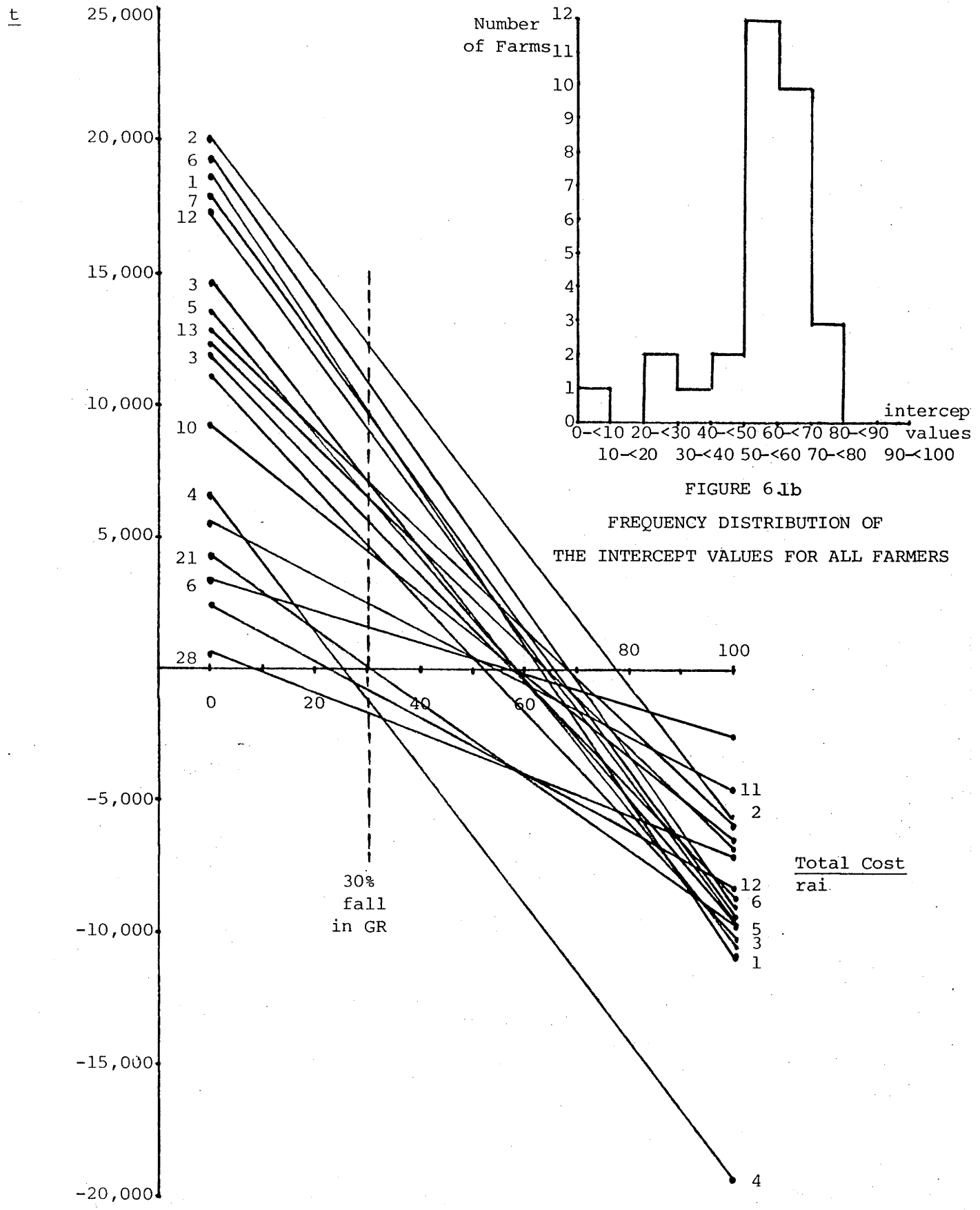


FIGURE 6.1b

FREQUENCY DISTRIBUTION OF

THE INTERCEPT VALUES FOR ALL FARMERS

FIGURE 6.1a

PRAWN ACTIVITY SENSITIVITY OF PROFIT FOR 18 SAMPLE FARMS

TABLE 6.1

BREAK-EVEN POINTS ASSUMING FALL IN REVENUE,

COSTS CONSTANT

Farm No.	(C) ฿ TC/Rai	(R) ฿ TR/Rai	(P) ฿ Profit/Rai	(F)* % fall in revenue at which Profit = o	X-axis intercept on Figure 6.2a
1	10,713	29,375	18,662	63.5	
2	5,785	25,793	20,008	77.6	
3	10,726	21,764	11,038	50.7	
4	19,300	26,078	6,778	26.0	
5	10,232	23,940	13,708	57.3	
6	8,996	28,215	19,219	68.1	
7	9,573	27,695	18,122	65.4	
8	9,517	27,360	17,843	65.2	
9	5,639	18,810	13,171	72.0	
10	2,343	5,700	3,357	58.9	
11	4,676	10,260	5,584	54.4	
12	6,303	8,550	2,247	26.3	
13	6,530	18,860	12,330	65.4	
14	9,474	21,374	11,900	55.7	
15	10,835	25,650	14,815	57.8	
16	6,813	15,913	9,100	57.2	
17	5,630	26,711	21,081	78.9	
18	6,090	19,310	13,220	68.5	
19	8,813	28,250	19,437	68.8	
20	14,719	28,333	13,614	48.0	
21	9,350	13,600	4,250	31.3	
22	11,482	23,800	12,318	51.8	
24	12,066	26,775	14,709	54.9	
25	9,884	23,800	13,916	58.5	
26	7,696	23,833	16,137	67.7	
28	6,556	7,150	594	8.3	
29	7,958	17,160	9,202	53.6	
32	16,442	24,024	7,582	51.6	
33	6,804	13,406	6,602	49.2	
34	6,890	22,392	15,502	69.2	
35	4,222	11,517	7,295	63.3	

* Calculated from F = 100 (1 - C/R)

activity profit/rai (obtained from activity budgets) for the three crops are compared. From this it is obvious that the mean return from prawns during the year of the sample was considerably higher than for rice and cassava (฿12,043 for prawns and ฿58 and ฿417 for rice and cassava). But the variance for prawns was also much higher implying the probability of not getting the mean profit from prawns was greater than the mean profit of the other two crops i.e. prawns appear to be first degree stochastically dominant to the two other crops. It is therefore likely that farmers faced with this information would choose to produce prawns in preference to the other crops if they faced no constraints on their behaviour. Risk therefore would not have been an important consideration in the decision either to grow prawns in the first place or to expand production on an existing farm.

But perceived probabilities of farmers may not be those observed in this study. Two qualifications must be made. Firstly, the lack of knowledge on prawns in some areas and among some farmers may create "uncertainty" of the type defined by Shubik (1954). In deciding whether to grow prawns, Thai farmers must consider the net returns from prawns in comparison to the returns they would have obtained from some other use of their land and other resources. Neither is known with certainty and, in order to make a decision, farmers must attach (implicitly) a probability distribution to the likely outcomes. This task would be much easier for the traditional crops which have been cultivated for generations than for prawns, where historical information about likely returns, for example, is not readily

available. Severe limitations of knowledge about prawns may prevent some farmers from making a decision of this nature i.e. they face uncertainty rather than risk. This may explain why many farmers who are isolated from the Fisheries Research Stations and extension workers have not chosen to produce prawns. It should be noted, however, that this concept of uncertainty is rejected by many economists, including Roumasset (1976).

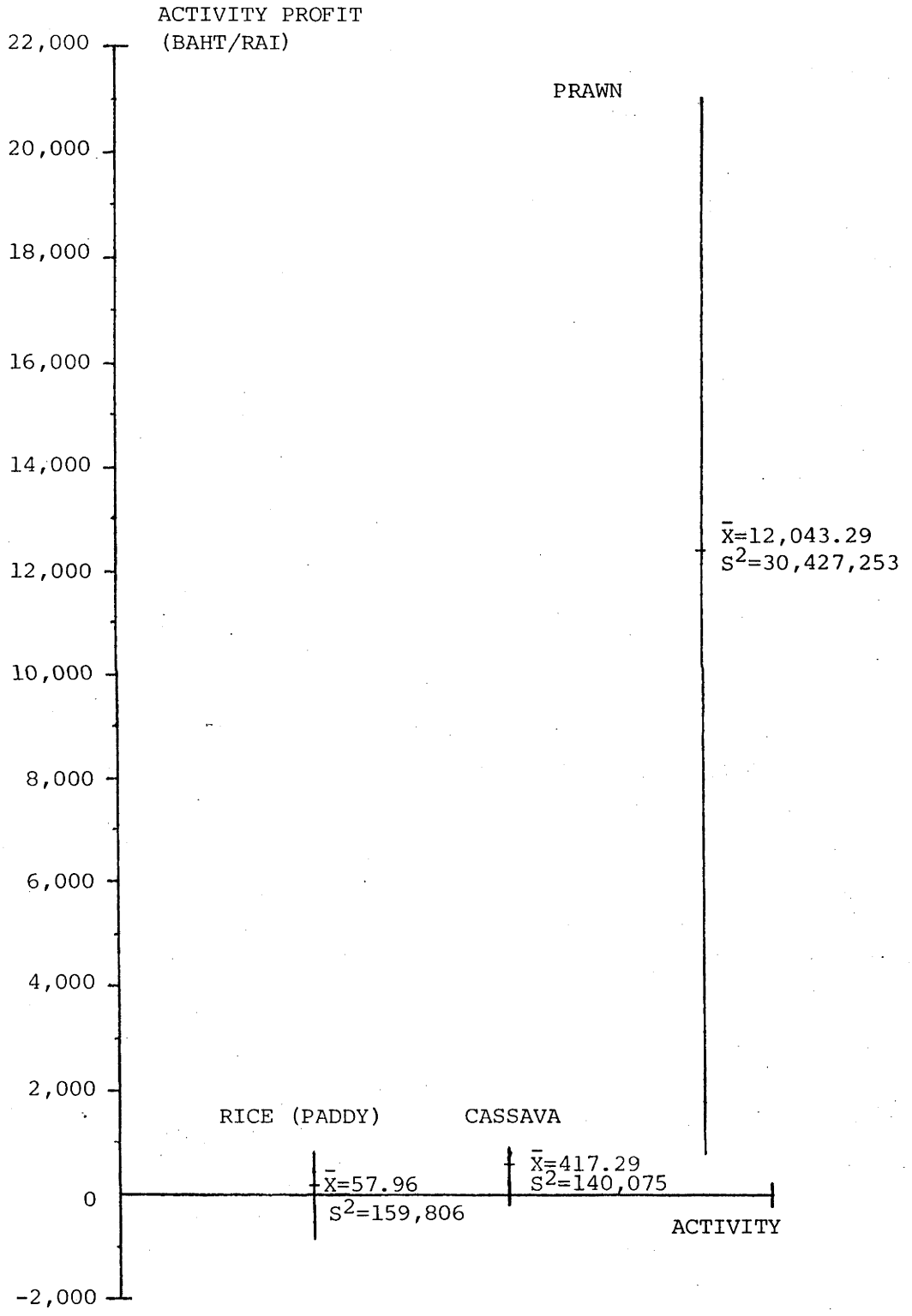
The second qualification is that farmers may have chosen not to grow prawns because they felt that they would not face the same distribution of returns as those outlined in Figure 6.2. This is based on realistic assumption that at least some of the farmers who switched to prawn did so because they faced conditions particularly favourable to prawn production. Two such conditions will be considered - the availability of a suitable water supply, and extension services.

