

## ASSESSING THE COMPETITIVENESS OF SHRIMP FARMING IN IRAN: USING PAM APPROACH

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### ABSTRACT

Shrimp farming in Iran is one of the fast growing segments of the economy. In 1994, around 1% of Iranian shrimp production was farmed and by 2003 the share of shrimp farming increased to 60%. In spite of the fact that shrimp culture had relatively rapid growth in last decade, due to increase in production cost and decrease in international price, the profit of shrimp production decrease in recent years. The purpose of this research is to analyze the competitiveness of Iranian shrimp farming. The policy analysis matrix (PAM) method was used to investigate divergence between market and social profit in the Iranian shrimp industry. The results indicated that social prices for production cost were higher than market prices for fuel, electricity, fertilizer, and less than market price for feed. It indicates that in spite of government subsidies to shrimp production inputs, the shrimp producers categorized as tax payers for total input cost. In addition, it was concluded that shrimp social price and production profit were less than market prices.

Keywords: shrimp farming, Iran, PAM, social price, protection

### INTRODUCTION

Shrimp farming is rapidly growing in the world. Asia raises approximately 70% of cultured shrimp. Thailand, Indonesia, Vietnam, India, Bangladesh, and Philippines are major producers. In Iran, farming of Indian white shrimp *Penaeus indicus*, the major shrimp species cultured is the fastest growing segment of economy, increasing at a rate of 68% per annum during last eight years. In 1994, approximately 1% of Iranian shrimp production was farmed; by 2004 this share had increased to 60%. Thus, due to some infection this share had decrease to 28% in 2005. The aims of Iranian shrimp farming were compensating of the decline in shrimp fishery, earning foreign exchange, enhancing employment opportunities and income for poor coastal communities. Iranian shrimp farming areas had been concentrated in the northern Persian Gulf and Oman Sea (figure1). There are about 4300 ha of shrimp ponds in Iran and shrimp farms are located in Khuzistan, Busher, Hormozgan and Balochistan provinces.

A few thousand hectares of land have been allocated for the establishment of shrimp ponds, and several hatcheries have been built to supply the post larvae from spawners caught from the north Oman Sea. In addition, Iran has 1800 Km of coastlines in the south, which are suitable for shrimp culture. Shrimp farm units are usually of 14 ha and composed of 1 ha. ponds. Shrimp production is affected by policies such as input subsidies, exchange rate devaluation, and export subsidies.

Figure 1. Location of shrimp farms in Iran



Shrimp farming in Iran is characterized by high pond water salinity and temperatures. Very high salinity (up to 60 ppt) can be observed during the first month of rearing when pond water exchange is low. Pond water temperatures are fluctuating between 30 and 35°C during the hottest months (from July to mid September) and in certain areas like Hormuzgan province pond water temperatures can reach 40°C during several days. Average of stocking density and yield is 23 PL's/m<sup>2</sup> and 2.1MT/ha, respectively.

Only one crop per year is achieved in Provinces located along the Persian Gulf and Oman Sea due to low temperatures encountered between October and April. However, two crops per year can be achieved in Balochistan where shrimp farming conditions are better in terms of pond water salinity and temperature most of the year expected during January and February. Iranian shrimp industry is depending on wild Indian white shrimp *Penaeus indicus* for grow-out larvae (Esmaili and Omar 2003).

In Iran, shrimps are cultured in a semi-intensive way. The post-larvae are transferred from hatcheries to the grow-out ponds from which they are harvested after five months, depending on the price, cost, and desired harvest weight (figure 2). After some processing, shrimp send to internal and international markets.

