Potential fishery industry activities and financial aspects of east Malaysian marine fisheries

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26 July 2004

POTENTIAL FISHERY INDUSTRY ACTIVITIES AND FINANCIAL ASPECTS OF EAST MALAYSIAN MARINE FISHERIES

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ABSTRACT

The South China Sea separates East Malaysia from Peninsular Malaysia that is consisted of two big states; Sarawak and Sabah. The marine resources of peninsular Malaysia have been adequately explored in last few decades whereas East Malaysian marine fisheries resources are still potential to be explored. The fisheries sector of Malaysia plays an important role by generating income and employment with foreign exchange. The contribution of marine captured fisheries was up to 89.8% of the total fish production with a value of RM3.81 billion in 1998 (Annual Fisheries Statistics, 1998). The Exclusive Economic Zone (EEZ) of Malaysia in the South China Sea is approximately 198,173 km^2 (Earth trend, 2004). Mainly the bulk of the unexploited resources come from offshore demersal fish, small pelagic fish, coastal tuna and oceanic tuna. Trash and low value fishes are usually dumped into the sea considering it has no market value. These unwanted fishes are potential as raw material for making fishmeal that could generate good profit. Despite having good resource base due to lack of ready and skillful labor with infrastructure, port facilities and expert advices, East Malaysian fisheries sector is not adequately contributive to the economy of the country. The study attempted to find out the potential fishing industry activities in East Malaysia. It also focuses on the financial aspects of various fisheries related activities such as fishmeal plant and ice plant by carrying out a simplified benefit-cost analysis. Fishery business makes much profit not from the capture side rather from the fish processing, marketing, ice plant and fish storage services. The study recommends that establishing and facilitating fishery industries is potential to contribute to the sector as well as to the economy significantly.

Keywords: East Malaysian marine fishery, Fishing industry, financial aspects, Benefit-cost ratio

INTRODUCTION

Malaysia is a member county of ASEAN lies in South East Asia (Latitude 1-8^{0}N, Longitude 100-119^{0}E) (FAO, 2004). Mainly the country is divided into two parts separated by South China Sea. West Malaysia is known also as Peninsular Malaysia because it is bounded by the sea on most sides except in the north where it is attached to the mainland of Asia. The part known as East Malaysia is consisted of the states of Sabah and Sarawak (Figure 1) which is a part of the island of Borneo, located 1200 km to the east of the Peninsular across the South China Sea. Sabah occupies the northern part of Borneo, while Sarawak is located entirely on the west of the island. The east coast of West Malaysia faces the South China Sea, as with Sarawak, and the western part of Sabah. The west coast of the Peninsula, however, is bordered mainly by the straits of Malacca and some of the Andaman Sea up north and Java Sea down south. The country has 328,550 sq km land and 1,200 sq km water.

The total coastline of Malaysia is 4,675 km (Peninsular Malaysia 2,068 km, East Malaysia 2,607 km) (Indexmundi, 2004). According to maritime claims the continental shelf is 200-m depth or to the depth of exploitation; specified boundary in the South China Sea. The territorial sea of the country is 12 nautical miles. The total size of the Exclusive Economic Zone (EEZ) of Malaysia in the South China Sea area is approximately 198,173 km^2 (Earth trend, 2004). Figure 1 shows the political map of Malaysia (Peninsular Malaysia and East Malaysia). Table 1 reveals the summary statistics of Malaysian coasts in comparison with world statistics.

Figure 1: Map of Malaysia (Peninsular Malaysia and East Malaysia).
Source: Nations online, 2004

Table 1: Costal Statistics of Malaysia

Item	Malaysia	World
Area of continental self (km^2)	335,914	24,285,959
Territorial sea (Up to 12 nautical miles) (km^2)	152,367	18816919
Claimed Exclusive Economic Zone (km^2)	198,173	102,108,403

Source: Earthtrends, 2004

The fishery sector of Malaysia is an important economic sector as it provides a vital source of animal protein as well as promotes rural development by creating employment opportunity. It contributes about 1.62% to the national Gross Domestic Product (GDP) and provides direct employment to more than 81,547 fishermen and 21,619 (Annual Fisheries Statistics, 1998) fish culturists. The fishery industries comprise marine (deep-sea and inshore) as well as inland fishing activities (the article will confine its discussion within marine fishery industries). Inshore fishery has been found to be main contributor by contributing more than 80% of the fish landings; exceeding 1 million mt. Deep-sea fishery landing contributes to about 15 % of the total fish production. Table 2 shows the year wise (1999-2001) fish landings from inshore and deep-sea fishery.

