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OPPORTUNITIES THROUGH VALUE CREATIONS FROM LOW VALUE FISH FOR FAMILY OWNED MICRO-BUSINESS ENTERPRISES IN WEST MALAYSIA

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Abstract

The project tried to discover opportunities for value creation from low value short mackerel (*Rastrelliger brachysoma*) using dried/salted and salted methods which will be introduce to FOMBEs in Malaysia. The systematic Stage-Gate model procedure was used as a tool to select the best species from the available low value fish in Malaysia for the production method of FOMBEs. The decisions to select the best species was apply by using the ABC analysis and weighted matrix with specified criteria and the highest scores will be the selected species to be implemented by FOMBEs. To find the feasibility of the project, the profitability model was used along the planning horizon of 10 years. The results show that FOMBEs are able to gain more than 20% from the investment of equity along the planning horizon, but the project is sensitive to the sales price, sales quantity and the variable cost. Application of knowledge in fish processing and financial prudence will have to be coordinated before profits can be realised. The formation of FOMBEs will create employment opportunities for rural coastal fishermen communities in Malaysia. It is a great opportunity for the Malaysian fisheries sector to form FOMBEs among the fisherman family to maximise the available resources from low value fish. Fisheries Development Authority of Malaysia (FDAM) can provide the technical assistance to structure the future FOMBEs. With the available financial assistance from the Malaysian government for Small and Medium Enterprises (SMEs) and low interest rate, FOMBEs may take advantage of capitalising on producing a quality product from low value fish.

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1. INTRODUCTION

The Malaysian fisheries sector plays an important role supplying protein as a source of food and providing employment for more than 125,000 fishermen (DOF 2009). The Fisheries Development Authority of Malaysia (FDAM) and the Department of Fisheries (DOF) are the government agencies responsible for providing assistance to fishermen communities in terms of social development and technical assistance to foster the growth of the fisheries sector. The Ministry of Agriculture and Agro-Based Industry (MOA) in Malaysia and its relevant authorities like MARDI (Malaysian Agriculture Research and Development Institution) provide assistance to the small and medium enterprises (SMEs) of the agriculture and fisheries sector to enhance the income and employment among rural fishermen communities. In 2009, Malaysia harvested 1.4 MT (Million Tonnes) of marine fisheries valued at 6.3 billion RM[1] (DOF, 2009). A large proportion of the volume of fish landed in Malaysia is of relatively low value. Family owned micro-business enterprises (FOMBEs) can develop value adding processed products from low value catches such as diverse dried, salted and smoked products.

The aim of this project is to study the opportunities for FOMBEs to increase value creations of low value marine fish landed in West Malaysia. This can create employment opportunities, social improvement for the rural fishermen communities and help fulfil the demand for protein. The purpose of this study is to discover good opportunities for value creation of low value fish products and establish convenient methods which would be introduced to FOMBEs in Malaysia answering the question: *What opportunities and methods of value addition can be introduced to FOMBEs in Malaysia for profitable production from low value fish?*
The expected outcomes from this study are:

i. To introduce opportunities for FOMBEs for the creation of employment opportunities for rural fishermen communities in Malaysia.
ii. To select a particular species of low value fish harvested in Malaysia that can be processed economically.
iii. To select a suitable method of production for adding value to the low value fisheries value chain.
iv. To estimate the profitability of the operations of FOMBEs producing products from low value fish.

[1] RM-Ringgit Malaysia (Malaysia currency)

The objective of this project is to suggest a profitable operating structure for micro business FOMBEs owned by the coastal fishermen and their families.

In this paper both primary and secondary data and information on specific aspects of value creations in Malaysian fisheries are analysed. The information was collected by reviewing both print and electronic documents from research publications (library and on-line reprints and databases), journals and by interviews conducted in Iceland. Calculations of assumptions and financial measurements are used to evaluate the feasibility of the project of establishing a FOMBE owned by fishermen and their families processing products from low value fish. Small and medium enterprises in Iceland producing dried, salted and smoked fish will be visited and their managers interviewed.

A Stage-Gate process will be applied to screen the process at every gate in order to identify feasible options of business for the FOMBEs. At the gates either go or kill decisions have to be used.

In the paper an ABC analysis method will be used. This method estimates different levels of significance. It is a form of Pareto analysis. Grade II and III species, suitable for salting, smoking or drying, are grouped into A, B and C categories according to the lowest average ex vessel price. The project then analyses the 10 groups of low value A species chosen.

A product development decisional process, The Stage-Gate Model, is used for structuring the decisions needed. Two decisional gates are used. A weighted importance matrix is then used for differentiating among the 10 species at gate one by assigning weights to importance criteria used. At gate two the 10 species are cut down to three. These criteria are awarded scores from 10 down to 1 and the weights and the scores multiplied giving a weighted score that is used for choosing the most important species to work with.

A profitability analysis model is then used to assess the feasibility of establishing a FOMBE processing 200 kg of fish each day for 200 working days a year. A sensitivity analysis is also conducted to estimate the changes in profitability for the FOMBE if sales, variable cost and cost of equipment would change from the assumptions of the model.

The justification for the author for starting this work is that information from the Malaysian fisheries statistics has shown that there are great opportunities for existing entrepreneurs and future FOMBEs among fishermen and their families. People are ready to identify the business opportunities in transforming low value fish into value added products.

In order for FOMBESs in Malaysia to be able to export value added fishery products to demanding foreign markets, the industry has to acquire the necessary skills to process high quality food for consumption and to fully meet all the standard requirements of food safety.

2. BACKGROUND

2.1. Overview of Malaysia

Malaysia is located in the South East Asian region, bordering Thailand in the north and Singapore on the southern tip (figure 1). It is situated at the coordinates of 2°30' north and 112°30' east. Malaysia gained its independence from the British in 1957. The capital city is Kuala Lumpur and the administrative centre is at Putra Jaya. The total population is about 28.3 million (World Fact Book 2010).

Figure 1 : Map of Malaysia (World Fact Book 2010)

Total area of the mainland is about 329,847 km² with a coastline of 4,675 km. The territorial sea of Malaysia is 12 nautical miles. The EEZ[2] of the Malaysian sea is 200 nautical miles from the shore line. The country is located at a very strategic location along the busiest straits in the world which are the Straits of Malacca along the west coast and the South China Sea in the east (World Fact Book 2010).

At present Malaysia is diversifying its economy, moving from export of raw materials to expansion into the multi-sector economy of manufacturing, services and tourism and shifting to knowledge-based technology. The government has encouraged private sectors and investors to invest through foreign direct investment in value added production chains in the high technology industries. The main export commodities are electronic equipment, petroleum, liquid natural gas, wood and woods products, palm oil, rubber, textiles and chemicals. In 2009 the per capita GDP was $13, 800 USD and the annual growth rate was negative by 2.3% compared to + 4.6% in 2008 (World Bank 2010). Malaysia has a labour force of 11.38 million (40.2%) from a total

[2] EEZ-economic exclusion zone

population of about 28.3 million with an unemployment rate of 3.7%. The most common occupations are in services (51%), industry (36%) and agriculture (13%) (World Fact Book 2010).

2.2. Malaysian fisheries

Fish contributes about two-thirds of all protein consumed in the country. In 2009, the fisheries sector for all of Malaysia contributed 1.3% to the GDP and employed about 4.3% of the population. More than 90% of the fisheries production is from marine capture fisheries. Landing quantity ranging from 1.3 MT[3] in 2000 to 1.4 MT in 2009 (Table 1). From the total landings 82% are captured from inshore and 18% from deep sea (DOF 2000; DOF 2001; DOF 2009).

Table 1 : Contribution of the Malaysian fisheries sector 2000 - 2009

Years	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Capture Fisheries (MT)	1.29	1.23	1.27	1.29	1.54	1.21	1.40	1.38	1.39	1.39
Aquaculture (MT)	0.12	0.14	0.15	0.15	0.20	0.21	0.21	0.27	0.35	0.47
Total Production (MT)	1.41	1.37	1.42	1.44	1.74	1.42	1.61	1.65	1.74	1.86
Value (RM billion)	5.37	5.45	5.41	5.31	5.50	4.30	6.26	6.43	7.37	8.60
GDP (%)	1.60	1.50	1.50	1.40	1.70	1.30	1.10	1.20	1.20	1.30

There were 125,632 local fishermen and 34,520 foreign fishermen working on 48,745 fishing vessels in 2009, excluding other workforce directly or indirectly involved in the upstream and downstream activities in the fisheries industry (DOF 2009). The marine capture fisheries catch landed in Malaysia is categorized into grade I, grade II and grade III according to the value of the fish. The definitions for fish grades are shown in Table 2. The grade I is normally caught by fishing gears like long lines, gill nets, fish traps and from daily trips of trawlers and purse seine vessels. Generally the duration of a trawling operation trip is between four to six days.