Figure 2. Shrimp aquaculture flow chart in Iran

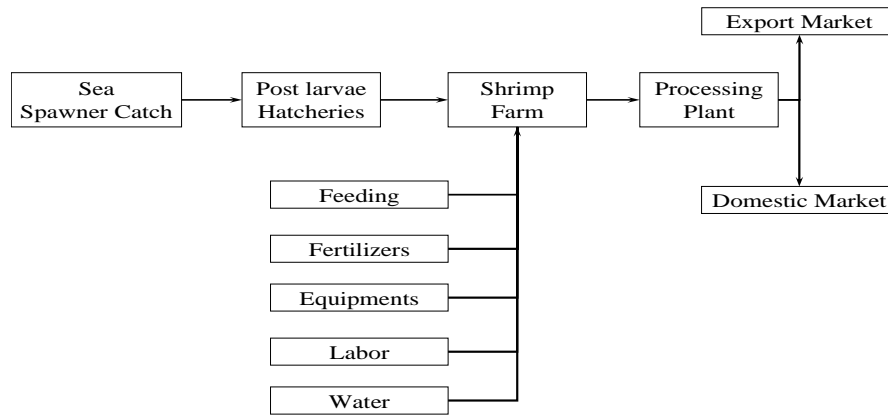
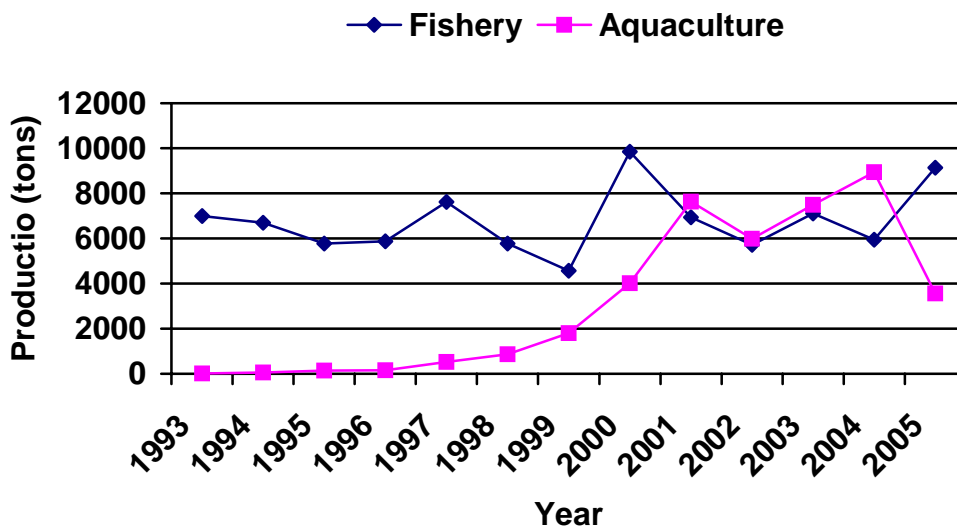


Figure 3. Shrimp fishery and shrimp aquaculture in Iran



Shrimp culture in Iran is a semi-intensive system. Although, shrimp productivity in Iran is higher than its world average, production costs of culture shrimp in Iran compare to Asian producing countries is high (Ling et al. 1999; Esmaeili 2003). Table shows shrimp aquaculture production in selected countries.

Shrimp production cost depends on shrimp species, productivity, crop seasons, and recourse endowment (Ling et al. 1999). Shrimp price depend on size and species. During recent years, shrimp prices were decreased for all species and countries.

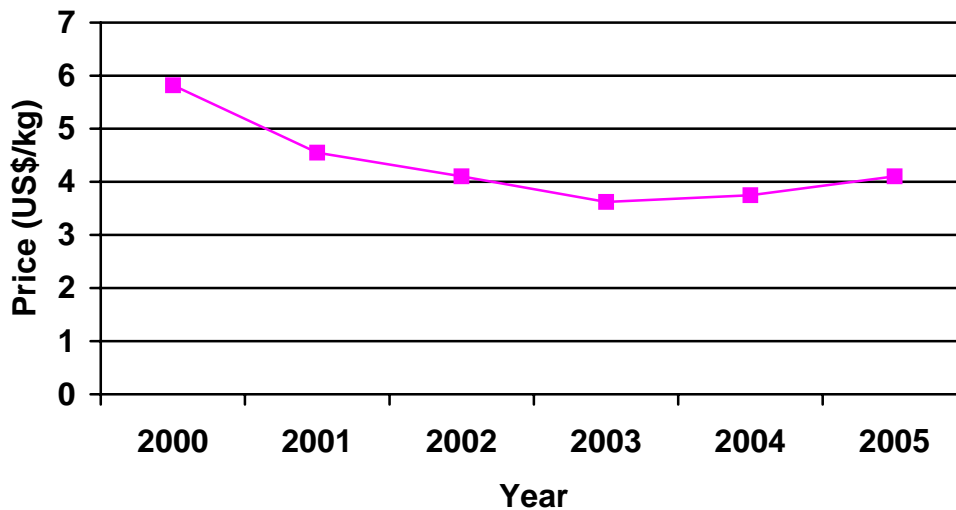
Table 1. Shrimp aquaculture in selected countries (2003)