Table 2: Quantity of Fish Production (mt) from 1999 -2001

Year	1999	2000	2001
Inshore fishery	1,109,733	1,114,669	1,063,363
Deep-sea fishery	138,669	171,027	167,926
Total landings	1,248,402	1,285,696	1,231289

Source: Department of Fisheries, Malaysia, 2001

According to the literature, inshore fishing activities are still confined to the west coast of Peninsular Malaysia, which accounts for more than 40% of the total inshore fish landings, followed by the east coast of Peninsular Malaysia (27%) and Sabah-Sarawak (25%). The west and east coasts of Peninsular Malaysia, together, also account for more than 70% of the total deep-sea fishery landings.

Table 3 shows the fish consumption and trade of Malaysian economy as a whole. A comparative picture of fish consumption and trade among Malaysia, Asia (excluding middle east) and world reveals that 21 % demand of protein in Malaysia is met by marine fisheries whereas 10% in Asia followed by 6% in world (Table 1). Figure 2 shows the average annual capture of marine fish of Malaysia. The fish landings trend has shown various increase and decreases in catch over the last 32 years. Though there were fluctuation in marine landings, but the landing trend over the years shows a steady production up to year 2000 (Figure 2).

Table 3: Fish Consumption and Trade, 2000

Item	Malaysia	Asia (excluding middle east)	World
Fish protein (% of total protein supply)	21%	10%	6%
Imports (Thousand $ US)	299,603	22,787,200	60,008,337
Percent change since 1980	319%	-	275%
Exports (Thousand $ US)	199,001	16,839,046	54,570,489
Percent change since 1980	57%	403%	258%

Source: Earthtrends, 2004

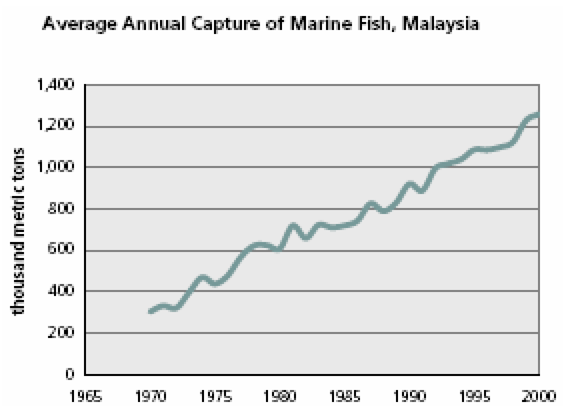

Figure 2: .Average annual capture of marine fish of Malaysia
Source: Earthtrends, 2004

This study attempted to determines the potential fishery industries in east Malaysia for utilizing the fisheries resources efficiently. By providing simplified financial analysis it focused on the profit margin of establishing various fishery industries. Based on the available literature the study has put effort to determine the status and availability of the resources to recommend potential fishery industries and related activities.

FISHERIES RESOURCES

East Malaysian seas have unique physical features. The Continental shelf (waters from the sea shoreline to 200m depth) extends between the low watermarks to 200 miles offshore. This area estimated at 335,914 km^2 and the seabed is interspersed with reefs and rough ground. The slope of continental shelf is steep dropping to a depth of 1000 m. Beyond the continental slope water depth may reach more than 2500 m. This diversity of habitat results in a diversity of fishery resources and can be categorized as follows (UBC, 2001):

- Coastal resources: - < 30nm from shore.
- Continental shelf resources: - extending to the 200 m isobath.
- Continental slope: - resources from depth of 200 to 1000m.
- Deepwater resources: (> 1000 m)
- Pelagic resources.

Sarawak is comparatively bigger than that State of Sabah (Figure3). But fishing industry activities in Sarawak is not as extensive as its potentialities. In 1998, the recorded fish landing from the off shore areas (beyond 30 nautical miles from the coast) was only 21,339 mt. It is obvious from this information that deep-sea fishing activities by the local fishermen are minimal. Thus there exists a good potential for further development of the fish resources. The deep-sea vessels (>70GRT) that operate fishing is mainly confined within the coastal area. Also the fish caught by deep sea fishing vessels are not properly utilized due to lack of fishery infrastructure such as fish preservation facilities and processing facility. A substantial amount of trash fishes are caught during fishing activities that are mostly dumped back into the sea considering trash catch.