Table 2 : Species of fish and grades in Malaysia (Modified from DOF 2009)

	Average Ex-Vessel Price Range (RM)	**Species**
Grade I	Price: RM10.00 and above Size: > 600 gm and above	Chinese Pomfret, Silver Pomfret, Black Pomfret, Large Threadfin, Spanish Mackerel, Wolf Herring, Grouper, Mangrove Snapper, Red Snapper and Sea Bass.
Grade II	Price: RM5.00 – RM9.99 Size: 6 – 8 pieces per kilogram	Longtail Shad, Shads/Slender Shads, Red Snapper, Sweetlip, Horse Mackerel, Indian Mackerel and Giant Sea Perch, Medium Threadfin, Neritic Tuna and other medium pelagic and demersal species.
Grade III	Price: RM4.99 and below Size: > 8 pieces per kilogram	Small Sting Ray, Sharks, Ribbon fish, Large Head Hairtail, Short Mackerel, Sardines, Scads, Croaker, Anchovy and other small pelagic and demersal species.

Grade II and III fish are considered as low commercial value fish. This makes up more than 80% of the total landings in West Malaysia, mostly from commercial trawlers and purse seiners consisting of small size pelagic fin fish and demersal

[3] MT- million tonnes

species. One of the issues of the Malaysian fisheries is the high volume landings of low commercial value from fish purse seiners and the by-catch from trawlers. This can be seen from the total landings of marine capture fisheries in West Malaysia (excluding trash fish, crustaceans and shell fish) according to grades as shown in figure 2 (DOF 2000; DOF 2001; DOF 2009).

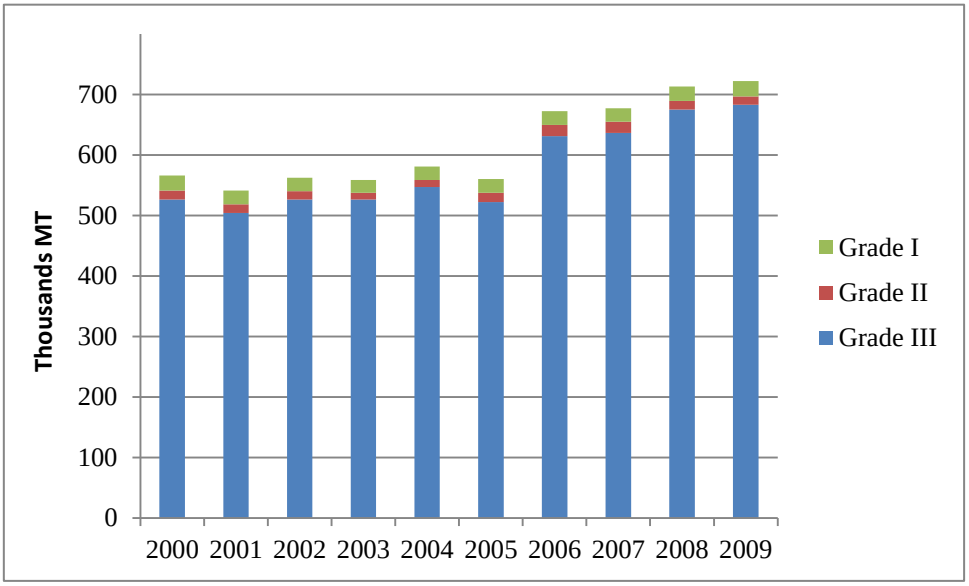

Figure 2 : Total landing of fish in West Malaysia by grades

The low commercial value fish can be utilised as fresh fish for direct human consumption, as a processed product for value addition, and as animal feed or oil. In 2009 (Table 3) the most common method of utilisation from Malaysian fisheries (63%) was the consumption of mostly fresh fish; 29% was utilised as fish meal or feed for animals and only 8% was processed for human consumption as value added products (DOF 2000-2009).

Table 3 : Utilization of West Malaysian capture fisheries 2000 - 2009

Disposition	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fresh	648,435	586,346	607,169	571,705	607,169	595,748	737,149	710,697	734,605	672,651
Frozen	5,100	5,360	3,497	3,653	3,497	5,886	3,310	15,150	6,382	10,410
Dried/Salted/ Smoke	39,496	35,082	38,893	41,420	38,893	20,136	23,501	18,892	33,110	31,928
Steamed/Boiled	1,900	2,413	2,925	3,253	2,925	4,800	4,811	4,371	3,932	5,951
Fermented	11,203	11,220	8,882	13,110	8,882	6,985	90,839	14,316	28,806	31,830
Fish meal/feed mill	170,807	183,859	206,529	196,392	206,529	112,178	154,563	161,293	143,010	211,682
Others	40,933	47,712	81,207	90,821	81,207	98,806	93,887	104,376	105,444	99,971
Total	919,874	873,993	951,104	922,357	951,106	846,544	1,110,066	1,031,102	1,057,297	1,066,432

N.B.: Including trash fish.

The major commercial fishing gears used in Malaysia are trawls and purse seine nets. Other fishing gears used are gill nets, fish traps, long lines, anchovy purse seines and small trawls. The by-catches (small pelagic fish and demersal fish) from trawlers and purse seiners are not discarded. They are landed and considered as grade III product. A survey conducted in Malaysian waters in 2004 showed that only 12% of the total

catch is grade I and II fish, 10% is high value jelly fish and the rest, 78% is the low value grade III fish (Mohammad Samauna Safa 2004). For small enterprises among the fisher community this offers great opportunities to create and add value to that low value by-catch.

3. LITERATURE REVIEW

3.1. Small and medium enterprises

Small and medium enterprises (SMEs) have unique advantages compared to bigger companies often due to fewer layers in the hierarchy and departments and less internal organisational barriers. The only barriers for SMEs starting a strategic alliance with bigger companies are the limited accessibility of resources such as capital, knowledge and time. According to Knútsson (2001) the following five factors can explain efficiency differences between large and small companies:

- The organisation culture for a small company is based on lean and informal enterprise characteristics, compared to large companies that have more formal hierarchy, bureaucracy and formalities
- The decision making process is very fast for small companies and can be easily done at the workplace. While large companies possess slow decision-making and they have to go through many levels until the top level will finally make the decisions
- The management style of small companies is based on strong leadership and spontaneous response. For bigger companies it is a traditional mechanism style of management.
- The different capabilities to change. Small companies are able to adapt quickly to changes by using innovation compared to bigger companies that change slowly due to their size.
- The different style in decision making. The management of partnership of small business allows the top manager responsible to have the authority for making decisions compared to bigger companies, where middle managers would be responsible and could not make decisions themselves.

SMEs act as a catalyst to industry. SMEs do business with big companies and are through that interlinked to agriculture, manufacturing and other related services. There are many small and medium enterprises that are involved in the bigger sectors and subsectors providing employment to the population. Medium size business employs 20 or more but fewer than 200 people (Price Waterhouse Coopers 2007). Small firms or organisations, often owner managed and with fewer than 50 employees, are considered small businesses (QFinance 2010). The Australian Bureau of Statistics (ABS) defines small businesses as companies that employ fewer than 20 people. They also included in their definition non-employing businesses, both sole proprietorships and partnerships without employees. Micro-businesses can be defined as an owner-operated business with few employees and a turnover of less than $250,000 (Viewpoint Banks 2010). These types of businesses can also be considered as very small commercial activities with fewer than 6 employees and limited access or no access to source of capital (Encarta 2010).

In Malaysia there are differences between micro enterprises, small enterprises and medium enterprises in various sectors (Table 4). Micro-business or micro-enterprises in the Malaysian agriculture sector is defined as an enterprise with sales turnover of less than RM 200,000 or full time employees of fewer than five. For small enterprises the sales turnover is in the range of RM 200,000 to RM 1.0 million or full time employees between five and 19. Medium enterprises have sales turnover of RM 1.0

million and RM 5.0 million and full time employees between 20 and 50 (SME Corp. 2010).