Farmers situated away from natural water sources would incur higher initial investment and operating costs of prawn production than those faced on farms in the sample. In some cases tube wells would have to be constructed. Profits would be expected to be lower and the costs of failure higher. These are factors which might prevent these farmers switching to prawns.

Prawns are a relatively new activity which require a high level of management skill. The farmers in the sample used in this study were closely assisted by extension workers. Farmers who did not have access to such extension services might have considered that they could not have obtained the same returns

FIGURE 6.2

RANGES OF ACTIVITY PROFIT/RAI
FOR RICE, CASSAVA AND PRAWN



as farmers in the sample. This implies that their perceived range of returns to prawns would have been lower than that given in Figure 6.2. Moreover, it is likely that in the absence of extension services, farmers considered that their probability of failure would be higher than when they could seek advice whenever necessary.

From the above arguments it is likely that the risk of a higher probability of failure associated with the higher costs of failure may have been an important reason why some farmers did not grow prawns.

6.2.2 Other Factors

(a) Debts

Small farmers in Thailand are generally poor, and in many cases have been in debt for long periods of time. In fact debts are often passed from generation to generation. Onchan and Ong (1979) estimated that 68 per cent of Thai farmers were in debt during the year 1962/3. The total amount they owed was in excess of 9 billion baht, and although these figures are a little outdated, they show the extent of debt in the community.

Many small farmers could not therefore meet the high initial investment and annual operating costs for prawns from their own resources. In order to produce prawns they would have to go further into debt. Even if such credit was readily available it is possible that some farmers would choose not to grow prawns despite the high expected profits.

Clements (1976) argued that asset holdings directly enter an individual's utility function. The more assets he holds, the more secure about the future he feels, and the

happier he is. This effect is in addition to the future consumption possibilities these assets offer. This argument can be applied to Thailand where debts, or negative assets, could enter household utility functions. In this case, the marginal utility of debt is negative in any period, and is independent of the impact of debts on future consumption.

Assuming that profits also enter the utility function (perhaps as a proxy for current consumption), there would be a trade off between higher profits and the necessity to go into debt. It is possible that the negative utility of having to go into debt to grow prawns might in some cases outweigh the positive utility of higher profits. This might be especially true for farmers who were already heavily in debt.

However, there is also an alternative point of view. Farmers may be more than willing to go into debt if credit is available and a greater problem may be getting them to pay back their debt rather than getting them to accept credit. Without a great deal of detailed research it is not possible to discuss this topic further.

(b) Tradition

Prawns are a relatively new crop to Thai farmers while rice, cassava, peanuts and vegetables, for example, are traditional crops. Rice in particular has been grown for generations. Moreover, rice has traditionally been grown mainly as a subsistence crop, although production in excess of home consumption requirements is usually sold.

A switch to prawns therefore requires a break with tradition in two ways. Not only is it a new crop which involves

unfamiliar management practices, but also it is oriented mainly towards the cash economy. In a system which has relied on rice production to survive for many generations, a change of this nature is quite radical for many farmers. It is not surprising therefore that prawns are not accepted completely in a short period of time.

(c) Socio-Economic Problems

Socio-economic problems may also influence farmer decision-making. For example, stealing is common in many localities of Thailand where poverty exists. In some areas, rice paddy standing in the field is even stolen. Prawns are a much more lucrative crop and more problems of this type can be expected. Not only might this impose extra money costs on prawn farmers, for example high barbed wire or electric fences might be necessary, other costs which cannot easily be measured in money terms are also incurred. Thai farmers do not enjoy visiting police stations, whatever the reason. These costs will be taken into account when a farmer is considering producing prawns.

6.3 Conclusion

At the beginning of this chapter two questions were posed. If prawns were so much more profitable than other crops, why have a large proportion of farmers not become involved in prawn production, and why have those who do grow prawns continued to cultivate other crops?

Part of the explanation lay with physical constraints on prawn production identified in the first part of the chapter. Restrictions on both water supply and information about prawn farming meant some farmers could not grow prawns. In other

cases, the area of land devoted to prawns could have been limited by a shortage of either prawn juveniles or credit facilities. Thus, some farmers may not have been able to grow more prawns than they did.

The second part of this chapter concentrates on other factors which might have influenced farmers' decision-making. Problems associated with risk and uncertainty were considered to be important, particularly in areas without extension services. The cost of total failure with prawns was shown to be high, which might have influenced some farmers to take the safer option of mixed farming.

Other factors such as levels of debt, tradition and consideration of a socio-economic nature were discussed. It appears therefore that some farmers may have chosen voluntarily not to grow prawns, or to limit the quantity they grew, even in the absence of physical restrictions. The policy recommendations which emerged from these conclusions are discussed in the next chapter.

CHAPTER 7

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary and Major Conclusions

This thesis is primarily concerned with factors affecting the acceptance of giant freshwater prawn production in three provinces of Thailand. Profitability is an important determinant of whether farmers will voluntarily switch from other crops to prawns, and so a large part of the thesis consists of a financial analysis of prawn production in comparison with the other two crops which are widely grown in the country, rice and cassava.

In Chapter 1 some of the economic problems faced by Thailand were considered. The role of the giant freshwater prawn in the Thai economy was discussed. It was shown that the Thai government was actively encouraging the introduction of pond rearing of this aquatic animal, yet little information on the economics of prawn production was available.

Some biological and economic aspects of the giant freshwater prawn were presented in Chapter 2. These included information on how to grow the giant freshwater prawn, price movements, marketing channels and the status of freshwater prawn farming in Thailand.

There are few studies of farms which had switched to prawn production (e.g., Wetchagarun et al, 1980 and Puttikorn et al, 1980). In both of these studies the number of farms included in the sample was low, and the sample was not selected scientifically. Therefore

farm level data collected by OAE for 35 farms was used as the basis of the thesis. These data have not previously been analysed. Details of the OAE study were presented in Chapter 3, including descriptions of the Study area, survey technique and the questionnaire used.

In the absence of data on small farmer prawn production noted earlier, the first important step was to discover whether prawns had in fact proved to be a relatively profitable crop once they were produced outside the research stations. Various ways of measuring this relative profitability were discussed in Chapter 4, including production and profit function analysis. A form of financial analysis which considered activity budgets and gross margins, was considered to be the best way to analyse profitability from the farmer's viewpoint. An example of an activity budget was provided.

The detailed result of the financial analysis for each farm were attached in Appendix C but a summary was provided in Chapter 5. The activity budgets showed that prawns were much more profitable than rice and cassava. However, they required a much higher initial investment - on pond construction and facilities. Moreover, the recurrent costs of prawn production, especially the non-labour costs, were also higher. Thus, not only was profit higher but the cash costs of production were also higher.

Prawn farming in Kalasin and Roi Et (North Eastern Region) was shown to be more profitable than in Chachoengsao (Central Region) because of difficulties obtaining a regular supply of fresh water in the latter area. However, the cost of production was also higher in the first two provinces.

A general sensitivity analysis was applied to these results. It was shown that even if costs rose and prawn prices fell significantly, most of the farmers in the sample would still have made relatively large profits from prawns. A more specific sensitivity analysis was used to see what the effect on profit would be if the government subsidy on pond construction was removed. It was shown that prawns would still have been most profitable. Policy implications of this conclusion are discussed in the next section.

In Chapter 5 prawns were shown to be very profitable, yet many farmers grew no prawns, and those that did, continued to grow other crops as well. Two possible explanations were considered in Chapter 6. Firstly, the possibility that there were physical constraints on the expansion of prawn production were discussed. The most important seemed to be constraints on land, location (in terms of access to water supply), the availability of prawn juveniles and credit. In some cases, problems with land tenure may have made farmers unwilling to make the large initial investments required and in outlying areas farmers may have had insufficient information to enable them to cultivate prawns successfully.

The second explanation considered was that farmers took factors other than profit into account when considering prawn production. Risk was considered. It was shown that risk was unlikely to be an inhibitor to the adoption of prawns assuming that farmers felt that the results obtained on the sample farms were generally applicable. However there were good reasons for suspecting that some of the farms under study were atypical in

that they faced conditions particularly favourable to prawn farming. In this situation risk considerations could have prevented some farmers from cultivating prawns. In this chapter attitudes to debt and tradition were also discussed.

The importance of this study is that it has shown for the first time that prawns can be very profitable when grown as a small holder crop in Thailand. However, it has also emerged that physical constraints and concern about factors other than profitability may have been more powerful inhibitors to the expansion of prawn production than worries about profit. This has important policy implications which are discussed in the next section.

It is difficult to say whether these results for a sample of existing prawn farmers can be used as an indicator of profitability of farmers not yet growing prawns. If farmers now growing prawns are the more innovative farmers, their management practices may be better than average. Also, prawn farming may first attract farmers with secure tenure and ready access to credit, who may also be better farmers than average or have better access to inputs. For this reason, the results presented in this study, while very encouraging, must be interpreted with caution.

We cannot therefore say that all farmers could achieve these levels of profitability should they grow prawns.

Cost factors may also vary for other farmers: wells may be necessary for water supply, input costs may be different and pond construction costs may be higher.

7.2 Recommendations

In this section, it is assumed that the government's aim of promoting prawn production in Thailand will continue. No attempt is made to examine the validity of this aim except to comment that prawns indeed appeared to be very much more profitable per rai than rice or cassava at the time of the survey.