Based upon all the current reports and fish resources survey available, the waters of Sarawak Extensive Economic Zone (EEZ) which span the southern part of the South China Sea are presently largely unexploited by Sarawak fisherman (UBC, 2001). An estimate on fish resources shows that there is a potential increase in fish landings from the 88,241mt in 1992 to 99,255 mt in 1995. Though the statistics are old it shows the increasing trend of fish landings. This figure however needs to be scrutinized very closely. The trend in fish landings has varied correspondingly over the last 7-8 years in Sarawak marine fish landing. Published statistics in 1986 indicates that the decade of the 70s experiences an average increase of 32% per year. From 1980 to 1987, the landings declined and ranged 60,000-70,000 mt. In 1988, there was steeper 19% increase in total landings and it was up to 80,000 mt. The production was almost similar up to 1991giving minimal annual increase of 1-2%.

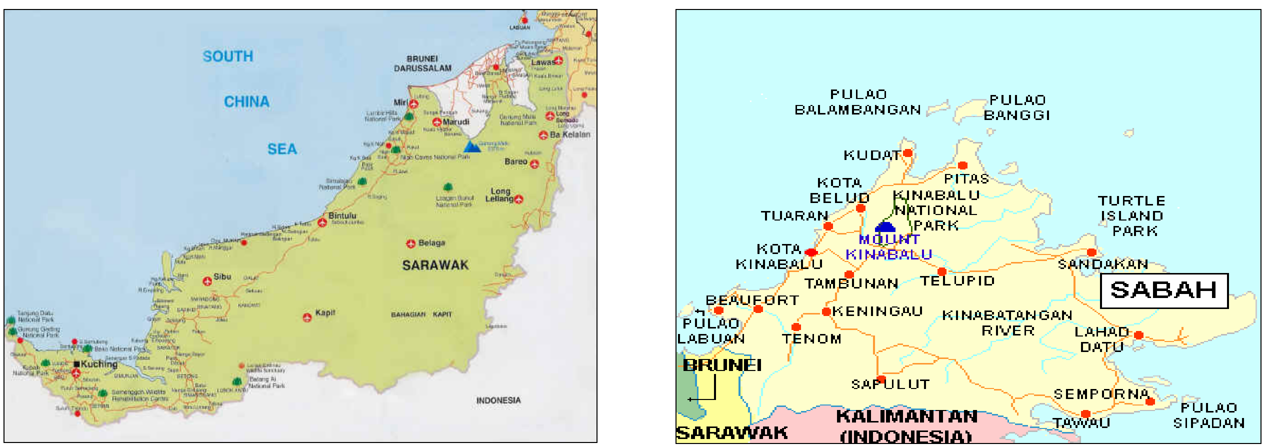

Figure 3a and 3b: Map of Sarawak and Sabah, respectively
Source: Nations online, 2004

Table 4 shows an estimation of the potential yield of the fishery resources of the Sarawak waters. The data available based on estimates of potential yield using various methods such as Fox model and the Shaeffer model showed that the potential yield from the waters of Sarawak is 310,996 mt. The bulk of the unexploited resources come from offshore demersal fish, reef and rough ground, small pelagic fish, coastal tuna and oceanic tuna amounting to 238,012 mt. The deep-sea resource of Sarawak is therefore virtually unexploited (especially by local fishermen) and there is a large potential to develop the deep-sea fishing and related industries.

Table 4: Fish Resources Potential and Status of Exploitation in Sarawak

Fish Resources	Potential yield (mt)	Current exploitation (mt)	Unexploited (mt)	Status
Prawn	15000	16000 (1993)	-	Overexploited
Coastal demersal fish	54000	57000 (1994)	-	Overexploited
Offshore demersal fish	72899	0.0 (1993)	72899	Slightly exploited
Reefs and rough grounds	33947	2384 (1993)	31565	Slightly exploited
Small pelagic fish	108150	17600 (1995)	90550	Slightly exploited
Coastal tuna	20000	2,000	18000	Slightly exploited
Oceanic tuna	25000	-	25000	Slightly exploited

Source: Albert Chuang and Hadil Bin Rajau, 1998

Sabah is another state of East Malaysia abutted the see by three-quarters of its boundaries. These seas possess some of the world's richest ecosystems characterized by extensive coral reefs and dense mangrove forests. The state is full of fisheries resources in the wide expanse of the deep seas. With these resources, the state of Sabah has high potentialities to develop substantial fishing industries for socio-economic development. The share of the fisheries sector of the state in state GDP is 2.4% which is possible to increase up to sound level by developing fishing industries and exploring the resources. In 1997, the fisheries production was 180,000 mt valuing at RM 590 million. For sustainable fishing resources and optimum return from Sabah, fisheries sector, deep-sea fishing effort is required to be increased.