Table 4: Malaysian micro, small and medium enterprises by sector

Sectors	**Micro-enterprise**	**Small enterprise**	**Medium enterprise**
Manufacturing, Manufacturing-Related Services and Agro-based industries	Sales turnover of less than RM250,000 OR full time employees fewer than 5	Sales turnover between RM250,000 and less than RM10 million OR full time employees between 5 and 50	Sales turnover between RM10 million and RM25 million OR full time employees between 51 and 150
Services, Primary Agriculture and Information & Communication Technology (ICT)	Sales turnover of less than RM200,000 OR full time employees fewer than 5	Sales turnover between RM200,000 and less than RM1 million OR full time employees between 5 and 19	Sales turnover between RM1 million and RM5 million OR full time employees between 20 and 50

The National Bank of Malaysia reported that in 2005, that there were about 519,000 SME business establishments in Malaysia and about 412,000 of them could be considered as micro business enterprises. SMEs employed more than three million workers and generated sales from value-adding of turnover more than RM 154 billion in 2003. In the agriculture subsectors there are about 32,000 SMEs and 93.3% of them are micro enterprises involved with food crops, market produce, horticulture and livestock. In terms of value-added product, agriculture contributed 39.7% from total value of RM 72 billion. In terms of ownership structure, 88% of SMEs were small businesses (BNM 2005).

Family owned business is currently recognised as both important and dynamic for world economic development. Family owned business can be considered as the oldest form of business organisation. A family owned business may be defined as any business in which two or more family members are involved and control the majority of the ownership and the control lies within the family members (US Legal 2010). Family businesses have become established as an increasingly significant element in the corporate sector and the ones that were established long time ago have proven performance track records. Scholars and practitioners acknowledge the successful performance of family controlled firms. There are many advantages in the family business hierarchy such as the sense of being in control of the destiny, greater feelings of independence, less bureaucracy and quick decision-making. Managers of family owned businesses have various perspectives towards shareholders, employees and customers that add value to the system and affect the good quality of the product (Ibrahim and Fazilah 2010).

Small-scale food processing companies play a dynamic role in the Malaysian economy. To maintain the industrial growth, the government supports small-scale industries with various policies and incentives such as providing technical, financial and marketing assistance for food processing companies. Activities of small scale processors for low value fish are mostly located near the fish landing sites. Among the popular products made from fish are fish balls, salted dried fish and fermented fish. Low value fish are processed by gutting and cleaning them before soaking in saturated

brine overnight. The next day the fish is sun dried for two or three days (Ghani 1995). In 2008, the food industry in Malaysia was dominated by SMEs. The Malaysian food export amounted to RM 17.9 billion and the second highest main products exported were fisheries products valued at RM 2.5 billion. Exported products from the fisheries subsector are processed seafood such as frozen and canned fish, crustacean and mollusc, surimi and surimi based products (MIDA 2010).

3.2. Low value fish

There are general broad definitions of the term "low value fish". What some countries may consider as non-food products or "trash fish" suited for fish meal/feed mills and given to animals, others consider as small/low economic value fish fit for human consumption, especially for the poor people living in rural areas. In China, the term "low value fish" is used for fish destined for human consumptions and trash fish is used for fish for animal feed. Some countries consider low value fish as fish that is by-catch from commercial trawlers operating offshore and should rightly be termed as "lowest value fish" (APFIC 2005). In Thailand, "trash fish" is defined as small fish for livestock/fish feed and most of the trash fish is sent to fish meal/oil production. Artisanal fisheries use low value food fish extensively for processing value added food for human consumption. The 'true' trash fish are small in size even though they are at the maturity stage (FAO 2005). Trash fish in Vietnam has no clear identification. Normally, trash fish is by-catch from trawlers and is important for artisanal fisheries in terms of weight and value. Previously of low and no economic value, they are now converted into value added products such as fermented stock for fish sauce, dried fish or salted. The price of the low value fish is now increasing in value due to the processing and value addition (FAO 2005). In Iceland, fisherman families used to produce salted and dried products from demersal fish, mainly cod and herring. The process of salting and drying does not need high technology or expensive equipment. Thus small companies with one to five employees are able to operate, although there are bigger companies that have implemented higher technology in production in the last decade. For the bigger companies salted fish is normally by-product production or secondary product for the company (Knútsson 2001).
Malaysia defined trash fish as by-catch from trawlers not fit for direct human consumption and smaller size of commercial species. The major disposition of trash fish is through fish meal for aquaculture or as feed mills for live stocks. Malaysian harvesters land most of the small low value pelagic fish and small size demersal fish as by-catch. The importance of the fish depends on the species, the size and the freshness of the fish. The major pelagic fish groups landed are Indian/short mackerels (*Rastrelliger* spp.), round scad (*Decapterus* spp.), neritic tunas, sardines (*Sardinella* spp. and *Dussumieria* spp.), hardtail scad (*Megalaspis cordyla*), ox-eye scad (*Selar boops*), anchovies and yellow-tail scad (*Alepes* spp.). The most landed demersal species are threadfin bream (*Nemipterus* spp.), jewfish/croaker (*Pennahia* spp., *Johnius* spp. and *Otolithes* spp.), rays, goatfish (*Upeneus* spp., *Parupeneus* spp.), lizard fish (*Saurida* spp., *Trachinocephalus* spp.) and marine catfish (*Arius* spp., *Osteiogenoisus* spp.) (Musa and Nuruddin 2005).

Traditional processed products are also still being produced, such as fermented fish for fish sauce and cured fish (dried, salted and smoked) for adding to the value of low value fish (Menasveta 2001). Low discard of fish among countries in Southeast Asia is due to the fact that low value fish is still used for direct human consumption. This is

the case in Malaysia, Indonesia and the Philippines, as some of the fish are sold at good prices for human consumption and fishmeal. Due to better quality catch, smaller vessels that normally sail short trips are able to sell their low value fish for human consumption (Goh and Tan 2008).
In 2005 the FAO defined low value/trash fish as;

"Fish that have a low commercial value by virtue of their low quality, small size or low consumer preference. They are either used for human consumption (often processed or preserved) or used to feed livestock/fish, either directly or through reduction to fish meal/oil." (FAO 2005)

Aggregated consumptions of low value food fish among developing countries has increased from 18 million tons in 1973 to 43 million tons in 1997. Herring and anchovies and other small pelagic fish from marine capture fisheries and carp and tilapia from fresh water/*diadromous* fisheries are considered low value fish. Shown in table 5 is the classification of low value and high value finfish according to IMPACT, the international model for policy analysis of agriculture commodities and trade groups (Delgado *et al.* 2003).

Table 5 : IMPACT fisheries commodity categories and component

Low value finfish	High value finfish
Carp, Barbell and other cyprinids, Herring, Sardines, Anchovies, Jack, Mullet, Sauries, Mackerel, Snoek, Cutlassfish, River eels, Shad, Tilapia, miscellaneous marine fishes and other cichlids	Cod, Hake, Haddock, Flounder, Halibut, Sole, Redfish, Bass, Conger, Salmon, Trout, Smelt, Shark, Ray, Chimera, Sturgeon, Paddlefish, Tuna, Bonito, Billfish

The global fisheries production (both capture and aquaculture) was about 140 million tons in 2008 and from that about 115 million tons (82%) were used for human consumption and the remaining 25 million tons (18%) were used for non-food products like fishmeal and oil. About 56.5 million tons (39.7 %) of the global production were consumed as fresh, 58.6 million tons (41.2%) went into value adding activities such as frozen, cured (dried, salted and smoked) and ready to eat food (FAO 2010).

3.3. Processing Methods

The catch in Malaysia may constitute 30 or more species, both pelagic and demersal, which can be consumed as fresh or in processed form. Small demersal fish are a diverse group that include different shapes and sizes and live deeper than pelagic fish. The size of small demersal fish is normally less than 25 cm with hard scales and moderately firm flesh. The oil content is generally less than 5% and much less than the pelagic fish. The group consists of many species such as small mullets, snappers, breams, croaker/jewfish and silver bellies.

Salted and dried products of good quality can be made from demersal fish but the products fetch a low price. Most of the demersal fish are lean and bony and not suitable for canning or as fermented products. They provide a low income group inexpensive source of protein food. Expensive methods of processing are not possible due to the low price of the processed product. Small scale industries process it as dried fish, depending on the seasonal availability. The most popular pelagic species are sardines, mackerels, ribbon fish, lizard fish, sharks, threadfin bream and snappers.