If farmers judged the relative attractiveness of prawns in terms of profitability alone, a high adoption rate would be expected for prawns. Yet many farmers in the three areas under study grew no prawns, and those that did continued to produce other crops. In discerning the possible reasons for this, a number of recommendations for government policy emerge.

7.2.1 Extension Services

It was shown in the last chapter that uncertainty about the techniques of prawn cultivation and the likely returns to prawns might have stopped some farmers from growing any prawns. Moreover, farmers that did grow prawns might have felt uncertain about their ability to manage prawns effectively if extension services were withdrawn. This could have prevented them from allocating more resources to prawn production.

One possible way might be to guarantee that existing extension services will continue for a reasonably long period. The farmers in these areas who did not grow prawns might be encouraged to do so, and the farmers growing prawns might be willing to expand production. This is because they would feel secure that extension services would not be withdrawn until they had learnt to manage prawns without outside help.

Another possibility is to introduce more extension services both to the areas currently covered, and to other areas suitable for prawns. This requires more qualified extension workers which, as pointed out earlier, are in short supply. In addition, more fisheries stations servicing the extension of prawns would have to be introduced.

Obviously, the above recommendations require additional expenditure. The government would have to consider these costs in view of the benefits that could be derived, and it is possible that there could be better ways of using the money. However, the costs could be reduced considerably by making the agricultural extension system more efficient. It may in fact be that the extra services could be provided at no extra cost. Some suggestions about possible ways to reorganize the extension system follow.

(a) Number of Extension Workers

The Government agencies involved in extension services in Thailand continually complain about a lack of manpower. This is particularly true in the fisheries and prawn areas. The real problem, however, is a lack of cooperation among the agencies which results in a duplication of services for farmers. Extension services are conducted on a single crop basis instead of considering farming as a business (whole farm basis). Thus, one farm may be served by many extension workers each with a different specialized field. This dramatically increases the number of extension workers necessary.

If cooperation among government agencies becomes possible, the required number of extension workers can be greatly reduced. This could be done by training them with knowledge on various crops,

livestock and aquaculture, so that one extension worker can handle all the activities on a given farm. The surplus extension workers could then be transferred to new areas.

In practice, this type of cooperation may be difficult because of the civil service regulations practised at present. In the short term, the DOF could attempt to improve its own extension services by training all the existing fisheries technicians thoroughly in the field of prawn production.

(b) Number of Fisheries Stations

It was mentioned earlier that only one fisheries station has been actively involved in the promotion of this relatively young industry, i.e., the Chachoengsao Fisheries Station. In fact, there are quite a number of other fisheries stations scattered throughout Thailand. Although these stations are not well equipped to provide services to farmers such as larval production and related extension activities, they could be adapted without the need to build new stations. If this was done in areas suitable for prawn farming, the government could encourage increased prawn production at relatively low cost.

7.2.2 Credit

It has been shown that because of the high initial investment and operating costs of prawn production many small farmers require access to substantial credit facilities if they are to produce prawns. Yet these farmers often have nothing to offer as security for loans and a large proportion of credit has gone to larger farmers. This is inconsistent with the government's stated intention of helping small farmers.

Part of the job of the BAAC, a government supported bank, is to provide credit to small farmers, and it does this at an interest rate that is slightly lower than the market rate. Just like other lending institutions, however, it requires land deeds to be lodged as security, and also seems to have only limited funds to lend. Further, the BAAC is probably hesitant to lend on a new activity such as prawns until it knows more about credit requirements, profitability and risk. The availability of credit is therefore likely to be a significant constraint on small farmers growing prawns.

Two recommendations can be made. The rate of adoption of prawns would be quicker if more credit was made available to small farmers. This might require lending institutions to relax their security requirements. The figures of Chapter 5 show that for the majority of sample farmers, prawn farming is sufficiently profitable to repay a loan after only one year of prawn production. For this reason it does not seem necessary for the BAAC to subsidize interest rates. It might in fact be preferable for it to charge a higher rate, which the farmers could afford, which would have the advantage of making more funds available for lending.

There may of course be some disadvantages of this action as well. For example, higher interest rates would increase the costs of total failure, which could inhibit farmers from growing prawns. At this stage it is not possible to say if the incentive effect of extra credit would be outweighed by the disincentive effect of the higher cost of failure.

The other aspect of credit which deserves consideration is the pay-off period of the loan. Although the earlier results showed that the average farmer would be able to repay the loan for pond construction and facilities after the first year of prawn production, additional credit would probably be required in at least the next year to cover the high operating costs. Moreover, many of the small farmers who do not grow prawns yet are currently heavily in debt to money lenders. These debts would have to be repaid at the same time as, (or even before), repayments of any loans for prawn production.

Farmers beginning prawns would normally require credit to cover pond construction and first year operating costs. After loan repayment many farmers may also require seasonal credit for operating costs. The ideal term of a loan for establishment costs would vary considerably from farmer to farmer but could be from 2 to 6 years, depending on the profitability and income from other sources, on the basis of the data presented in Chapter 5. At present, banks offer short (six to twelve months) or medium term (one to five years) credit almost exclusively.

A more general problem in relation to agricultural credit is an apparent unwillingness of some farmers to repay loans. This means that the costs of such credit programmes could be very high and should be carefully assessed before implementation.

7.2.3 Prawn Juveniles

It was pointed out earlier that the limited supply of juveniles was an important constraint on how many prawns farmers could grow. It also caused understocking which reduced land productivity on the farms that grew prawns. It is crucial,

therefore, that the supply of juveniles be increased if prawn production is to expand further.

The technology involved in juvenile production seems to be of a fairly high level and farmers seem to trust government hatcheries more than the private hatcheries. However, production at both types of hatchery could expand especially if the government is willing to make its technology more available to the private sector. Again because prawns were so profitable it appears that the government could charge for this technology, and juveniles could be charged at the full cost of production. Obviously this requires sufficient credit to be available and, as in the case of interest rates, would raise the cost of failure.

7.2.4 Other Recommendations

Other recommendations emerge from the problems associated with water supply and land tenure discussed earlier. Most prawn farms relied on surface water which is subject to contamination. A shortage of water often is experienced during the dry season and this prevents farmers from growing prawns continuously. It also results in slow growth rates and low pond productivity. These problems could be overcome if tube wells were built on each farm. This measure would substantially increase initial investment costs and so adequate credit would have to be available if small farmers are to participate. The cost of total failure is also increased which could have a disincentive effect as discussed earlier. It is, however, worth conducting a study to discover if tube wells would make economic sense in areas with inadequate water supplies.

A less costly way of controlling water contamination may be to develop a means to prevent water pollution. An effective law may be the answer if it was strictly policed, but it must be

remembered that this would have costs and benefits which would have to be analysed carefully.

Problems connected with the land tenure arrangements could also be improved with legislation. The tenants' ability to make long term decisions would be increased if all contracts were signed for a fairly long period of time. However, this law might be difficult to enforce in practice.

A problem related to the increase in prawn production is that many farmers had switched from the less profitable fish culture to prawns. Fish consumers therefore would anticipate that the price of fish would rise before the new market equilibrium occurs. In Thailand increases in the price of basic food stuffs can cause political problems which policy makers prefer to avoid.

One way of reducing this problem in a way which will also raise prawn pond productivity is to introduce polyculture of prawns and herbivorous fish. This is actually being researched by the DOF and the dispersion of this technology to farmers might help to improve farmers' earnings and indirectly increase the adoption rate for prawns.

In conclusion, there have been very few studies of the economics of freshwater prawn production in Thailand and those that have been done are inadequate in a number of ways illustrated earlier. The major contribution of this thesis was therefore to analyse in detail the profitability of prawns in comparison to two of the major competing crops of rice and cassava. The data came from a relatively large sample which was selected randomly. The study showed that prawns were much more profitable than the other two crops.

However, the study recognized that there may be many factors other than profitability influencing the adoption of prawns and the expansion of this industry. For example the data analysed was for the 1980 crop year. Farmers may have considered that the results were unusual and could not be obtained in future years. A number of policy recommendations emerged from the discussion of these factors, but at times it was not possible to decide if disincentive effects outweighed incentive effects. It is therefore strongly recommended that more detailed studies of the factors influencing farmers in their decision about whether to grow prawns be conducted. This research is critical if policy implications are to be considered in more detail.

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APPENDIX A

MONTHLY WHOLESALE PRICE OF FRESHWATER PRAWN IN BANGKOK (1970-1979)

(Average Size = 250 grams each)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Average	% Change
1970	41.80	42.08	38.64	41.44	40.94	41.09	40.86	41.51	42.08	42.11	41.85	43.70	41.51	-
1971	44.05	43.72	42.72	43.40	43.15	44.02	44.02	44.18	44.20	44.28	44.50	46.20	44.04	+6.09
1972	46.61	47.14	47.20	48.00	48.74	49.01	50.75	50.93	56.26	56.51	54.02	54.68	50.82	+15.04
1973	55.48	60.06	62.24	65.15	64.64	67.32	68.41	69.68	70.75	71.88	69.77	70.68	66.34	+30.54
1974	78.40	77.84	77.22	79.37	79.48	79.31	78.88	80.28	80.11	78.85	77.02	86.16	79.41	+19.70
1975	77.25	76.50	76.46	76.75	76.44	81.48	92.78	90.70	95.28	93.33	93.67	95.48	85.51	+7.68
1976	98.23	92.78	92.60	92.71	93.75	93.54	94.79	101.25	112.34	113.34	106.20	100.49	99.34	+16.17
1977	109.23	111.99	108.73	111.94	111.97	109.40	116.12	128.60	132.58	135.55	136.70	134.02	120.57	+21.37
1978	137.23	141.56	143.85	147.96	151.98	152.16	154.88	153.87	159.88	164.64	158.75	161.02	152.32	+26.33
1979	164.68	171.02	175.86	175.86	218.75	230.00	230.00	230.00	198.92	201.03	198.06	197.82	199.34	+30.87
Average													93.92	+19.35

Source: Puttikorn and Tongchat, 1980.