Countries	Production (Tons)	Area farmed (Hectares)	Productivity (Kg/Hectare-Year)
China	370000	257000	1440
Thailand	280000	64000	4375
Indonesia	168000	200000	840
India	160000	195000	821
Brazil	90190	14824	6084
Ecuador	81400	130900	622
Iran	7492	3589	2087
<b>World</b>	1630800	1701590	958

Source: Shrimp Outlook 2003, Wurmman et al. 2004, Iranian Fishery Company

For instance, Iranian shrimp FOB price decreased 29% during recent 6 years (Figure 4). Thus, Iranian government was support shrimp industry by 5000 Rials (0.54 US\$) per kilogram of export.

Figure 4. Price of exported Iranian shrimp (frozen, size 60-70)



During the next decade, Iran same as other developing countries should decline interventions in agricultural market. So it is important to examine the compositeness of the shrimp farming in the country. This study is used PAM to assess the competitiveness of shrimp culture in Iran.

In the next section, a summary of the policy analysis matrix approach is presented. The third section presents results and the final section some concluding remarks.

## Methods

The PAM model introduced by Monke and Pearson (1989) were used by many researchers for measuring input use efficiency, comparative advantage and the degree of government interventions (Nelson and Panggabean 1991, Yao 1997, Adesina and Conlibaly 1998, Mohanty and Chaudhary 2002). The basic format of PAM, as show in Table 2 is a matrix of two-way accounting identities. Construction of the PAM model starts with the estimation of farm cost and returns. The production inputs have to be first broken down into tradable inputs and non-tradable or domestic inputs.

The distinction between tradable and domestic inputs is at the core of the conceptual framework. Tradable inputs can be internationally traded and includes both importable and exportable inputs. The second category of inputs is the domestic factors which include non tradable inputs such as labor and land. The prices of domestic inputs are mainly determined by local market. In contrary, price of the tradable inputs are determined by international markets.

Table 2. Structure of the policy analysis Matrix

	Revenue	Input costs		Profit
		Tradable input	Domestic costs	
Private prices	A	B	C	D
Social prices	E	F	G	H
Transfer	I	J	K	L

On the first line of the PAM is the calculation of private profitability (D), defined revenue (A) minus total costs (B+C). Where, B and C are tradable and domestic inputs, respectively (Table 2). In other words, the first line of the PAM contains the value for the accounting identity measured at private prices, which are the price actually used by the different agents to purchase their inputs and domestic factors and sell their outputs. Private profitability in the first row, demonstrates the competitiveness of the shrimp production system, given current prices for inputs, outputs and policy.

The second line of the PAM calculates the social profit that reflects social opportunity costs. Social profits measure efficiency and comparative advantage. Social profitability (H) measures revenue valued at social prices less value of tradable and domestic input both valued at social price. A positive social profit indicates that the system uses scarce resources efficiently and contributes to national income (Nelson and Panggabean 1991). The negative social profits indicate social inefficiencies suggest that production at social costs exceed the costs of import. In other words, the sector cannot survive without government support.

The final line of the matrix represents transfers that come into play due to policy-induced market distortions. The Third line of PAM accounts for the differences of the elements in the first row minus the corresponding elements in the second row. The difference between private and social values of costs, revenues, and profits can be explained by policy interventions. In the last line of PAM, I is out put transfer, J is tradable input transfer, and L is the net transfer (Pearson et al.