They can be boiled or salted and dried. Normally in Malaysia, fish, both demersal and pelagic, is sold fresh but it can also be marketed after processing (ILO-WEP 1982). Some of the by-catch species are prepared dried, salted or fermented.

Large quantities of small low value pelagic species (small mackerels or Indian chub mackerel) are harvested seasonally. Most of these species have high oil content and are often dried whole without salting or smoking, but the products are fragile and break easily. They can also be boiled or salted and dried. Normally the fish are sold fresh and can be marketed after processing. Only fresh fish makes a good product (ILO-WEP 1982).

The most important factor for the suitability of processing small fish for drying, salting and smoking is the size, oil content and the flesh texture. Smaller size fish can be dried whole, but the bigger the size it has to be cut and split for better penetration of salt and moisture removal. Fish with high oil content are more rancid and generally not suited for salting or drying. The oil is a barrier to salt penetration and moisture reduction. Normally it is cooked/boiled and then dried or smoked. Often it is pickled in salt. Fish that contains moderately or firm flesh texture is easier to handle and transport in dried form. It is more suitable to be dried or salted. Fish size between 15-25 cm is better if cut and split for the penetration of salt and moisture loss (ILO-WEP 1982).

By salting fish it loses some water content from its flesh when absorbing the salt. Salt is desirable for protecting the product during the curing process. Salting can be done by various methods, depending on both the final product that is desired by consumers and the production cost. There are many factors that may influence the quality of the product such as the quality of the fish, climate and salt quality. Salting is done by rubbing dry salt on to the fish and immersing them in a brine solution (a solution of salty water). The fish are then drained before drying or covered with salt for pickle curing. The yield for salted mackerel after 48 hours curing is 70% with a moisture content of 60%. If the salted fish is dried in the sun the yield will vary according to moisture content (ILO-WEP 1982).

The quality of the raw material is important. In Iceland, fresh fish has been used for salting (Thorarinsdottir *et al.* 2010). The quality of the raw material largely depends on the gear type used to harvest the fish. Trawls give less quality fish compared to other fishing gears because the fish can be compressed at the end of the net. The handling of raw materials, from harvesting to processing, influences the quality and yields of the final products (Valdimarsson and Gunnarsdottir 1982). If the raw materials are not properly handled it may cause defects such as bruises, blood clots and gaping (Botta *et al.* 1987a; Thorarinsdottir *et al.* 2010). The high contents of omega-3 fatty acids in pelagic species are beneficial for humans. Thorarinsdottir *et al.* (2010) also reported that according to the "Norwegian Industry Standard for salted and dried salted products" superior quality of salted fish is made from raw materials that are thoroughly cleaned. In Iceland, the salting procedure uses wet salting, that is brining and injection of brine (Thorarinsdottir 2010; Lindkvist *et al*. 2008). New methods of salting have increased yields and quality.

The simplest, commonest and cheapest method used in tropical countries for drying fish is natural drying by using the sun and wind. Dried fish is commonly used by low-

income groups which cannot afford to buy other more expensive fish products. Simple improvement such as using a suitable method of drying in order to avoid contamination may help to raise product quality. The common process for dried fish is sun drying with a moisture content of up to 40% (ILO-WEP 1982).

Smoking is the process whereby the heat from a fire dries the fish while chemicals from the smoke impregnate the flesh. The final flavours of the smoked product depend on the raw materials used, type of wood used and the duration of time used to smoke the fish. Traditional smoking methods range from simple open fires or smoke pits to a smoke house. It is inexpensive to build smoke pits using local materials. Smoking is common practice for curing when there is a short supply of salt. Fatty fish such as mackerel and sardines are very suitable for smoking and the water content in the flesh is then reduced by salting or drying or a combination of both. Fatty fish such as mackerels and sardines are very popular smoked products in Europe and Africa (ILO-WEP 1982).

3.4. Prospects for low value fish

A number of countries of the Southeast Asian Region are producers and important consumers of dried seafood, importing products from neighbouring countries and offering new possibilities for Malaysian exporters. A study by Richmond (1997) reported good sales prospects for new products, innovative and ready to eat food. Fish snacks are considered popular in Singapore. Southeast Asian nations are the main suppliers to Singapore due to abundance of fish and demand by consumers offering reasonable prices. There is a potential product diversification possibility for mackerel and croaker from the present product forms such as dried, boiled and raw material for surimi plants. Mackerel and croaker can be converted into dressed and marinated products and surimi base fabricated products both for domestic consumption and the export market. There are great opportunities to improve the product processing and presentation from this sector (FAO 2008).

In Japan, cod stomachs, gills and gullets are slated and preserved for human consumption. If larger quantities of fish offal are available, a product known as fish silage could be produced by acidification with minerals and organic acids. Silage is prepared by adding formic acid and letting the whole mass break down to a liquid. There is great interest in silage production now even more than for the production of fishmeal. Silage can be dried and added into animal feed. Fish offal can also be fermented by adding lactic acid in order to produce silage. The skins and heads of the fish can be used to produce fish glue. This is done by steaming fresh material for about 8 hours over perforated screens. The glue was used extensively in furniture making, bookbinding and making leather goods before synthetic glue was introduced. An important byproduct from fish waste is fish oil which is derived from a fish meal process. Fish oil contains high levels of vitamins A and D and can be extracted from the fish livers (ILO-WEP 1982).

The world's most widely traded food commodities are fishery products and the trade is dominated by developing countries. Most eco-labelling studies indicate that labelling of quality attributes provides a flow of information between consumers and producers. A study by Caswell and Anders (2009) on food safety and quality received global attention among consumer trends researchers and showed consumers' greater

concern about the health and safety benefits of the product. They are more aware of this when making buying decisions. This is especially true for women as most of them act as the gate keeper and decision maker in preparing food for the family.

Fisheries products attributes' quality is determined by a set of intrinsic and extrinsic quality such as food safety, nutrition, taste, value/function and the method of production. All these intrinsic quality attributes are signalled to consumers through extrinsic quality such as brand name, price, labelling and certification (Table 6). All these intrinsic and extrinsic quality attributes may bring the product to a premium price and influence customers to make buying decisions (Caswell and Anders 2009). In the following table, "other" is used for miscellaneous attributes not formally identified.

Table 6 : Attributes for fisheries products (Modified and adapted from Caswell (2006))

Intrinsic Quality Attributes	**Extrinsic Quality Indicators and Cues**
Food Safety Attributes	***Test/Measurement Indicators***
Foodborne Pathogens	Quality Management Systems
Heavy Metals and Toxins	Certification
Pesticide or Drug Residues	Records
Soil and Water Contaminants	Traceability
Food Additives, Preservatives	Quality Signalling/Labelling
Physical Hazards	Minimum Quality Standards
Spoilage and Botulism	Occupational Licensing
Irradiation and Fumigation	Other
Other	
Nutrition Attributes	***Cues***
Calories	Price
Fat and Cholesterol Content	Brand Name
Sodium and Minerals	Manufacturer Name
Carbohydrates and Fibre Content	Store Name
Protein	Packaging
Vitamins	Advertising
Other	Country of Origin
Process Attributes	Distribution Outlet
Animal Welfare	Warranty
Authenticity of Process/Place of Origin	Reputation
Legality of Production Practices	Past Purchase Experience
Traceability	Other Information Provided
Biotechnology/Biochemistry	
Organic/Environmental Impact	
Worker Safety	
Other	

The intrinsic quality attributes for buying dried fish are colour and dryness and the extrinsic quality indicator is price. The moisture content must neither be too high since that may encourage the growth of bacteria nor too dry which may result in the product breaking too easily. Other factors such as bigger sized fish will be more expensive and the red texture colour is regarded as a sign of decay (Richmond 1997). For the extrinsic quality cues packaging plays a significant role in product marketing and acts as protection as well as a promotion tool (Agustini *et al.* 2008). Product labelling with a third party certification will be very important in the future because they may provide not only a premium price but it may also increase the market shares.

This may happen even if the product comes from nations with underdeveloped fishing industry and the terms of "environmentally friendly" or "sustainability harvested" may differ between countries. For small scale producers to be certified increased cost may be perceived as a trade barrier (Vidarsson, 2008).