Deep see fishing operations already being carried out in Sabah in the early 1960s but these became active only about the mid-1980s (Town planning, 2004). Deep sea fisheries have seen major developments in the last 3 years. Although before this there have been fishing activities beyond the 30 nautical mile limit, these have been using mainly traditional gears which are inefficient and of low economic viability and thus not considered as true deep see fishing operation. Deep sea resources are estimated to be 139,500 mt and comprised of about 68,000 mt pelagic fishes and about 11,000 mt demersal fishes which are commercially exploitable. Deep sea fish production accounted for about 30% of the total fish landings in Sabah. The main types of fish landed are shoaling pelagics such as tuna, rumahan, selar, cencaru, etc. At the present fishing activities in the state are concentrated within the 30 nautical mile limit and thus Sabah's fisheries may be terms as predominantly coastal. In 1996, the total fish production from marine capture was 167,000 mt. The marine fisheries resources of the waters of Sabah have an estimated potential yield of 251,500 mt. the coastal waters of Sabah have about 112,000 mt of demersal fish resources while pelagic stocks are to be about 40,000 mt. Table 3 shows marine fish production and projections of the state Sabah.

Table 5:.Marine Fish Production and Projection of Sabah

Production	1995	1996	1997	1998	1999
Quantity (mt)	180,000	167,000	175,000	183,000	191,000
Value (Million RM)	583	509	530	543	583

Source: Town planning, 2004

The amount of fishes processed in Sabah has been estimated 60,000 mt whereas in comparison with the potential deep-sea fish resources, it is low. In the past, processed fish were solely dried/salted fish but in the last few years, downstream processors have diversified to semi-processed fish (de-headed, scaled, gilled and gutted) and value-added fish products such as fish fillet, shark's fins, surimi, katsuobushi and fish meal. Also, apart from fish and prawns, processors have processed squids and octopus (cephalopods, whole, cleaned or fillet), jelly fish, slipper lobsters and coral lobsters. There are about 40 processing plants of various size and capacities in Sabah. Of which 20 are primarily prawn-processing plants that mostly process prawns and demersal fishes. Six plants process food-fishes for the markets and the by-catch into fishmeal. The development of fishing industries of Sabah is at a better condition than Sarawak. Table 4 shows a comparative marine fisheries production among Peninsular Malaysia, Sarawak and Sabah from 1992 to 1995. Mostly fish landings of Sabah are higher than Sarawak in each year. But both the states individually show lower landings than Peninsular Malaysia.

Table 6: Trend of Marine Fish Landings, 1992 – 1995 (Quantity in tones)

Year	1992	1993	1994	1995
Peninsular Malaysia	767,532	791,618	785,079	819,464
Sabah	148,000	154,667	160,328	166,462
Sarawak	88,241	81,924	95,624	99,255
Total	1,023,516	1,047,350	1,065,585	1,108,436

Source: The Annual Fisheries Statistics 1995, Volume 1 and Volume 2

CATCH COMPOSITION

Coastal fisheries are mainly the catch of prawns and fin-fishes from trawlers. By the mid 1980s, coastal fisheries have shown an increase in finfish trawl fisheries and at present this fisheries has become just as economically significant as the prawn fisheries. The catch composition shows an inordinate proportion of low grade (grade III) fish species (64% in 1991), trash fish (15%) and high value jelly fish (10%). Grade I and Grade II fish species contributed only 12%. The tropical demersal fish community is multi species. A survey showed that more than 271 species representing 112 families are found in the catch. Nine dominant families are caught representing from 2.7% to 15% of the catch. These families are Monacanthidae, Nemipteridae, Carangidae, Leiognathidae, Synodontidae, Mullidae, Priacanthidae, Gerreidae, Lutjanidae, and the rays group (UBC, 2001). From the catch composition it is clear that the main issue in the catch of offshore demersal fishery is the capture of "low value fish". High value fish species or sometimes termed "table fish" such as the Lutjanidae, Carangidae and rays only represent 16 % of the catch. Other high value species/family such as Serranidae, Sciaenidae, Lethrinidae, and Pomadasyidae only represent less than 1 % of the catch. The data gathered from catch data of the present chartered vessel showed an even lower percentage of high value fish. The Thai vessels reporting 5% to 10% while the Korean freezer vessels working the rough and reef grounds reported some 22% of table fish in the catch. The rest of the catches are made up of industrial fish and trash fish. Industrial fish making up some 50% of the catch and the remaining are 30% to 40 % trash fish (UBC, 2001). The catch of trash fish may be even higher if not for the discard of trash fish in the first few days of the trip.