APPENDIX B

QUESTIONNAIRES

2.1 Use of Labour in the Farm

Crop Production Activities	Family Labour (hours)					Hired Labour (hours)					Exchange Labour (hrs.)	Food (Baht)
	Land Preparation	Planting	Intercultural Practices	Harvesting	Post-harvest Practices	Land Preparation	Planting	Intercultural Practices	Harvesting	Post-harvest Practices		
Animal Production Activities	Watering Feeding	Intercultural Practices	Pen Construction & Maintenance	Egg Collection & Animal Catching	Others	Watering Feeding	Inter-cultural Practices	Pen Construction & Maintenance	Egg Collection & Animal Catching	Others	(Specify)	
Fish Production Activities	Pond Maintenance	Feeding	Pond Draining	Fish Catching & Selecting	Others	Pond Maintenance	Feeding	Pond Draining	Fish Catching & Selecting	Others	(Specify)	
Prawn Production Activities	Pond Maintenance	Feeding	Pond Draining	Prawn Catching & Selecting	Others	Pond Maintenance	Feeding	Pond Draining	Prawn Catching & Selecting	Others	(Specify)	

2.2. Prawn Production Activity Overview

2.2.1 Size of Prawn Ponds

Pond Number	Size of Land		Size of Dike		Supplementary Materials				Initial Investment in Pond Construction
	Width	Length	Width	Height	None	Yes Specify	Size	Value	
1									
2									
3									
4									

2.2.2 Pumping of Water into Prawn Ponds

Number of times water being pumped into prawn pond ..... times per month..... hours per pumping time
Water services from (canals, ...) distance ..... kms. Is water available all year round .....?

2.2.3 Future Production of Prawns: Your Plan to Expand the Production of Prawns

Year	1	2	3	4	5
Number of Ponds					
Area (Rai)					
Expected Credit Needed					

2.2.4 Problems in Prawn Production From Your Point of View Including Suggested Solutions.

3. Revenue, Yields and Uses of Products

3.1 Sources of Revenue and Products Other Than Prawns

Activities	Yields (kg)	Home Consumption (kg)	Keep for next Planting (kg)	Donation (kg)	Animal Feed (kg)	Pay Rent in Kind (kg)	Sold	Place Where Sold	Value of Product Sold (Baht)
Non-glutinous rice									
Glutinous rice									
Upland crop (specified)...									
Upland crop									
Upland crop									
Vegetable (specified)									
Vegetable									
Fruit (specified)									
Livestock (specified									
Livestock									
Livestock									
Fish (specified)									
Fish									
Trade									
Being employed									
Others									

3.2 Revenue From Prawn Production

Items	Year 1979					Year 1980						
	Aug	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June	Jul.
Pond stocking date												
Number of prawns grown												
Harvesting time												
Quantity caught (kgs)												
No. of small prawns (heads/kgs)												
No. of medium prawns (heads/kgs)												
No. of large prawns (heads/kgs)												
Price received for small prawns												
Price received for medium prawns												
Price received for large prawns												
Qty. of fish caught in prawn ponds												
Price of fish received (฿/kg)												

4. Expenditure

4.1 Expenditure on Crop and Livestock Activities Except Prawns

Items	Types of Crops, Animals						N.B.
Crops 1. Tractor hire for ploughing							
2. Hire for harrowing							
3. Hire for furrowing							
4. Seed							
5. Fertilizer							
6. Pesticides							
7. Fuel							
8. Transportation							
9. Maintenance of equipment							
10. Selling expenditure							
11. Others (specify)							
	Swine	Duck	Chick	Fish			N.B.
Livestocks 1. Seed							
2. Feed							
3. Medicine							
4. Pen and/or pond maintenance							
5. Maintenance of equipment							
6. Selling expenditure							
7. Rope							
8. Others (specify							

N.B. In case an expenditure cannot be differentiated for a specific type of crop or livestock, that expenditure will be filled in N.B. column.

4.2 Expenditure on Prawn Production

Items	Unit	Quantity used up			Price/Unit (Baht/)	Total Cost (Baht)
		Qty.used up per month	Number of months covered	Total Qty. used up		
1. Fuel	Litre					
- Diesel						
- Gasoline						
2. Lubricator						
3. Grease						
4. Kerosene						
5. Electricity						
6. Fertilizer						
7. Feed						
8. Fish Eradicating Solvent						
9. Charcoal, lamp, gas						
10. Pond construction						
11. Pond maintenance						
12. Others (specify)						

5. Farmers' indebtedness

Source of Credit	Loan	Number of years since credit given	Repayment during a year		Purpose of credit	Security	Pay back period	Interest rate	Loan to be paid off	N.B.
			Principal (Baht)	Interest (Baht)						
Bank for Agriculture and Agricultural Co-operatives										
Commercial Banks										
Agricultural Co-operatives										
Merchants										
Relatives										
Neighbours										
Others (specify)										

N.B. If pay back in kind, the value of the products will be inputed.

6. Permanent Assets

Type	Size and Model	Number (unit)	Price paid	Condition when purchased		How old before	No. of years after purchase (years)	Present Value if sold (B)
				New	Old			
House								
Shed								
Barn								
Animal pens								
Plough, ploughing tractor								
Water pump								
Pump hose								
Sprayer								
Hatchery pond								
Power generator								
Sewing machine								
Vehicles (specify)								
Others (specify)								

7. Livestock and Other Assets

Item	At Present		Item	At Present	
	No.	Value		No.	Value
Ox-Cows			Axe		
Buffalos			Prawn rearing equipment (eg. bamboo trap, net)		
Swine			Others (specify)		
Duck, Geese					
Chickens					
Hoes					
Spades			Cash on hand		
Knives			Bank deposit		
Scythes			Out loan		
Shovels					
Sickles					
Rakes					

APPENDIX C

ACTIVITY BUDGETS

FARMS 1-35 EXCLUDING FARM 27, 30 AND 31

ACTIVITY BUDGET Farm No. 1

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)			2-1-50	2-1-50
(Rai)			2.38	2.38
Output (kg)			403	403
A. Gross Revenue (฿)			69,912	69,912
Variable Costs (฿)				
Seed			8,400	8,400
Lime			800	800
Fertilizer			180	180
Feed			5,130	5,130
Fuel			-	-
Lub. & Grease			-	-
Electricity			-	-
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			4,800	4,800
Family Labour Charge			750	750
Others			-	-
Contingencies (5% of above)			1,003	1,003
TVC			21,063	21,063
B. Gross Margin (฿)			48,849	48,849
Gross Margin/Rai (฿)			20,525	20,525
Fixed Cost (฿)				
Rent			476	476
Depreciation I			-	-
Depreciation II			526	526
Interest (Investment)			904	904
Interest (Borrowing)			2,528	2,528
TFC			4,434	4,434
C. Total Cost (TC) (฿)			25,497	25,497
D. Activity Profit (฿)			44,415	44,415
Activity Profit/Rai (฿)			18,662	18,662
E. Net Activity Income (฿)			45,297	45,297
Family Labour (Manday)			30	30
Net Activity Income/Manday (฿)			1,510	1,510

ACTIVITY BUDGET Farm No. 2

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)			6-0-0	6-0-0
(Rai)			6	6
Output (kg)			905	905
A. Gross Revenue (฿)			154,755	154,755
Variable Costs (฿)				
Seed			14,480	14,480
Lime			-	-
Fertilizer			-	-
Feed			10,200	10,200
Fuel			-	-
Lub. & Grease			-	-
Electricity			-	-
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			-	-
Family Labour Charge			1,150	1,150
Others			-	-
Contingencies (5% of above)			1,292	1,292
TVC			27,122	27,122
B. Gross Margin (฿)			127,633	127,633
Gross Margin/Rai (฿)			21,272	21,272
Fixed Cost (฿)				
Rent			1,200	1,200
Depreciation I			-	-
Depreciation II			134	134
Interest (Investment)			3,000	3,000
Interest (Borrowing)			3,255	3,255
TFC			7,589	7,589
C. Total Cost (TC) (฿)			34,711	34,711
D. Activity Profit (฿)			120,044	120,044
Activity Profit/Rai (฿)			20,007	20,007
E. Net Activity Income (฿)			121,396	121,396
Family Labour (Manday)			46	46
Net Activity Income/Manday (฿)			2,639	2,639

ACTIVITY BUDGET Farm No. 3

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	44-0-0	-	2-3-0	46-3-0
(Rai)	44	-	2.75	46.75
Output (kg)	10,240		350	10,590
A. Gross Revenue (฿)	20,480		59,850	80,330
Variable Costs (฿)				
Seed	600		9,000	9,600
Lime	-		140	140
Fertilizer	960		200	1,160
Feed	-		7,200	7,200
Fuel	-		5,200	5,200
Lub. & Grease	-		240	240
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	2,200		-	2,200
Hired Labour	18,000		-	18,000
Family Labour Charge	120		1,000	1,120
Others	400		150	550
Contingencies (5% of above)	1,114		1,157	2,271
TVC	23,394		24,287	47,681
B. Gross Margin (฿)	-2,914		35,563	32,649
Gross Margin/Rai (฿)	-66		12,932	698
Fixed Cost (฿)				
Rent	8,800		550	9,350
Depreciation I	112		-	112
Depreciation II	423		606	1,029
Interest (Investment)	-		1,140	1,140
Interest (Borrowing)	2,807		2,914	5,721
TFC	12,142		5,210	17,352
C. Total Cost (TC) (฿)	35,536		29,497	65,033
D. Activity Profit (฿)	-15,056		30,353	15,297
Activity Profit/Rai (฿)	-342		11,037	327
E. Net Activity Income (฿)	-14,915		31,529	16,614
Family Labour (Manday)	4		40	44
Net Activity Income/Manday (฿)	-3,729		788	378

ACTIVITY BUDGET Farm No. 4

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	16-0-0	-	0-2-0	16-2-0
(Rai)	16	-	0.5	16.5
Output (kg)	2,040	-	77	2,117
A. Gross Revenue (฿)	5,100	-	13,039	18,139
Variable Costs (฿)				
Seed	50		1,050	1,100
Lime	-		-	-
Fertilizer	500		200	700
Feed	-		960	960
Fuel	-		1,296	1,296
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	6,000		3,000	9,000
Family Labour Charge	-		750	750
Others	-		-	-
Contingencies (5% of above)	328		363	691
TVC	6,878		7,619	14,497
B. Gross Margin (฿)	-1,778		5,420	3,642
Gross Margin/Rai (฿)	-111		10,840	221
Fixed Cost (฿)				
Rent	3,200		100	3,300
Depreciation I	620		11	631
Depreciation II	162		286	448
Interest (Investment)	-		720	720
Interest (Borrowing)	825		914	1,739
TFC	4,807		2,031	6,838
C. Total Cost (TC) (฿)	11,685		9,650	21,335
D. Activity Profit (฿)	-6,585		3,389	-3,196
Activity Profit/Rai (฿)	-412		6,778	-194
E. Net Activity Income (฿)	-6,585		4,271	-2,314
Family Labour (Manday)	-		30	30
Net Activity Income/Manday (฿)	N/A		142	-77