Looking closer at the environmental attributes and the intrinsic attributes of nutrition and food safety, Menasveta (2001) in her report concluded that the increasing demand of fish and fish products due to the expanding of population may create more stress to the inshore fishery with already depleted stocks. Sivasubramaniam (2000) noted that due to intensive exploitation of demersal species by trawlers, stocks have been significantly reduced and the size of the species caught becomes smaller as is the case of Thai and Malaysian waters. As cited by FAO (2010), that unless effective effort is given to the sustainable fisheries management the increased percentage of over exploited, depleted and declining of the global catch in the last few years may affect the production from wild capture fisheries. Hotta (2000) also reported that coastal areas are overfished by small-scale fisheries whereby catch rates, fish sizes, quality and fisher income are declining. In some cases like in the South China Sea most of the fish stocks are been fully exploited or depleted.

According to Seafish (2010), and certified by the Food Standards Agency, it is safe to eat smoked fish if it is cured and not in raw form. Andrew and Helen (2005) point out that processed fish such as dried and salted fish may contain higher cholesterol and sodium contents compared to fresh fish. Older age groups who are more health conscious should avoid the product. Jonsson *et al.* (2007) stated that dried fish is a protein-rich food supplement and based on numerous research have proved that fish is good for health and can minimise the risk of stroke.

High concentration of Omega-3[4] oil is in seafood and it is therefore among the healthiest dietary choices as it is low-fat but high density source of protein. Oily fish such as mackerel, sardines, herring, pilchards and salmon are rich in essential fats such as Omega-3. By consuming more fish women are much less likely to suffer from post-natal depression. Fish is also a source of vitamin A, healthy for skin and eyes and also for vitamin D, helping the body absorb calcium to strengthen teeth and bones (Seafish 2010). As Hotta (2000) mentioned fish has for a long time played an important role in regional food security for the South East Asian people by supplying nutritious food which includes protein, amino acids, fish oils and other micronutrients such as calcium, iodine and vitamins. A research by Jonsson *et al.* (2007) concluded that protein in dried fish was of high quality containing between 80-85% of protein. Dried fish also contain high quantity of amino acids.

[4] Omega 3- a type of fat that is found in oil-rich fish.

3.5. New product investment and profitability analysis

For this project a game plan or 'Stage-Gate' system for product innovation and ABC analysis is applied to determine the feasibility and attractiveness of the products.

A 'Stage-Gate' model

A 'Stage-Gate' model is a new product process and acts as a road map to guide and facilitate a new product from an idea stage to product launch. It is designed to manage risk and every stage is viewed as an information acquisition stage. The Stage-Gate model starts from ideation (idea creation) to identifying necessary sources for product launch, including basic research needed to start the up the project. From ideation it will continue to the first gate for initial screening of the idea. Gate 1 is subject to "must meet" and "should meet" criteria and mainly based on the opportunity and market attractiveness of the project. If the decision from gate one is go, then it will enter a second stage for preliminary investigations and in-depth research on the technical aspects and marketplace. The Stage-Gate model will continue until stage five for full product and market launch (Cooper 1997). For this project only the innovation process of the first and second stage is used, observed, analysed and broken into a series of stages (Figure 3).

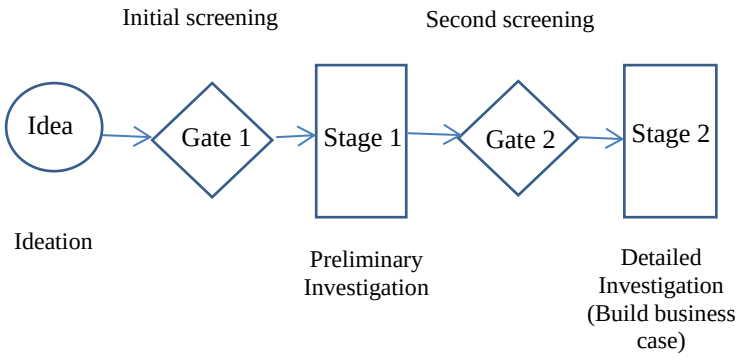

Figure 3: Stage-Gate model (Cooper 1997)

Findings from the data will go through each gate. The gates are central to the new product game plan. At every stage it acts as quality control check points and as a quality control mechanism. Go/kill decisions at every gate weed out the bad ones and proceed with good ones. The Stage-Gate model is a parallel processing technique that balances the need for a complete and quality process. The model requires a multifunctional empowered team led by a leader with authority. The members should be from various departments such as marketing, technical etc. and need active involvement and commitment. The leader must have the authority over the resources and the team. The model is customer-market-driven and customer-focused. Customer inputs and customer focus is very important throughout the process. Key marketing elements from preliminary to product launch are a central feature to the model. Product predevelopment is crucial to success and must be built in a consistent and systematic way. Failure or success of the new product plan model depends on the earlier product stages (Cooper 1997). The Stage-Gate plan will continues until stage 5 for full product and market launch but for this project only up to stage two is applied.

Capital budgeting

Capital budgeting is the process of making decisions in assets acquisitions or assets investment. Capital investment includes buying new equipment or buildings as assets to be used for a long period of time (Oliver and Horngren 2010). For example, future FOMBEs need to invest in buildings, new processing centres and equipment, such as a cold room for storage of raw materials and finished product. Management uses capital budgeting techniques to determine which projects will offer the highest return over the period of the planning horizon. The popular methods of capital budgeting include net present value (NPV), internal rate of return (IRR), accounting rate of return (ARR) and payback period. ARR and payback period are used to screen out potential investments from those that are less necessary. The NPV and IRR use the factor of time value of money for longer term investment. If the NPV is positive then, according to the assumptions, the investment should be started. The IRR of the project's cash flow gives the percentage of the rate of return at the point when the NPV is exactly 0.

4. PROJECT ANALYSIS

The project analysis starts by analysing the ideas behind the first screen of the Stage-Gate model for the low value fish harvested in West Malaysia. All relevant statistical data is analysed to find out the source of resources. After analysing the data it will be discussed at gate one which is the initial screening of the project. A decision either to proceed or not will be decided at gate one. If the decision is to proceed then it will go to stage one for a quick scope of preliminary market assessments, technical assessment and financial assessment. The process will proceed to gate two for decision making to either go or kill the project. If the results from gate two are "go" then it will proceed to stage two which is the detailed investigation of the project. A further detailed assessment will be conducted in stage two. In this project it will end at stage two.

4.1. Ideation

The statistical data and information on the quantity of grade II and III fish landed in West Malaysia revealed that there appears to be a possibility for FOMBEs and small entrepreneurs to venture into processing of low value fish in Malaysia. As reported by Ghani (1995), small-scale food processing is expected to play an important role in the Malaysian economy and thus for the Malaysian government. The fact is that the government is now recognising the functions of the SMEs as not only providing job opportunities but as companies playing an important role in the social, economic and political development of the country. The government is currently supporting such incentives by providing technical, financial and marketing assistance to the SMEs through various policies and incentives. The agencies that provide micro credit finance to SMEs in Malaysia are Amanah Ikhtiar Malaysia (AIM), TEKUN Nasional and Malaysia National Bank (BNM) channelling it through 10 financial institutions. The maximum loan provided for working capital is RM 50,000.00. The loan tenure is 10 years with 4% interest (SME Corp. 2010).

In the last century Icelandic fisherman families did not need high capital investment for the technology or equipment used to process demersal fish through the process of salting or drying (Knutson 2001). Although modern processing has developed in Malaysia, traditional processes such as dried, salted and smoked fish products are still being produced in order to increase the value addition of low value fish (Menasveta 2001). FAO (2005) has pointed out that low value fish, previously of low or no economic value, is now being converted into value added products such as dried and salted fish products and fermented fish used in fish sauce.

In 2009, almost 78% of the total capture fisheries landed in West Malaysia are from trawlers (51%) and fish purse seiners (27%) (Appendix 1). The major landing areas from trawlers are the states Perak (26%), Selangor (20%) and Pahang (16%). The three states control about 62% of the total fish landed by trawlers. The second most large catches come from the fish purse seiners and are mostly landed in the states Perlis (34%), Perak (21%) and Terengganu (15%). These three states control about 70% of the total capture fisheries landed by the purse seines. Analysing the combined landings of both fishing gears shows that the major states are Perak (24%), Perlis (18%), Selangor (13%) and Pahang (13%). The four states received 68% from the two main fishing gears in West Malaysia. It can be concluded that the main sources of low

value fish are to be found in these four states out of the eleven states in West Malaysia. For this project it is important to identify the sources since the project needs to be implemented as near to the resources as possible. Therefore for this project the FOMBEs are assumed to come from one of these states.