FISH PROCESSING AND OTHER RELATED ACTIVITIES

The main emphasis of the National Agriculture Policy of Malaysia is to increase food production. At the same time, the importance of managing the fishery resources on a sustainable basis is fully recognized. National Agriculture Policy III (NAP3) stressed on the self-sufficiency in food production by introducing integrated farm management. In fisheries sector the policy focused on offshore fishing, aquaculture and downstream value-added activities. At present fish post harvest and fish processing industries are not adequate to meet the necessity. Trash fish usually make up 50% of the catch and is dumped into the sea because of the low price. But if there are processing facilities at the ports it is possible to process the trash fishes as fish meal. For the catch of last few years showed that there is a potential for four economically viable industries. The four industries are: ice plant, surimi plant, fishmeal plant and fish processing plant (UBC, 2001). These potential industries are discussed in the following sections briefly.

Ice plant is a vital necessity in fishing activities and industries. Though it is not directly called fishing industry its economic return as a supportive industry is very high and potential (Appendix A). Mostly

Block Ice Plant and Flake Ice Plant are necessary for preserving fish during fishing activities as well as during post harvest processing. It has a ready market in the fishing areas.

Surimi Plant produces Surimi. Frozen Surimi is one way to use efficiently unused or underutilized species as human food. The use of frozen Surimi has increased significantly in Southeast Asia. Several factories in the region have been producing frozen Surimi using tropical fish species for the Japanese and Southeast Asian market. Surimi factories could be established at or near fish landing areas. The fish species used for producing Surimi in south East Asia are threadfin bream (*Nemipterus* sp.; local name-Herisi), big-eye snapper (*Priacanthus* sp.; local name-Loloy Box), barracuda (*Sphypaena* sp.; local name-Soded) and croaker (*Pennahia* sp.*, Johnius* sp.) (UBC, 2001). Any species of fish with good gel-forming ability and white meat color can be used for Surimi production. But the species must also be low priced and readily available.

Fish meal plant is one of the highly potential fishing industries based on the catch of east Malaysian water. The strong development of aquaculture during the last years has substantially modified and expanded the fishmeal and fish oil industry. By establishing fish meal plant trash fishes could be used as raw material and stopped dumping back to the sea. Each fishing vessel is capable of catching between 5-7 mt of trash fish per trip in the South China Sea region. On an average of 10 vessels landing per day there will be around 50-70 mt of trash fish available for processing.

Fish processing plant sector is currently focused on export sales of medium grade prawn and jellyfish products. Some processors import fish and fish products from other regional markets to meet domestic demand. The priority areas of development opportunity for fish processing sector are establishment of mixed species canneries and value-added processing. Pelagic catches should prove adequate to support a small cannery to process mackerel, tuna, scad, trevacily and sardine species for the local market to provide a substitute for part of the canned fish imports which, were reported to be 2,899 mt with a value of RM 1.6 million. For the domestic market, apart from the existing range of processed products there is little possibility, at the present time, of expanding the range to include other value added products such as frozen fillets, steaks, and other processed fish items. The prospects for the diversification and improvement of export earnings of the fisheries sector by an expansion of value added processing of demersal species to add to the current range of products being processed such as jelly fish, prawn, surimi and minor amounts of fish fillets, are also somewhat limited at this time, but will offer significant potential in the future.