ACTIVITY BUDGET Farm No. 5

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	-	-	0-2-0	0-2-0
(Rai)	-	-	0.5	0.5
Output (kg)	-	-	70	70
A. Gross Revenue (฿)	-	-	11,970	11,970
Variable Costs (฿)				
Seed			1,800	1,800
Lime			200	200
Fertilizer			100	100
Feed			1,000	1,000
Fuel			-	-
Lub. & Grease			-	-
Electricity			-	-
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			-	-
Family Labour Charge			550	550
Others			-	-
Contingencies (5% of above)			183	183
TVC			3,833	3,833
B. Gross Margin (฿)			8,137	8,137
Gross Margin/Rai (฿)			16,274	16,274
Fixed Cost (฿)				
Rent			100	100
Depreciation I			120	120
Depreciation II			243	243
Interest (Investment)			360	360
Interest (Borrowing)			460	460
TFC			1,283	1,283
C. Total Cost (TC) (฿)			5,116	5,116
D. Activity Profit (฿)			6,854	6,854
Activity Profit/Rai (฿)			13,708	13,708
E. Net Activity Income (฿)			7,501	7,501
Family Labour (Manday)			22	22
Net Activity Income/Manday (฿)			341	341

ACTIVITY BUDGET Farm No. 6

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	6-0-0	-	2-0-0	8-0-0
(Rai)	6	-	2	8
Output (kg)	1,550	-	330	1,880
A. Gross Revenue (฿)	3,875	-	56,430	60,305
Variable Costs (฿)				
Seed	125		6,600	6,725
Lime	-		160	160
Fertilizer	-		260	260
Feed	-		5,250	5,250
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		800	800
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		700	700
Hired Labour	-		-	-
Family Labour Charge	1,800		700	2,500
Others	-		-	-
Contingencies (5% of above)	96		724	820
TVC	2,021		15,194	17,215
B. Gross Margin (฿)	1,854		41,236	43,090
Gross Margin/Rai (฿)	309		20,618	5,386
Fixed Cost (฿)				
Rent	1,200		400	1,600
Depreciation I	28		-	28
Depreciation II	36		443	479
Interest (Investment)	-		132	132
Interest (Borrowing)	243		1,823	2,066
TFC	1,507		2,798	4,305
C. Total Cost (TC) (฿)	3,528		17,992	21,520
D. Activity Profit (฿)	347		38,438	38,785
Activity Profit/Rai (฿)	58		19,219	4,848
E. Net Activity Income (฿)	2,464		39,261	41,725
Family Labour (Manday)	60		28	88
Net Activity Income/Manday (฿)	41		1,402	474

ACTIVITY BUDGET Farm No. 7

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	23-0-0	21-3-0	1-0-0	45-3-0
(Rai)	23	21.75	1	45.75
Output (kg)	9,200	70,000	145	79,345
A. Gross Revenue (฿)	23,000	24,500	27,695	75,195
Variable Costs (฿)				
Seed	500	-	3,000	3,500
Lime	-	-	-	-
Fertilizer	-	-	-	-
Feed	-	-	2,600	2,600
Fuel	-	-	-	-
Lub. & Grease	-	-	-	-
Electricity	-	-	600	600
Repairs & Maintenance	-	-	-	-
Insecticides	-	-	-	-
Selling Cost	-	-	-	-
Transportation	-	3,500	-	3,500
Service Hired	-	3,000	-	3,000
Hired Labour	-	1,400	-	1,400
Family Labour Charge	3,300	690	500	4,490
Others	-	-	-	-
Contingencies (5% of above)	190	430	335	955
TVC	3,990	9,020	7,035	20,045
B. Gross Margin (฿)	19,010	15,480	20,660	55,150
Gross Margin/Rai (฿)	827	712	20,660	1,205
Fixed Cost (฿)				
Rent	4,600	4,350	200	9,150
Depreciation I	358	338	340	1,036
Depreciation II	62	58	314	434
Interest (Investment)	-	-	840	840
Interest (Borrowing)	479	1,082	844	2,405
TFC	5,499	5,828	2,538	13,865
C. Total Cost (TC) (฿)	9,489	14,848	9,573	33,910
D. Activity Profit (฿)	13,511	9,652	18,122	41,285
Activity Profit/Rai (฿)	587	444	18,122	902
E. Net Activity Income (฿)	17,392	10,463	18,710	46,565
Family Labour (Manday)	110	23	20	153
Net Activity Income/Manday (฿)	158	455	936	304

ACTIVITY BUDGET Farm No. 8

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	8-3-75	5-2-0	7-0-0	21-1-75
(Rai)	8.94	5.5	7	21.44
Output (kg)	4,040	19,000	1,120	24,160
A. Gross Revenue (฿)	8,080	15,200	191,520	214,800
Variable Costs (฿)				
Seed	80	-	22,400	22,480
Lime	-	-	-	-
Fertilizer	480	240	-	720
Feed	-	-	27,000	27,000
Fuel	200	300	600	1,100
Lub. & Grease	-	-	600	600
Electricity	-	-	-	-
Repairs & Maintenance	-	-	-	-
Insecticides	-	-	-	-
Selling Cost	-	1,000	-	1,000
Transportation	500	1,500	-	2,000
Service Hired	-	1,200	-	1,200
Hired Labour	-	-	-	-
Family Labour Charge	6,150	3,000	800	9,950
Others	-	-	600	600
Contingencies (5% of above)	371	362	2,600	3,333
TVC	7,781	7,602	54,600	69,983
B. Gross Margin (฿)	299	7,598	136,920	144,817
Gross Margin/Rai (฿)	33	1,381	19,560	6,755
Fixed Cost (฿)				
Rent	1,788	1,100	1,400	4,288
Depreciation I	1,199	717	163	2,079
Depreciation II	97	60	2,587	2,744
Interest (Investment)	-	-	1,320	1,320
Interest (Borrowing)	934	912	6,552	8,398
TFC	4,018	2,789	12,022	18,829
C. Total Cost (TC) (฿)	11,799	10,391	66,622	88,812
D. Activity Profit (฿)	-3,719	4,809	124,898	125,988
Activity Profit/Rai (฿)	-416	874	17,843	5,876
E. Net Activity Income (฿)	3,513	8,337	125,839	137,689
Family Labour (Manday)	205	100	32	337
Net Activity Income/Manday (฿)	17	83	3,932	409

ACTIVITY BUDGET Farm No. 9

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	65-0-0	2-0-0	1-2-0	68-2-0
(Rai)	65	2	1.5	68.5
Output (kg)	32,580	4,000	165	36,745
A. Gross Revenue (฿)	82,990	3,000	28,215	114,205
Variable Costs (฿)				
Seed	840	-	3,300	4,140
Lime	-	-	-	-
Fertilizer	600	-	120	720
Feed	-	-	2,025	2,025
Fuel	-	-	-	-
Lub. & Grease	-	-	-	-
Electricity	-	-	-	-
Repairs & Maintenance	100	-	-	100
Insecticides	20	-	-	20
Selling Cost	-	-	-	-
Transportation	600	280	70	950
Service Hired	8,900	-	-	8,900
Hired Labour	2,250	-	-	2,250
Family Labour Charge	11,970	360	750	13,080
Others	-	-	-	-
Contingencies (5% of above)	1,264	32	313	1,609
TVC	26,544	672	6,578	33,794
B. Gross Margin (฿)	56,446	2,328	21,637	80,411
Gross Margin/Rai (฿)	868	1,164	14,425	1,174
Fixed Cost (฿)				
Rent	13,000	400	300	13,700
Depreciation I	470	14	-	484
Depreciation II	46	1	71	118
Interest (Investment)	-	-	720	720
Interest (Borrowing)	3,185	81	789	4,055
TFC	16,701	496	1,880	19,077
C. Total Cost (TC) (฿)	43,245	1,168	8,458	52,871
D. Activity Profit (฿)	39,745	1,832	19,757	61,334
Activity Profit/Rai (฿)	611	916	13,171	895
E. Net Activity Income (฿)	53,822	2,255	20,639	76,716
Family Labour (Manday)	399	12	30	441
Net Activity Income/Manday (฿)	135	188	688	174

ACTIVITY BUDGET Farm No. 10

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	12-2-0	35-0-0	3-0-0	50-2-0
(Rai)	12.5	35	3	50.50
Output (kg)	4,000	26,042	100	30,142
A. Gross Revenue (฿)	10,000	12,500	17,100	39,600
Variable Costs (฿)				
Seed	125	-	1,200	1,325
Lime	-	-	107	107
Fertilizer	750	-	325	1,075
Feed	-	-	1,700	1,700
Fuel	-	-	-	-
Lub. & Grease	-	-	-	-
Electricity	-	-	-	-
Repairs & Maintenance	-	-	-	-
Insecticides	-	-	-	-
Selling Cost	-	-	-	-
Transportation	-	-	-	-
Service Hired	1,150	5,250	-	6,400
Hired Labour	2,400	4,500	-	6,900
Family Labour Charge	1,950	900	575	3,425
Others	-	-	-	-
Contingencies (5% of above)	319	533	195	1,047
TVC	6,694	11,183	4,102	21,979
B. Gross Margin (฿)	3,306	1,317	12,998	17,621
Gross Margin/Rai (฿)	264	38	4,333	349
Fixed Cost (฿)				
Rent	2,500	7,000	600	10,100
Depreciation I	40	111	-	151
Depreciation II	34	95	1,714	1,843
Interest (Investment)	-	-	120	120
Interest (Borrowing)	803	1,342	492	2,637
TFC	3,377	8,548	2,926	14,851
C. Total Cost (TC) (฿)	10,071	19,731	7,028	36,830
D. Activity Profit (฿)	-71	-7,231	10,072	2,770
Activity Profit/Rai (฿)	-6	-207	3,357	55
E. Net Activity Income (฿)	2,222	-6,173	10,748	6,797
Family Labour (Manday)	65	30	23	118
Net Activity Income/Manday (฿)	34	-206	467	58