From the statistical data on total fish landed by species and fishing gear, as is shown in Appendix 2, trash fish and miscellaneous fish landed was excluded from being a potential raw material for the FOMBEs. This amounts to almost 40% of the total catch. Based on the statistics and excluding this and molluscs, crustaceans and shells, there are 22 species of fish which are landed in West Malaysia. The most harvested species are mackerels (35%), scads (28%), croaker fish (8%) and then there are 29% from other species. From the data given it can be assumed that the low value species are mostly harvested by fish purse seiners and by-catch from trawlers.

The average ex-vessel price[5] in 2009 for all the 22 species was observed as shown in appendix 3. From the average price it can be seen that most of the low value fish are small demersal and pelagic fin fish. The price varies between grades I, II and III. The lowest price is RM 1.15 per kilogramme for tiger tooth croaker and the highest price is RM 13.32 for Spanish mackerel. All but one of the species are from grades II and III. The Spanish mackerel is in grade I and can therefore not be included as a possible alternative. From the average price statistic there seem to be great opportunities for value adding for Grade III species due to the low prices.

Malaysian capture fisheries put the fish through various processing, as is shown in appendix 4. Almost 54% of the small low value fish are used for fish meal or feed mills as 14% is processed traditionally as locally popular fish crackers and 8% are processed as salted, dried/smoked and the balance of 14% as fertilizers, surimi and surimi based products. Most of the processed products are for domestic consumption except for the first grade surimi which is exported as are the frozen molluscs, shells and crustaceans. Smoked fish from sardines and short mackerel are not popularly known local products perhaps due to eating habits or lack of promotion to the public. Although there is an effort made to produce smoked fish products the quantity of that is not significant. As the statistics from 2000-2009 show the production of dried and salted products is increasing every year.

The biggest part of the Malaysian catch is consumed as fresh whole fish (appendix 5). Dried and salted fish are the most popular fish products. The dried/salted processing of low value fish is normally done by small scale processors for the fisher's family members. Among the popular species for dried/salted processing are croakers, scads, mackerels and rays. The smaller species such as anchovies are put through a dried and fermented process in order to produce local fish sauces which are popularly known as *'budu'.* Other small species such as the goatfish (*biji nangka*) are filleted and grilled to produce '*satay*' fish snacks, as the locals call it. The species with low fat content are mostly being processed as surimi and part of the low grade surimi that will be used to produce products such as fish balls, fish cakes, nuggets and fish paste (*otak-otak*). Some of the species are seasonally caught and if the quantity of landings is high it will be used for fish meal, feed mills and as fertilizers.

[5] Ex-vessel price- Price received by fishermen for fish, shellfish and other aquatic plants and animals landed at the dock.

SMEs will be an important part of the Malaysian economy in the future. For the fishermen and their families their SMEs can be seen to be small and mostly use the labour of the family members. Still, if they are to be able to grow they have to be structured as a family owned business enterprise or the FOMBE. It can therefore be suggested that forming FOMBEs in Malaysia could lead to a great success for the fishermen and their families. The great opportunities of FOMBEs in the fisheries sector can be defined as small business activities producing fisheries products by the labour of 1 to 5 of the family members. The members of the FOMBEs must directly be involved in all activities such as harvesting, processing, marketing and management. For the enterprise to be a FOMBE it must be registered under the Malaysian Company Act 1965 as a sole proprietorship or partnership of family members. Sales turnover of the company must be at least RM 200,000 annually and the capital assets must be of less than RM 50,000 (SME Corp. 2010).

4.2. Gate 1: Initial screening

At the initial screening stages of the Stage-Gate Plan ten species out of twenty four of those with the lowest average ex-vessel price were chosen for the first screening by an ABC analysis method. Two species from the twenty four low value species had already been excluded since their catch is very low and had the categories "trash fish" and "miscellaneous fish" (see appendix three). Nine criteria of importance were identified to assess the factors for the 10 species chosen. These criteria in their order of weighted importance are: the price of raw material (0.175), the yield of flesh (0.140), quality of catch (0.140), quantity of grade II and II (0.123), market familiarity (0.105), suitable for drying (0.088), suitable for salting (0.088), suitable for smoking (0.088) and use of by-product (0.053). The weights of importance (1.0) were determined by the author based on his experience. A low price for the raw material was thought to be most important for the FOMBEs along with a good yield of flesh for easier production, the possible raw material quality from the vessels and the possible quantity of raw material. The importance of familiarity in the market, along with how well suited for processing the species are, was also deemed very important. At last it was estimated how easily by-products from the species can be used. A score of 0 to 10 was then awarded to all species in each category according to the species' category performance. The score was either given as the relative best of the species score (10 the highest) or as scores compared to general information (highest score lower than 10). Again this was decided on according to the author's experience (see Appendix 7). Further reasoning for the weights and grades of the criteria are as follows:

Price of raw material

The price of raw material is given the highest weight of 0.175 (17.5%) since in the fish processing industry in Malaysia, the cost of purchasing raw material is more than 80% of the variable cost. Low price of raw material is also important for both the FOMBEs and the traditional processors so as not to need to a high working capital. The price of the same species may vary according to the quality and fishing gear used or by volume of purchase. Therefore an average ex-vessel price for the species is used. Normally the bigger processors purchase the raw material with a long term contract price and it will be lower than market price. Here the same price pr. kg. raw material is believed to apply for both the traditional processors and the FOMBEs. All species are given the weight according to the 2009 average price (Appendix 3) with

the lowest price for the tiger tooth croaker with a maximum score of 10.0 and the highest price for round scad with the lowest score of 1.0.

Yields of flesh
The yield of flesh (not including head, bones and guts) is the second most important criteria with a weight of 0.14 (14%). If the yield of flesh is high the production will be more efficient. In this context the round scad is awarded a maximum score of 8 and the goat fish with the lowest score of 3.

Quality of catch
According to Agustini *et al.* (2008) the freshness and the quality of the fish depends heavily on fishing techniques and fish handling. The best quality of raw material to produce processed products is from fresh fish. The quality of catch was given a weight of 0.14 (14.0%). In this context the harvest from the fish purse seine or fish traps is found to be the best because the fish are caught alive and then chilled with ice to maintain the freshness. Moreover the fish purse seiners mostly operate for one or two days per trips. Fish harvested from gill nets is also fresh since the operations are normally only daily trips. The harvest from trawlers offers less quality due to the fact that the smaller size fish is being pressed at the cod end of the bag net and also because most trawlers operate for 3 to 5 days per trip. Taking this into consideration, the short mackerel, sardine and round scad get the highest score of 8 since they are mostly caught by purse seine and gill nets but large head hair tail gets the lowest score of 4 since it is mostly caught by trawlers.

Quantity of grade II and III
A steady supply of raw material is necessary for stable and consistent processing of fish products and furthermore the price of raw materials will then be more stable and less risk to the processors. Therefore the quantity of catch was given a weight of 0.123 (12.3%). Based on the landing statistics for West Malaysia in 2009 the most harvested species are mackerels (35%), scads (28%), croaker fish (8%) and 29% from other species (DOF 2009). Here the short mackerels are given the highest score of 10 and large head hair tail with the lowest score of 1.

Market familiarity
In Malaysia, most of the fish products are consumed fresh/chilled or dried. The most popular dried products are from the low commercial value fish, both from pelagic and small demersal species. Dried fish is common for low-income groups who cannot afford to buy more expensive fish products (ILO-WEP 1982). It has been stated that the croakers and mackerels are a popular dried and salted fish product that can be converted to other fabricated products for domestic and export market for croakers (FAO 2008). Higher income Malaysian households spend more on processed fish and traditionally processed fish such as salted fish which is considered a delicacy (Andrew and Helen 2005). Market familiarity was given a weight of 0.105 (10.5%). In terms of familiarity among the species, croaker fish is given the maximum score of 8 and large head hair tail with the least score of 5.