FINANCIAL ASPECTS

Two prospective industries namely fish meal plant and ice plants have been discussed in this section with simplified benefit-cost ratio. Most of the fish meal plant in Asia process lean fish and fish waste. A lean fish plant is very simple to operate and maintain. The fishmeal plant that is able to operate 60% of the year (220 full days out of 365 days, 5280 hours out of 8760hours) is considered productive. As a general guide, the break-even point for most fishmeal plants is about 25% operation per year (about 100 days). Generally the yield of fish meal from residue materials is expected to be 25% (4 tons of fish to 1 ton of fishmeal) for a medium size fishmeal plant. The quality of the fishmeal depends on the freshness of the fish. This will mean that trash fish have to be preserved with fish and ice mix. The medium size fish meal plant is suitable for the starting of such fishing industry at the port or port areas. Fishmeal plants always have shown to make a profit provided there is enough raw fish or fish waste available at acceptable price. Table 6 shows the benefit-cost ratio of a medium size fishmeal plant and ice plant. Both plants are financially feasible. Considering the payback of credit the plants have been also found to be feasible. Table 7 shows the result of sensitivity analysis conducted based on the fluctuation in price of raw materials for fish meal plant. If the price of raw materials decreases 10 %, the benefit-cost ratio has been found to be very high indicating high feasibility. In case of 10% increase in price the fishmeal plant has been found to be feasible, too. Between fish meal and ice plant, the benefit-cost ratio of ice plant is significantly higher than the fish meal plant. It is so, because of low cost of production, ready market and good price of ice (Appendix A).

Table 7: Benefit-Cost Ratio of Fish Meal and Ice Plant

lant	BCR[1]	BCR with pay back
Fish meal	1.48	1.32
Ice plant	3.20	1.43

Table 8: Sensitivity Analysis of Benefit-Cost Ratio for Fish Meal and Ice Plant

Plant	BCR	BCR with pay back
Fish meal	1.38 (10% increase in the price of raw materials)	1.24 (10% increase in the price of raw materials)
	1.60 (10% decrease in the price of raw materials)	1.41 (10% decrease in the price of raw materials)

CONCLUSION

East Malaysian fishery is remarkably potential for meeting the growing demand of food of the country for the growing population. Both inshore and offshore fisheries of East Malaysia are still to be explored to contribute to the GDP. Fishery industries in Sabah have already been escalated to face the local demand as well as international whereas Sarawak is needed further attention to be attended for infrastructural development for fishery industries. The government is putting greater efforts to sustain growth in fish production; and to make the Malaysian fishery industry more competitive in international market. Thus, the study has revealed a very timely issue to be assessed. It focused on the Initiatives are to be taken by the government to develop a good network for fishery industries that could promote the sector. Incentive packages from the government, somewhat similar to other industries are required to encourage participation in fishery industry. In order to face depletion of fish resources there is a need to tap the future potential of deep see fishing activities. Another issue that is to be considered primly is infrastructural facilities such as landing jetties, roads, and wholesale centers. At the same time sufficient preservation facilities are needed to be developed.

ACKNOWLEDGEMENT

The author wishes to thank Prof. Dr. Mohd. Ibrahim Hj Mohamed for making the topic interesting. Special gratitude is due to Mr. Nurus Safa for his inspiration to write the article. Last but not the least, the staff of University Putra Malaysia is warmly acknowledged for their kind assistance.

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[1] The calculation of BCR has been shown in appendix A

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Appendix A

A. LFT 40 medium size fish meal plant[2]

a. Cost calculation		
Annual fixed plant cost	352,400	
Variable costs		
Costs of raw materials	770,000	
Plant costs	117,194	
Total production cost	1,239,594	
b. Benefit calculation		
Sell of fishmeal/day	13, 376	**(A)**
Production cost/day	9027	**(B)**
c. Profit calculation		
Profit/day (A-B)	4349	
d. Benefit-cost ratio	**1.48**	
Cost added for payback	1099	
Production cost/day during payback	10126	
e. Benefit-cost ratio with payback	**1.32**	

B. Ice plant 50 MT/day Block Ice Plant

a. Cost and Benefit calculation		
Sell of fishmeal/day	8,000	**(A)**
Production cost/day	2486	**(B)**
b. Profit calculation		
Profit/day (A-B)	5514	
c. Benefit-cost ratio	**3.2**	
Cost added for payback	3100	
Production cost/day during payback	5586	
d. Benefit-cost ratio with payback	**1.43**	

Source: UBC, 2001

[2] 110 days operation, volume of raw material 3080 mt (RM 250/mt) 25% yield, amortization for 10 yrs at 12%.