ACTIVITY BUDGET Farm No. 11

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	10-0-0	4-0-0	5-0-0	19-0-0
(Rai)	10	4	5	19
Output (kg)	4,040	9,920	300	14,260
A. Gross Revenue (฿)	10,100	3,670	51,300	65,070
Variable Costs (฿)				
Seed	100	200	8,000	8,300
Lime	-	-	150	150
Fertilizer	1,000	-	-	1,000
Feed	-	-	8,500	8,500
Fuel	-	-	-	-
Lub. & Grease	-	-	-	-
Electricity	-	-	-	-
Repairs & Maintenance	-	-	-	-
Insecticides	150	-	-	150
Selling Cost	120	-	-	120
Transportation	200	-	-	200
Service Hired	-	1,200	-	1,200
Hired Labour	-	-	-	-
Family Labour Charge	2,160	480	950	3,590
Others	-	-	-	-
Contingencies (5% of above)	187	94	880	1,161
TVC	3,917	1,974	18,480	24,371
B. Gross Margin (฿)	6,183	1,696	32,820	40,699
Gross Margin/Rai (฿)	618	424	6,564	2,142
Fixed Cost (฿)				
Rent	2,000	800	1,000	3,800
Depreciation I	111	44	-	155
Depreciation II	44	18	600	662
Interest (Investment)	-	-	1,080	1,080
Interest (Borrowing)	470	237	2,218	2,925
TFC	2,625	1,099	4,898	8,622
C. Total Cost (TC) (฿)	6,542	3,073	23,378	32,993
D. Activity Profit (฿)	3,558	597	27,922	32,077
Activity Profit/Rai (฿)	356	149	5,584	1,688
E. Net Activity Income (฿)	6,098	1,161	29,039	36,298
Family Labour (Manday)	72	16	38	126
Net Activity Income/Manday (฿)	85	73	764	288

ACTIVITY BUDGET Farm No. 12

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	24-0-0	-	1-2-0	25-2-0
(Rai)	24	-	1.5	25.5
Output (kg)	7,110	-	75	7,185
A. Gross Revenue (฿)	15,436	-	12,825	28,261
Variable Costs (฿)				
Seed	236		1,500	1,736
Lime	-		-	-
Fertilizer	1,000		-	1,000
Feed	-		4,900	4,900
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	200		-	200
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	6,900		-	6,900
Family Labour Charge	4,290		500	4,790
Others	-		-	-
Contingencies (5% of above)	631		345	976
TVC	13,257		7,245	20,502
B. Gross Margin (฿)	2,179		5,580	7,759
Gross Margin/Rai (฿)	91		3,720	304
Fixed Cost (฿)				
Rent	4,800		300	5,100
Depreciation I	213		12	225
Depreciation II	566		429	995
Interest (Investment)	-		600	600
Interest (Borrowing)	1,591		869	2,460
TFC	7,170		2,210	9,380
C. Total Cost (TC) (฿)	20,427		9,455	29,882
D. Activity Profit (฿)	-4,991		3,370	-1,621
Activity Profit/Rai (฿)	-208		2,247	-64
E. Net Activity Income (฿)	54		3,958	4,012
Family Labour (Manday)	143		20	163
Net Activity Income/Manday (฿)	0.38		198	25

ACTIVITY BUDGET Farm No. 13

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	30-0-0	15-0-0	8-2-0	53-2-0
(Rai)	30	15	8.5	53.5
Output (kg)	14,528	29,412	937.5	44,877.5
A. Gross Revenue (฿)	44,390	25,000	160,312	229,702
Variable Costs (฿)				
Seed	508	-	15,000	15,508
Lime	-	-	240	240
Fertilizer	2,100	-	400	2,500
Feed	-	-	7,590	7,590
Fuel	-	2,000	-	2,000
Lub. & Grease	-	-	-	-
Electricity	-	-	-	-
Repairs & Maintenance	-	-	-	-
Insecticides	350	-	-	350
Selling Cost	-	-	-	-
Transportation	250	2,000	200	2,450
Service Hired	-	-	-	-
Hired Labour	4,600	1,350	-	5,950
Family Labour Charge	3,000	6,300	750	10,050
Others	-	-	-	-
Contingencies (5% of above)	540	583	1,209	2,332
TVC	11,348	12,233	25,389	48,970
B. Gross Margin (฿)	33,042	12,767	134,923	180,732
Gross Margin/Rai (฿)	1,101	851	15,873	3,378
Fixed Cost (฿)				
Rent	6,000	3,000	1,700	9,700
Depreciation I	402	148	-	550
Depreciation II	92	34	740	866
Interest (Investment)	-	-	24,629	24,629
Interest (Borrowing)	1,362	1,468	3,047	5,877
TFC	7,856	4,650	30,116	42,622
C. Total Cost (TC) (฿)	19,204	16,883	55,505	91,592
D. Activity Profit (฿)	25,186	8,117	104,807	138,110
Activity Profit/Rai (฿)	840	541	12,330	2,582
E. Net Activity Income (฿)	28,714	15,526	105,689	149,929
Family Labour (Manday)	100	210	30	340
Net Activity Income/Manday (฿)	287	74	3,523	441

ACTIVITY BUDGET Farm No. 14

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	27-0-0	-	0-2-0	27-2-0
(Rai)	27	-	0.5	27.5
Output (kg)	8,660	-	62.5	8,722.5
A. Gross Revenue (฿)	12,990	-	10,687	23,677
Variable Costs (฿)				
Seed	480		1,000	1,480
Lime	-		80	80
Fertilizer	600		-	600
Feed	-		2,240	2,240
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	150		-	150
Family Labour Charge	3,660		450	4,110
Others	-		-	-
Contingencies (5% of above)	245		189	434
TVC	5,135		3,959	9,094
B. Gross Margin (฿)	7,855		6,728	14,583
Gross Margin/Rai (฿)	291		13,456	530
Fixed Cost (฿)				
Rent	5,400		100	5,500
Depreciation I	53		-	53
Depreciation II	202		11	213
Interest (Investment)	-		192	192
Interest (Borrowing)	616		475	1,091
TFC	6,271		778	7,049
C. Total Cost (TC) (฿)	11,406		4,737	16,143
D. Activity Profit (฿)	1,584		5,950	7,534
Activity Profit/Rai (฿)	59		11,900	274
E. Net Activity Income (฿)	5,888		6,479	12,367
Family Labour (Manday)	122		18	140
Net Activity Income/Manday (฿)	48		360	88

ACTIVITY BUDGET Farm No. 15

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)			2-0-0	2-0-0
(Rai)			2	2
Output (kg)			300	300
A. Gross Revenue (฿)			51,300	51,300
Variable Costs (฿)				
Seed			8,000	8,000
Lime			-	-
Fertilizer			600	600
Feed			6,900	6,900
Fuel			-	-
Lub. & Grease			-	-
Electricity			-	-
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			-	-
Family Labour Charge			1,125	1,125
Others			-	-
Contingencies (5% of above)			831	831
TVC			17,456	17,456
B. Gross Margin (฿)			33,844	33,844
Gross Margin/Rai (฿)			16,922	16,922
Fixed Cost (฿)				
Rent			400	400
Depreciation I			80	80
Depreciation II			704	704
Interest (Investment)			934	934
Interest (Borrowing)			2,095	2,095
TFC			4,213	4,213
C. Total Cost (TC) (฿)			21,669	21,669
D. Activity Profit (฿)			29,631	29,631
Activity Profit/Rai (฿)			14,816	14,816
E. Net Activity Income (฿)			30,954	30,954
Family Labour (Manday)			45	45
Net Activity Income/Manday (฿)			688	688

ACTIVITY BUDGET Farm No.16

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	7-0-0	-	0-3-0	7-3-0
(Rai)	7	-	0.75	7.75
Output (kg)	910	-	78	988
A. Gross Revenue (฿)	2,275	-	11,935	14,210
Variable Costs (฿)				
Seed	58		1,200	1,258
Lime	-		-	-
Fertilizer	400		20	420
Feed	-		1,870	1,870
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	1,125		-	1,125
Family Labour Charge	-		750	750
Others	-		-	-
Contingencies (5% of above)	79		192	271
TVC	1,662		4,032	5,694
B. Gross Margin (฿)	613		7,903	8,516
Gross Margin/Rai (฿)	88		10,537	1,099
Fixed Cost (฿)				
Rent	1,400		150	1,550
Depreciation I	266		-	266
Depreciation II	146		60	206
Interest (Investment)	-		384	384
Interest (Borrowing)	199		484	683
TFC	2,011		1,078	3,089
C. Total Cost (TC) (฿)	3,673		5,110	8,783
D. Activity Profit (฿)	-1,398		6,825	5,427
Activity Profit/Rai (฿)	-200		9,100	700
E. Net Activity Income (฿)	-1,398		7,707	6,309
Family Labour (Manday)	-		30	30
Net Activity Income/Manday (฿)	N/A		257	210

ACTIVITY BUDGET Farm No. 17

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	8-0-0	-	2-0-0	10-0-0
(Rai)	8		2	10
Output (kg)	5,200		312.5	5,512.5
A. Gross Revenue (฿)	13,000		53,422	66,422
Variable Costs (฿)				
Seed	500		4,375	4,875
Lime	-		60	60
Fertilizer	-		50	50
Feed	-		3,210	3,210
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	100		-	100
Selling Cost	-		-	-
Transportation	500		-	500
Service Hired	880		-	880
Hired Labour	2,730		-	2,730
Family Labour Charge	1,830		1,000	2,830
Others	300		200	500
Contingencies (5% of above)	342		445	787
TVC	7,182		9,340	16,522
B. Gross Margin (฿)	5,818		44,082	49,900
Gross Margin/Rai (฿)	727		22,041	4,990
Fixed Cost (฿)				
Rent	1,600		400	2,000
Depreciation I	268		-	268
Depreciation II	74		257	331
Interest (Investment)	-		142	142
Interest (Borrowing)	862		1,121	1,983
TFC	2,804		1,920	4,724
C. Total Cost (TC) (฿)	9,986		11,260	21,246
D. Activity Profit (฿)	3,014		42,162	45,176
Activity Profit/Rai (฿)	377		21,081	4,518
E. Net Activity Income (฿)	5,166		43,338	48,504
Family Labour (Manday)	61		40	101
Net Activity Income/Manday (฿)	85		1,083	480