Suited for drying
Size is an important factor for drying fish, as small fish may be dried whole but larger fish have to be cut, gutted and split to increase the surface area and moisture evaporation. Generally in Malaysia, only very small fish may be dried without salting as larger fish often spoils before the drying process is complete. Fish with a firm or

moderate texture is more suitable for drying. The oil content is generally preferred to be less than 5%. This applies to small mullets, snappers, breams, croakers, jewfish and silver bellies as they are suitable for drying as cited from ILO-WEP (1982). Fish with high oil content are not very suitable for drying as the flesh then becomes fragile and breaks easily. Suited for drying was given a weight 0.088 (8.8%). All smaller size fish from demersal species are suited for drying and therefore tiger tooth croaker, round scad and croaker fish are given a score of 8 and the rest of the species a score between of 5 to 7.

Suited for salting
For smaller species it is difficult to fillet the fish and it will have to be cured as whole fish. Bigger size fish will be gutted, cleaned and split with head-on before curing to increase the surface area for salt penetration and moisture evaporation. Small fish may be salted whole. Bigger fish, such as demersal fish which have a fat content of less than 5%, are also suitable for split or fillet salting. Fish which contain much oil have flesh that acts as a barrier to salt penetration and moisture loss. The firmer the flesh of the fish is the easier it is for handling and transportation without breaking up the flesh. Salted and dried products of good quality can be processed from the demersal fish but normally those products fetch a low price (ILO-WEP, 1982). Suited for salting was given a weight 0.088 (8.8%). Round scad is given the highest score of 9 and the goat fish the lowest score of 4.

Suited for smoking
Fish with high oil content such as sardine-like, herring-like species and mackerels with relative small scales and soft flesh is most suitable for smoking. Suited for smoking was given a weight 0.088 (8.8%). After considering the fat contents the round scad and fringescale sardine are given the maximum score of 9 and the tiger tooth croaker, the goat fish and croaker the lowest score of 3.

Use of by-product
People in South Asia use dried fish both in whole and split open forms. For them the fish maws (fish swim bladder) are special and they believe in the health benefits derived from eating the products. The most expensive fish maws are from the giant yellow croakers. For protection due to the danger of that species's extinction, smaller fish maws from other croaker species are also collected and sold in the market (Clarke 2009). Fish maws in Singapore can fetch a price between US$116 to US$160 per kilogram (Richmond 1997).

Waste from fish processing in the form of fish offal, heads and trimmings may also be commercialised. An important by-product from fish waste is fish oil which is derived from the fish meal process. The oil can be used for human consumption or it can be used for the production of various compounds. Fish oil can be extracted from the fish livers and contains vitamins A and D (ILO-WEP 1982). Use of by-product was given a weight of 0.053 (5.3%). For the by-products the fish maws differentiate the most since small size of the Grade II and III fish make it impossible to use for other by-products than fishmeal or oil. The fish maws from the croaker might be small but the processor may dry it. For use from by-products the croaker fish is given the score of 5 and the tiger tooth croaker and goat fish end up with the lowest score of 2 (due to their small size).

After calculations the weighted total score of the ten species was found to be in the range from 4.65 for the large head hair tail to 6.93 for the short mackerel. Five species were given a total score over 6.0 but only three of them scored over 6.5. These were the croaker fish with 6.7, the round scad with 6.81 and the short mackerel with 6.93 (Appendix 6). For this reason and since the difference was so small these three species were chosen for the preliminary investigation that follows.

4.3. Stage 1: Preliminary investigation

The criteria for the second gate had to be decided on and necessary calculations were then carried out. The same process of deciding on important criteria, their weights and scores was used as before. Processed products used for comparison were for dried and for salted for all three species. Processed smoked products were only used for the short mackerel and round scad. As for Gate 1, the croaker was not deemed suitable for smoking (scores of 8, 9 and 3 respectively).

The efficiency and effectiveness of operations is of great importance for the criteria of Gate 2. The three species are therefore evaluated for each of the following criteria:

- EBIT (earnings before interest and taxes) – value for an entity operating solely with its highest return product, this shows the earnings before interest and taxes from the operations of the process, given the assumptions.
- An effective price margin – this is of importance as it shows the difference between the revenue and the price pr. effective kg (product) of raw material.
- Amount for investment needed – this was also deemed important since the FOMBEs and the traditional processors have limited funds for investment. The lower the capital of investment is the better for both processors.
- Possibilities of new products – this relates to the possibilities to grow and increase the profitability by introducing new and better products for both the domestic and the regional markets.

From the study by Caswell and Anders (2009) it was seen that the attribute quality is determined by a set of both intrinsic and extrinsic quality such as food safety, nutrition, taste, value/function and that the method of production which may bring the product a premium price and influence customers to make buying decisions. In light of this the safety attributes, nutritional attributes and environmental attributes were also used as criteria for Gate 2 evaluation of the three species:

- Environmental attributes - are important regarding responsible and sustainable methods of harvest.
- Safety attributes – concern food safety in handling the fish from harvest to table. Although there may be some preservatives used, they must be within the permitted level.
- Nutritional attributes – concern the nutritional values for the consumer. All types of fish have high nutritional value, but fish with high oil content is here deemed better for dietary health

Further calculation and reasoning for the weights and grades of the criteria are as follows;

Calculating EBIT for the FOMBEs

Earnings before interest and tax are all profits before taking into account the interest payments and income taxes. EBIT is also known as operating earnings or operating income.

The formula to derive the EBIT is

EBIT= Revenue – Operating expenses

The assumptions used for the calculations are as follows (Table 7): the capacity of operations for the FOMBE is 200 kg of raw materials per day. The operation is 200 working days per year for all the products of the three species. The sales price used are prices stated by operating staff of FDAM in Perlis and staff of AFA in Rompin Pahang giving both prices for raw material and selling price.

Table 7: Three species EBIT calculation for FOMBEs

Species	**Croaker**			**Short mackerel**			**Round scad**		
Methods	**Dried**	**Dried /Salted**	**Smoked**	**Dried**	**Dried /Salted**	**Smoked**	**Dried**	**Dried /Salted**	**Smoked**
Sales (tonnes)	12.6	14.4	12.6	14.4	18.36	12.6	14.4	16.2	12.6
Price (RM/per tonnes)	12,000	15,000	16,000	13,000	15,000	16,000	13,000	15,000	16,000
Revenue	151,200	216,000	201,600	187,200	275,400	201,600	187,200	243,000	201,600
(-) Variable cost (RM)	104,380	114,040	112,730	144,920	155,426	152,730	164,920	174,670	172,730
Net profit contribution	46,820	101,960	88,870	42,280	119,974	48,870	22,280	68,330	28,870
(-) Fixed cost (RM)	45,216	41,901	41,900	45,216	41,901	41,900	45,955	41,901	44,901
EBIT (Operating surplus)(RM)	1,604	60,059	46,970	-2,936	78,073	6,970	-23,675	26,429	-16,031
EBIT as percentage of revenue	1%	28%	23%	-2%	28%	3%	-13%	11%	-8%

The selling prices used are different from the average prices used for the analysis in gate 1. There an average ex vessel prices were used for all the 23/10 species. The difference is quite high. For the raw materials the price used is 66% lower than the average price for the croaker, almost 18% lower for the short mackerel and around 27% lower for the round scad. This is mainly due to the fact that the average price shows a mix of grade II and III fish. The selling prices are also based on interviews with the operating staff. Variable costs include raw material, water and electricity bills, labour costs and overtime, salt, packaging and marketing costs (Appendix 9). The fixed costs include renting land, electricity and telephone, maintenance and repair costs, insurance, permanent employee costs, licences and other fees (Appendix 9).

The highest EBIT of all species is chosen for gate two scoring. The dried/salted process always gives the highest EBIT. For the croaker the EBIT is RM 60,059, for the short mackerel it is 78,073 and for the round scad it is 26,429. The short mackerel provides the highest earnings before interest, taxes and then building up profit.

The effective price margin

The effective price margin is an important ratio for determining its effective raw material contribution margin as is shown in Table 9. The formula for deriving the effective price margin is:

Effective price margin = (selling price pr. kg x yields) – price of raw materials used

As seen from Table 8 the highest percentage effective margin is 67% for the salted croaker then 61% for the short mackerel and 48% for the round scad.