2003). Output transfer (I) a measure of the implicit tax or subsidy on outputs, equal revenue (A) less social revenues (E). Thus, tradable input transfer (J), a measure of the implicit tax or subsidy on tradable input, equal private tradable input costs (b) less social tradable input costs (F). The net transfer (L) is a net effect of all divergences or as the difference between private and social profitability.

A number of important indicators can be derived from PAM framework. Three important indicators that can be calculated from the PAM are include the effective protection coefficient (EPC), the domestic resource cost (DRC), and the nominal protection coefficient (NPC).

Effective protection coefficient is the ratio of value added in social prices  $\left[ \frac{(A-B)}{(E-F)} \right]$ . EPC value of

less than one suggests that government policies provide negative protection to producers, while EPC value greater than one indicate positive incentives to producers.

Nominal protection coefficient (NPC) which defined by the ratio of domestic price to the social price, NPC can be calculated for both output  $\left( \frac{A}{E} \right)$  and input  $\left( \frac{B}{F} \right)$ . The output NPC greater than 1

reveals that producers are protected for the product. Similarly using input cost NPC; measure the ratio of private cost of tradable inputs to their social cost. In this case, NPC greater than one indicates producers subsidized for input purchase. The domestic resource cost ratio (DRC) reveals the difference between opportunity costs of using domestic resources (G) and the value-added generated by the activity (E-F). The DRC  $\left( \frac{G}{E-F} \right)$  value less than 1 reveals that the

domestic factors are socially profitable. Although the DRC is widely used by Food and Agriculture Organization (FAO) and World Bank to measure comparative advantage, but DRC biased against activities that rely heavily on domestic factors (Masters and Nelson, 1995). An alternative for DRC in measuring comparative advantage is social cost benefit (SCB). The SCB is defined by the ratio of total resources cost (F+G) to the revenue (E). The SCB provides more accurate rankings of the comparative advantage of alternative activities. In this study only on activity (shrimp culture) is investigated. So the result of DRC is similar to use SCB.

## Results

The data requirement for constructing a PAM model are includes inputs, yield, exchange rate, transportation cost, subsidies, and prices for inputs and output.

In this study a PAM model build for shrimp culture in Iran. Most data are come from filed survey and Iranian Fishery Company. The survey sampling was two stage random sampling. The questionnaire collected information from 34 shrimp farmer in the south of Iran. Data collected included quantities and prices of fixed and variable inputs (feed, seed, fertilizer, labor, machine, fuel, land) and shrimp harvest.

The most difficult tasks for construction PAM are estimating social prices for outputs, and inputs (Yao, 1997). For computing social prices of inputs and outputs, world prices are used. The world prices are adjusted for transportation costs and other costs. For importing inputs, social prices are calculated by adding marketing costs to the Bandar Abbas CIF prices. In addition Bandar Abbas

FOB expert price are used for exportable inputs. Another important component in PAM is the tradable and non tradable inputs. Based on Monka and Pearson (1989), some inputs such as land, labor, seed and water considered non tradable. Descriptive statistics of farm production costs and inputs are presented in Table3. The share of feed and seed in the total production cost calculated 69% and 18%, respectively. It could be estimate that any policies regarding those inputs are very important for shrimp farming profitability. Table 4 shows market and social price for inputs. The social price for all tradable inputs except for feed is higher than market price.

Table 3. Summary of input used and production cost in ha. (2003)

Variable	Mean used	Cost (Rials)
Seed (No.)	224005	7168159
Feed (kg)	3133	26633619
Fertilizer (kg)	373	171283
Labor (day)	15	602518
Fuel (L)	474	78183
Cultivation (h)	87	827338
Transportation	3340	818072
Calcium carbonate	2985	1173141
Water	124	173741
Rent	1	496403
Electricity	11634	186151

Table 4. Market and social price for Inputs (2003)

Variable	Market price (Rials)	Social price (Rials)
Seed	32	32
Feed	8500	5415
fertilizer	459	1792
labor	40000	40000
fuel	165	948
Cultivation	9486	9962
Transportation	245	257
Calcium carbonate	393	1550
Water	1400	1400
Rent	22150	22150
Electricity	16	132

The social price (opportunity cost) of land for a particular crop is given as the highest net return to land of its competitive crops (Yao, 1999). Land used for shrimp culture in Iran is salty, poor and only few alternative activities available for that land. In addition, sea water is used for shrimp farming and there are no water charges. Therefore, the social cost for water assumed to be zero. Farmer is use pump for pond water exchange. Each farm has maintenance cost and operation cost for its irrigation system.