ACTIVITY BUDGET Farm No. 18

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	15-0-0	-	3-1-0	18-1-0
(Rai)	15		3.25	18.25
Output (kg)	5,880		367	6,247
A. Gross Revenue (฿)	15,528		62,757	78,285
Variable Costs (฿)				
Seed	448		5,250	5,698
Lime	-		182	182
Fertilizer	-		-	-
Feed	-		8,400	8,400
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	125		-	125
Service Hired	1,000		-	1,000
Hired Labour	2,250		-	2,250
Family Labour Charge	4,440		850	5,290
Others	150		813	963
Contingencies (5% of above)	421		775	1,196
TVC	8,834		16,270	25,104
B. Gross Margin (฿)	6,694		46,487	53,181
Gross Margin/Rai (฿)	446		14,304	2,914
Fixed Cost (฿)				
Rent	3,000		650	3,650
Depreciation I	751		82	833
Depreciation II	131		60	191
Interest (Investment)	-		780	780
Interest (Borrowing)	1,060		1,952	3,012
TFC	4,942		3,524	8,466
C. Total Cost (TC) (฿)	13,776		19,794	33,570
D. Activity Profit (฿)	1,752		42,963	44,715
Activity Profit/Rai (฿)	117		13,219	2,450
E. Net Activity Income (฿)	6,973		43,963	50,936
Family Labour (Manday)	148		34	182
Net Activity Income/Manday (฿)	47		1,293	280

ACTIVITY BUDGET Farm No. 19

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	-	-	53-2-0	53-2-0
(Rai)	-	-	53.5	53.5
Output (kg)	-	-	8,890.5	8,890.5
A. Gross Revenue (฿)	-	-	1,511,385	1,511,385
Variable Costs (฿)				
Seed			160,650	160,650
Lime			-	-
Fertilizer			-	-
Feed			120,000	120,000
Fuel			25,600	25,600
Lub. & Grease			2,000	2,000
Electricity			-	-
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			80,000	80,000
Family Labour Charge			-	-
Others			-	-
Contingencies (5% of above)			19,413	19,413
TVC			407,663	407,663
B. Gross Margin (฿)			1,103,722	1,103,722
Gross Margin/Rai (฿)			20,630	20,630
Fixed Cost (฿)				
Rent			10,700	10,700
Depreciation I			1,200	1,200
Depreciation II			2,029	2,029
Interest (Investment)			960	960
Interest (Borrowing)			48,920	48,920
TFC			63,809	63,809
C. Total Cost (TC) (฿)			471,472	471,472
D. Activity Profit (฿)			1,039,913	1,039,913
Activity Profit/Rai (฿)			19,438	19,438
E. Net Activity Income (฿)			1,039,913	1,039,913
Family Labour (Manday)			-	-
Net Activity Income/Manday (฿)			N/A	N/A

ACTIVITY BUDGET Farm No. 20

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	5-0-0	-	2-1-0	7-1-0
(Rai)	5		2.25	7.25
Output (kg)	2,000		375	2,375
A. Gross Revenue (฿)	4,400		63,750	68,150
Variable Costs (฿)				
Seed	44		10,500	10,544
Lime	-		150	150
Fertilizer	500		-	500
Feed	-		12,626	12,626
Fuel	150		2,800	2,950
Lub. & Grease	-		560	560
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	-		-	-
Family Labour Charge	1,740		750	2,490
Others	-		-	-
Contingencies (5% of above)	122		1,369	1,491
TVC	2,556		28,755	31,311
B. Gross Margin (฿)	1,844		34,995	36,839
Gross Margin/Rai (฿)	369		15,553	5,081
Fixed Cost (฿)				
Rent	1,000		450	1,450
Depreciation I	520		-	520
Depreciation II	180		143	323
Interest (Investment)	-		318	318
Interest (Borrowing)	307		3,451	3,758
TFC	2,007		4,362	6,369
C. Total Cost (TC) (฿)	4,563		33,117	37,680
D. Activity Profit (฿)	-163		30,633	30,470
Activity Profit/Rai (฿)	-33		13,615	4,203
E. Net Activity Income (฿)	1,883		31,515	33,398
Family Labour (Manday)	58		30	88
Net Activity Income/Manday (฿)	32		1,051	380

ACTIVITY BUDGET Farm No.21

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	15-0-66	-	2-2-0	17-2-66
(Rai)	15.17		2.5	17.67
Output (kg)	3,500		200	3,700
A. Gross Revenue (฿)	7,700		34,000	41,700
Variable Costs (฿)				
Seed	220		10,500	10,720
Lime	-		120	120
Fertilizer	-		64	64
Feed	-		7,700	7,700
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	-		-	-
Family Labour Charge	5,130		500	5,630
Others	-		-	-
Contingencies (5% of above)	268		944	1,212
TVC	5,618		19,828	25,446
B. Gross Margin (฿)	2,082		14,172	16,254
Gross Margin/Rai (฿)	137		5,669	920
Fixed Cost (฿)				
Rent	3,034		500	3,534
Depreciation I	173		-	173
Depreciation II	99		419	518
Interest (Investment)	-		248	248
Interest (Borrowing)	674		2,379	3,053
TFC	3,980		3,546	7,526
C. Total Cost (TC) (฿)	9,598		23,374	32,972
D. Activity Profit (฿)	-1,898		10,626	8,728
Activity Profit/Rai (฿)	-125		4,250	494
E. Net Activity Income (฿)	4,135		11,214	15,349
Family Labour (Manday)	171		20	191
Net Activity Income/Manday (฿)	24		561	80

ACTIVITY BUDGET Farm No. 22

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	18-0-0	-	5-0-0	23-0-0
(Rai)	18		5	33
Output (kg)	7,350		700	8,050
A. Gross Revenue (฿)	17,010		119,000	136,010
Variable Costs (฿)				
Seed	770		16,800	17,570
Lime	-		180	180
Fertilizer	-		220	220
Feed	-		29,160	29,160
Fuel	-		-	-
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	1,260		-	1,260
Hired Labour	900		-	900
Family Labour Charge	1,560		450	2,010
Others	-		-	-
Contingencies (5% of above)	225		2,341	2,566
TVC	4,715		49,151	53,866
B. Gross Margin (฿)	12,295		69,849	82,144
Gross Margin/Rai (฿)	683		13,970	2,489
Fixed Cost (฿)				
Rent	3,600		1,000	4,600
Depreciation I	160		-	160
Depreciation II	120		760	880
Interest (Investment)	-		600	600
Interest (Borrowing)	566		5,898	6,464
TFC	4,446		8,258	12,704
C. Total Cost (TC) (฿)	9,161		57,409	66,570
D. Activity Profit (฿)	7,849		61,591	69,440
Activity Profit/Rai (฿)	436		12,318	2,104
E. Net Activity Income (฿)	9,684		62,120	71,804
Family Labour (Manday)	52		18	70
Net Activity Income/Manday (฿)	186		3,451	1,026

ACTIVITY BUDGET Farm No. 23

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	13-1-65	-	-	13-1-65
(Rai)	13.41			13.41
Output (kg)	7,400			7,400
A. Gross Revenue (฿)	16,280			16,280
Variable Costs (฿)				
Seed	440			440
Lime	-			-
Fertilizer	-			-
Feed	-			-
Fuel	-			-
Lub. & Grease	-			-
Electricity	-			-
Repairs & Maintenance	-			-
Insecticides	45			45
Selling Cost	300			300
Transportation	-			-
Service Hired	-			-
Hired Labour	600			600
Family Labour Charge	9,690			9,690
Others	-			-
Contingencies (5% of above)	554			554
TVC	11,629			11,629
B. Gross Margin (฿)	4,651			4,651
Gross Margin/Rai (฿)	347			347
Fixed Cost (฿)				
Rent	2,682			2,682
Depreciation I	16			16
Depreciation II	177			177
Interest (Investment)	-			-
Interest (Borrowing)	1,395			1,395
TFC	4,270			4,270
C. Total Cost (TC) (฿)	15,899			15,899
D. Activity Profit (฿)	381			381
Activity Profit/Rai (฿)	28			28
E. Net Activity Income (฿)	11,776			11,776
Family Labour (Manday)	323			323
Net Activity Income/Manday (฿)	36			36

ACTIVITY BUDGET Farm No. 24

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	110-0-0	-	4-0-0	114-0-0
(Rai)	110		4	114
Output (kg)	43,000		630	43,630
A. Gross Revenue (฿)	86,000		107,100	193,100
Variable Costs (฿)				
Seed	3,000		11,250	14,250
Lime	-		360	360
Fertilizer	900		128	1,028
Feed	-		23,833	23,833
Fuel	-		2,618	2,618
Lub. & Grease	-		220	220
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	30		-	30
Selling Cost	1,500		-	1,500
Transportation	2,000		-	2,000
Service Hired	7,700		-	7,700
Hired Labour	7,620		-	7,620
Family Labour Charge	1,770		1,000	2,770
Others	1,000		-	1,000
Contingencies (5% of above)	1,276		1,970	3,246
TVC	26,796		41,379	68,175
B. Gross Margin (฿)	59,204		65,721	124,925
Gross Margin/Rai (฿)	538		16,430	1,096
Fixed Cost (฿)				
Rent	22,000		800	22,800
Depreciation I	386		14	400
Depreciation II	137		267	404
Interest (Investment)	7,200		840	8,040
Interest (Borrowing)	3,216		4,965	8,181
TFC	32,939		6,886	39,825
C. Total Cost (TC) (฿)	59,735		48,265	108,000
D. Activity Profit (฿)	26,265		58,835	85,100
Activity Profit/Rai (฿)	239		14,709	746
E. Net Activity Income (฿)	28,347		60,011	88,358
Family Labour (Manday)	59		40	99
Net Activity Income/Manday (฿)	480		1,500	893

ACTIVITY BUDGET Farm No. 25

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	32-0-0	25-0-0	4-0-0	61-0-0
(Rai)	32	25	4	61
Output (kg)	10,330	32,800	560	43,690
A. Gross Revenue (฿)	27,489	30,176	95,200	152,865
Variable Costs (฿)				
Seed	889	N/A	11,200	12,089
Lime	-	-	90	90
Fertilizer	80	-	150	230
Feed	-	-	17,486	17,486
Fuel	150	-	2,000	2,150
Lub. & Grease	-	-	201	201
Electricity	-	-	-	-
Repairs & Maintenance	-	-	-	-
Insecticides	75	-	-	75
Selling Cost	120	3,836	-	3,956
Transportation	-	-	-	-
Service Hired	-	-	-	-
Hired Labour	-	9,150	-	9,150
Family Labour Charge	6,960	3,750	775	11,485
Others	500	-	-	500
Contingencies (5% of above)	439	837	1,595	2,871
TVC	9,213	17,573	33,497	60,283
B. Gross Margin (฿)	18,276	12,603	61,703	92,582
Gross Margin/Rai (฿)	571	504	15,426	1,518
Fixed Cost (฿)				
Rent	6,400	5,000	800	12,200
Depreciation I	343	268	43	654
Depreciation II	152	119	691	962
Interest (Investment)	-	-	484	484
Interest (Borrowing)	1,106	2,109	4,020	7,235
TFC	8,001	7,496	6,038	21,535
C. Total Cost (TC) (฿)	17,214	25,069	39,535	81,818
D. Activity Profit (฿)	10,275	5,107	55,665	71,047
Activity Profit/Rai (฿)	321	204	13,916	1,341
E. Net Activity Income (฿)	18,460	9,517	56,576	84,553
Family Labour (Manday)	232	125	31	388
Net Activity Income/Manday (฿)	80	76	1,825	218