When the parity prices of products and inputs are estimated, the social exchange rate instead of the official exchange rate is used to convert the international prices into the Iranian Rials. To determine the shadow exchange rate, it is necessary to compute devaluation from two sources, different inflation and the structure of protection.

The policy of maintaining low prices of fuel, electricity, and fertilizers has been viewed as a major policy for agriculture growth in Iran, but these input have a small share in shrimp production cost (table 4). Based on the fact that the market price of feed is higher than social price and feed has big share in shrimp production cost, in overall shrimp farmer receive input tax as they were paid higher for tradable inputs than the true social value (table 5).

The biggest government direct subsidy on output comes in the form of the export subsidy. The principle determination of transfers to the inputs is the difference between world and domestic prices. The CIF price for shrimp in 2004 was 4.2\$ per kg equivalent to a wholesale social price of 18743 Rials per kg (after converting to social cost and subtracting the social value of transport cost).

Table 5 contains the PAM for shrimp production in Iran. I assumed that feed, fertilizer, calcium carbonate, and fuel are totally tradable. In terms of private (market) price shrimp farming is profitable. Contrary, in terms of social price it is not profitable activity. The most striking policy effect is illustrated by the divergences between private and social feed costs. The shrimp farmer paid 20% above world prices for their feeds. Turning to the domestic resources, the major policy impact was on fuel cost which was subsidized.

Table 5. The policy analysis Matrix for shrimp farming in Iran (2003)

	Revenue (Rials)	Input costs (Rials)		Profit (Rials)
		Tradable input	Domestic costs	
Private prices	42987000	28056227	10272382	4658391
Social prices	32592084			
Transfer	10394916	22711988	11704564	-1824438
		5344239	-1432182	6482529

The nominal protection coefficient (NPC) for shrimp was computed 1.31. This suggests that farmers received more for their shrimp as a result of export subsidy and exchange rate devaluation. NPC for tradable input computed for 1.23 this implies that although farmer was protected for fuel, electricity, fertilizer price, due to inputs high feed price, in all tradable inputs farmers are taxpayers.

EPC values measure the net effects of subsidies, tax, and distortion in exchange rates both for input and output market. The EPC value was 1.51, indicate that net effect of distortion is in fever of shrimp farmer. The computed value for DRC indicate that shrimp production has DRC higher than one (1.18), suggesting that exist comparative disadvantage in shrimp farming.



## Discussion

This research analyzed the comparative advantage of shrimp production in the southern Iran using policy analysis matrix. The PAM indicators suggest that shrimp is not efficiently produced in Iran. In addition, the results indicate that shrimp subsidies in output and inputs are higher than taxes via market distortions.

Results also reveal that the profitability of shrimp farming has increased with the devaluation of exchange rate. In the terms of market prices shrimp farming in Iran is profitable. Compare to others Asian countries, shrimp farming in Iran is less competition potential to India, China, Thailand and Philippine (Shang et al. 1998). The negative value of social profits indicates social inefficiencies; suggest that Iranian shrimp farming industry cannot survive without government support.

The results of this study have several implications. First, in spite of high governmental incentives for shrimp production, this activity socially was not profitable. Second, although Iranian government, like many countries support aquaculture industry, but the subsidy in short terms and during infant period is acceptable. Third, both private and government sectors should emphasis on research to increase resources productivity and shrimp farming profitability. Fourth, feed is very important factor in shrimp farming, producing cheaper feed contribute shrimp farming industry. Fourth, sensitivity analysis results indicate that shrimp aquaculture social profitability sensitive to exchange rate, shrimp price and feed price.

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