ACTIVITY BUDGET Farm No. 26

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	-	-	3-0-0	3-0-0
(Rai)			3	3
Output (kg)			500	500
A. Gross Revenue (฿)			71,500	71,500
Variable Costs (฿)				
Seed			5,000	5,000
Lime			560	560
Fertilizer			160	160
Feed			5,880	5,880
Fuel			1,500	1,500
Lub. & Grease			1,460	1,460
Electricity			-	-
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			-	-
Family Labour Charge			1,450	1,450
Others			-	-
Contingencies (5% of above)			801	801
TVC			16,811	16,811
B. Gross Margin (฿)			54,689	54,689
Gross Margin/Rai (฿)			18,230	18,230
Fixed Cost (฿)				
Rent			600	600
Depreciation I			53	53
Depreciation II			1,171	1,171
Interest (Investment)			2,436	2,436
Interest (Borrowing)			2,017	2,017
TFC			6,277	6,277
C. Total Cost (TC) (฿)			23,088	23,088
D. Activity Profit (฿)			48,412	48,412
Activity Profit/Rai (฿)			16,137	16,137
E. Net Activity Income (฿)			50,117	50,117
Family Labour (Manday)			58	58

ACTIVITY BUDGET Farm No. 28

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)			4-0-0	4-0-0
(Rai)			4	4
Output (kg)			200	200
A. Gross Revenue (฿)			28,600	28,600
Variable Costs (฿)				
Seed			12,740	12,740
Lime			630	630
Fertilizer			-	-
Feed			3,800	3,800
Fuel			450	450
Lub. & Grease			-	-
Electricity			100	100
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			-	-
Family Labour Charge			825	825
Others			-	-
Contingencies (5% of above)			927	927
TVC			19,472	19,472
B. Gross Margin (฿)			9,128	9,128
Gross Margin/Rai (฿)			2,282	2,282
Fixed Cost (฿)				
Rent			800	800
Depreciation I			532	532
Depreciation II			143	143
Interest (Investment)			2,940	2,940
Interest (Borrowing)			2,337	2,337
TFC			6,752	6,752
C. Total Cost (TC) (฿)			26,224	26,224
D. Activity Profit (฿)			2,376	2,376
Activity Profit/Rai (฿)			594	594
E. Net Activity Income (฿)			3,346	3,346
Family Labour (Manday)			33	33
Net Activity Income/Manday (฿)			101	101

ACTIVITY BUDGET Farm No.29

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	80-0-0		4-0-0	84-0-0
(Rai)	80		4	84
Output (kg)	21,500		480	21,980
A. Gross Revenue (฿)	60,200		68,640	128,840
Variable Costs (฿)				
Seed	4,200		9,600	13,800
Lime	-		-	-
Fertilizer	4,000		-	4,000
Feed	-		6,600	6,600
Fuel	500		6,750	7,250
Lub. & Grease	-		-	-
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	-		-	-
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	13,000		-	13,000
Family Labour Charge	2,790		625	3,415
Others	-		-	-
Contingencies (5% of above)	1,225		1,179	2,404
TVC	25,715		24,754	50,469
B. Gross Margin (฿)	34,485		43,886	78,371
Gross Margin/Rai (฿)	431		10,972	933
Fixed Cost (฿)				
Rent	16,000		800	16,800
Depreciation I	1,815		25	1,840
Depreciation II	111		643	754
Interest (Investment)	86,400		2,640	89,040
Interest (Borrowing)	3,086		2,970	6,056
TFC	107,412		7,078	114,490
C. Total Cost (TC) (฿)	133,127		31,832	164,959
D. Activity Profit (฿)	-72,927		36,808	-36,119
Activity Profit/Rai (฿)	-912		9,202	-430
E. Net Activity Income (฿)	-69,646		37,543	-32,103
Family Labour (Manday)	93		25	118
Net Activity Income/Manday (฿)	-749		1,502	-272

ACTIVITY BUDGET Farm No. 32

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	60-0-0	-	0-2-0	60-2-0
(Rai)	60		0.5	60.5
Output (kg)	20,500		84	20,584
A. Gross Revenue (฿)	61,500		12,012	73,512
Variable Costs (฿)				
Seed	1,500		1,750	3,250
Lime	-		-	-
Fertilizer	6,000		-	6,000
Feed	-		4,030	4,030
Fuel	500		343	843
Lub. & Grease	-		20	20
Electricity	-		-	-
Repairs & Maintenance	-		-	-
Insecticides	500		-	500
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	7,000		-	7,000
Family Labour Charge	6,780		500	7,280
Others	-		-	-
Contingencies (5% of above)	1,114		312	1,426
TVC	23,394		6,955	30,349
B. Gross Margin (฿)	38,106		5,057	43,163
Gross Margin/Rai (฿)	635		10,114	713
Fixed Cost (฿)				
Rent	12,000		100	12,100
Depreciation I	1,302		2	1,304
Depreciation II	143		89	232
Interest (Investment)	-		240	240
Interest (Borrowing)	2,807		835	3,642
TFC	16,252		1,266	17,518
C. Total Cost (TC) (฿)	39,646		8,221	47,867
D. Activity Profit (฿)	21,854		3,791	25,645
Activity Profit/Rai (฿)	364		7,582	424
E. Net Activity Income (฿)	29,827		4,379	34,206
Family Labour (Manday)	226		20	246
Net Activity Income/Manday (฿)	132		219	139

ACTIVITY BUDGET Farm No. 33

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	6-0-0		4-0-0	10-0-0
(Rai)	6		4	10
Output (kg)	4,800		375	5,175
A. Gross Revenue (฿)	14,880		53,625	68,505
Variable Costs (฿)				
Seed	372		3,750	4,122
Lime	-		-	-
Fertilizer	600		-	600
Feed	-		10,875	10,875
Fuel	400		700	1,100
Lub. & Grease	-		160	160
Electricity	-		200	200
Repairs & Maintenance	-		-	-
Insecticides	100		-	100
Selling Cost	-		-	-
Transportation	-		-	-
Service Hired	-		-	-
Hired Labour	750		-	750
Family Labour Charge	690		875	1,565
Others	-		350	350
Contingencies (5% of above)	146		846	992
TVC	3,058		17,756	20,814
B. Gross Margin (฿)	11,822		35,869	47,691
Gross Margin/Rai (฿)	1,970		8,967	4,769
Fixed Cost (฿)				
Rent	1,200		800	2,000
Depreciation I	700		200	900
Depreciation II	51		57	108
Interest (Investment)	12,000		6,270	18,270
Interest (Borrowing)	367		2,131	2,498
TFC	14,318		9,458	23,776
C. Total Cost (TC) (฿)	17,376		27,214	44,590
D. Activity Profit (฿)	-2,436		26,411	23,975
Activity Profit/Rai (฿)	-406		6,603	2,398
E. Net Activity Income (฿)	-1,625		27,440	25,815
Family Labour (Manday)	23		35	58
Net Activity Income/Manday (฿)	-71		784	445

ACTIVITY BUDGET Farm No. 34

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)	-	-	5-0-0	5-0-0
(Rai)	-	-	5	5
Output (kg)	-	-	780	780
A. Gross Revenue (฿)			111,960	111,960
Variable Costs (฿)				
Seed			7,500	7,500
Lime			1,600	1,600
Fertilizer			-	-
Feed			9,000	9,000
Fuel			1,222	1,222
Lub. & Grease			-	-
Electricity			-	-
Repairs & Maintenance			4,000	4,000
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			-	-
Family Labour Charge			725	725
Others			-	-
Contingencies (5% of above)			1,202	1,202
TVC			25,249	25,249
B. Gross Margin (฿)			86,711	86,711
Gross Margin/Rai (฿)			17,342	17,342
Fixed Cost (฿)				
Rent			1,000	1,000
Depreciation I			-	-
Depreciation II			371	371
Interest (Investment)			4,800	4,800
Interest (Borrowing)			3,030	3,030
TFC			9,201	9,201
C. Total Cost (TC) (฿)			34,450	34,450
D. Activity Profit (฿)			77,510	77,510
Activity Profit/Rai (฿)			15,502	15,502
E. Net Activity Income (฿)			78,363	78,363
Family Labour (Manday)			29	29
Net Activity Income/Manday (฿)			2,702	2,702

ACTIVITY BUDGET Farm No. 35

Item	Rice (Paddy)	Cassava	Prawn	Activity Mix
Area cropped (Rai-Ngan-Wa^2)			8-1-0	8-1-0
(Rai)			8.25	8.25
Output (kg)			625	625
A. Gross Revenue (฿)			95,015	95,015
Variable Costs (฿)				
Seed			6,250	6,250
Lime			800	800
Fertilizer			-	-
Feed			10,000	10,000
Fuel			-	-
Lub. & Grease			-	-
Electricity			-	-
Repairs & Maintenance			-	-
Insecticides			-	-
Selling Cost			-	-
Transportation			-	-
Service Hired			-	-
Hired Labour			-	-
Family Labour Charge			2,875	2,875
Others			1,100	1,100
Contingencies (5% of above)			1,051	1,051
TVC			22,076	22,076
B. Gross Margin (฿)			72,939	72,939
Gross Margin/Rai (฿)			8,841	8,841
Fixed Cost (฿)				
Rent			1,650	1,650
Depreciation I			6	6
Depreciation II			649	649
Interest (Investment)			7,800	7,800
Interest (Borrowing)			2,649	2,649
TFC			12,754	12,754
C. Total Cost (TC) (฿)			34,830	34,830
D. Activity Profit (฿)			60,185	60,185
Activity Profit/Rai (฿)			7,295	7,295
E. Net Activity Income (฿)			63,566	63,566
Family Labour (Manday)			115	115
Net Activity Income/Manday (฿)			553	553