Table 8 : Effective price margin in RM

Species	**Croaker**		**Short mackerel**			**Round scad**	
Method of curing	**Dried**	**Salted**	**Dried**	**Dried/ Salted**	**Smoked**	**Dried**	**Salted**
Ringgit Malaysia	**RM**	**RM**	**RM**	**RM**	**RM**	**RM**	**RM**
Price of raw material per kg	2.00	2.00	3.00	3.00	3.00	3.50	3.50
Selling price per kg	12.00	15.00	13.00	15.00	16.00	13.00	15.00
Yields (%)	0.35	0.40	0.40	0.51	0.35	0.40	0.45
Effective price	4.20	6.00	5.20	6.50	5.60	5.20	6.75
Effective price margin per kg	**2.20**	**4.00**	**2.20**	**4.65**	**2.60**	**1.70**	**3.25**
% effective price margin	52%	67%	42%	61%	46%	33%	48%

When comparing processing methods for head-on and fillet products, the first method will naturally have better yields. Comparison between pelagic and demersal species also show that the pelagic species have more fat and maintain high moisture content in the flesh and thus for some processes provide better yields than demersal species. The yield used is founded on information from ILO-WEP (1982) for mackerel (used here for the all the species) and shows that if the moisture content is 45% the yields will be for 51% and decrease to 40% if the moisture content is 30% (Appendix 10).

Investment needed
The investment needed depends on the process used. It is assumed that both for drying and drying/smoking the investment for the FOMBEs is RM 51,611. This covers buildings, equipment and 5% contingencies. For smoking this amount is RM 45,310 (Appendix 8). For the traditional processors the amount for investment needed is RM 1,100 for dried and dried/salted and RM 2,750 for smoking (Appendix 8). Registered FOMBEs are entailed for loans up to RM 50,000 at 4% interest for the period of 10 years.

Possibilities of new product
New products are necessary for the growth of companies. One reason for this is that the life cycle of the company's product mix will call for decline and diminishing sales at the declining stage after the stages of introduction, growth and maturity. In developing countries there is a trend to increase methods of advanced value-addition applied, such as breading, quick-freezing, and cooking (FAO 2010). In Malaysia modern fish processing factories have developed and introduced many new products such as fish balls, fish cakes, breaded fish or shrimp which are now available in the Malaysian supermarkets in urban centres (Menasveta 2001). Consumers seem to change their preferences towards the growing needs of time-saving products such as pre-cooked or prepared products from seafood. This offers producers chances for better price, added value and profitability (Montfort 2006).

The possibilities of new products are deemed highest for the short mackerel as it is possible to introduce products from it as ready meals, for example smoked with sauces as is done in Asian countries and with other types of mackerel. It has until recently been offered smoked whole but is not available any longer. The croaker fish also offers possibilities for new products by filleting the bigger fish and breading it. The round scad offers fewer possibilities for new products as it is now already used for surimi and surimi based products.

Environmental attributes
The different methods of fish harvesting and the possible depletion of fish stocks mostly determine the environmental attributes. The round scad is not a depleted stock species and is mostly fished by purse seiners. The way of fishing is not quite environmentally friendly enough to be graded very highly. However, it gets a better grade than the short mackerel. The short mackerel is not a depleted stock species but is fished both by purse seiners and by gill nets. The croaker fish is mostly fished by trawlers and is in more of a danger of depletion as the fish caught is getting smaller.

Safety attributes
For the three species there is no difference regarding the safety attributes. There are no additives used for the drying but for the drying/salting preserves are used. In excess salting is also not very good for human consumption. With increasing demand for seafood products consumers may face exposure to foodborne risks. Biological, chemical and physical hazards may be found relating to the potential of Listeria monocytogenes in seafood products. For ready-to-eat foods that are heat-treated and preserved foods, a level below ten L.monocytogene per gram is regarded as acceptable. The World Health Organization states that weekly intake of 1.7% (2.3µg/day) is tolerable for countries that have a high intake of seafood. It is important

for processors to handle the raw materials as high levels of histamine may indicate the process of decomposition (Arvanitoyannis 2009).

Nutritional attributes
Oil content from fish is believed to be good and among the healthiest dietary choices. Here the short mackerel and round scad are given top scores because of their high fat and oil content but the croaker fish scores a little lower.

4.4. Gate 2: Second screening

At the second screening stage of the project, information obtained from the preliminary investigation is added and used for the screening. Same methods as before are used for assigning the weights and scores to the criteria. Greater importance is on the operational criteria than the attributes. EBIT is given the weight of 0.3 out of 1.0, the effective price margin 0.2, the amount of investment needed 0.15 and the possibility of new products 0.15. For the attributes the environmental-, safety-nutritional attributes were given 0.10, 0.05 and 0.05 respectively.

The criteria are given a high score from 10 to the lowest score of 1. The scoring is given all species according to their best process, dried, dried/salted or smoked. Again the author will give the scores based and from his experience and from his calculations as explained in the preliminary investigation, either as relative highest scores or generally observed scores. The criteria score is then multiplied by the weights and the results investigated both for FOMBEs and for traditional processing. After that one species will be chosen for a detailed investigation in stage 2.

The results of second screening are shown in Table 9.

Table 9 : Second screening for FOMBEs

Criteria	Weight	Croaker		Short mackerel		Round scad	
EBIT Micro business	**0.30**	8	**2.40**	10	**3.00**	3	**0.90**
Effective price margin	**0.20**	10	**2.00**	9	**1.80**	6	**1.20**
Investment for FOMBEs	**0.15**	10	**1.50**	9	**1.35**	9	**1.35**
Possibilities of new product	**0.15**	9	**1.35**	10	**1.50**	7	**1.05**
Environmental attributes	**0.10**	5	**0.50**	6	**0.60**	7	**0.70**
Safety attributes	**0.05**	9	**0.45**	9	**0.45**	9	**0.45**
Nutritional attributes	**0.05**	8	**0.40**	10	**0.50**	10	**0.50**
Total			**8.60**		**9.20**		**6.15**

Short mackerel has the highest score of 9.2. Croaker comes next with a score of 8.6 and round scad scores only 6.15. For the FOMBEs, the short mackerel is the best choice for the detailed investigation needed.

4.5. Stage 2: Detailed investigation

A detailed investigation is conducted for the species short mackerel. It will initially be done by using a profitability analysis model designed by professor Pall Jensson of the

University of Iceland (Appendix 11) for estimating the profitability of establishing a FOMBE processing products of the short mackerel in Malaysia.

The highest EBIT contribution for the short mackerel is for the dried/salted process (Table 8). Additional information from staff in the AFA in Pahang indicated that a mix of Grade II and II is sold together and that when selling products dried/salted the same is the case. This means that for both raw material and that the selling price the customer expects a mix of grade II and III fish. For the detailed investigation a mix of 70% grade II fish and 30% grade III fish is used. Both the raw material and selling prices that are used take that into account.

The processes for the short mackerel products under the detailed investigation are in the beginning dried, dried/salted, salted and smoked products.

The short mackerel
Short mackerel (*Rastrelliger brachysoma*) is a common species in the Malaysian fish market. The species is mostly consumed as a fresh fish although products both salted and dried/salted can be found in the market. Short mackerel is a neritic-pelagic species with a distribution along the tropical climate area and the common length is 20 cm (Fish Base 2010).

Figure 4 : Short mackerel (Rastrelliger brachysoma)

Short mackerel was partly selected as the target species due to the availability of resources. The volume of short mackerel harvested from marine capture fisheries in West Malaysia is about 15% of all the catch (Figure 7). Due to seasonality the ex-vessel price of the species varies between RM 3.00 to RM 4.00 per kilogram but the fish processors normally negotiate a stable long term contract price from suppliers. (Suriza Suboh, personal communication FDAM, Perlis 2011; Rosnani Bidin, personal communication Area Fisherman Association, Rompin, Pahang 2011).

Site selection
For the detailed investigation the proposed site for the project is in the state of Perlis (Figure 5) which is situated on the northern part of West Malaysia. Perlis was partly chosen over Perak and Selangor for the quality of raw material since in Perlis 34% of the total catch of the purse seiners in West Malaysia is landed at the Kuala Perlis fisheries complex. Also since the supply of short mackerel is more consistent there than in Pahang in the east.

Figure 5: Perlis, West Malaysia the proposed site selection

Perlis has a good fisheries infrastructure such as fish landing complexes and supporting facilities and good access to electricity, water supplies and telecommunications systems. It also has good road connections to other major cities in West Malaysia.

Production mix selection
The most feasible production methods for the short mackerel have to be estimated. For doing that the EBITs of the four processed products were compared (Table 10).

Table 10 : EBIT for processed products

Species	**Short mackerel**			
Methods	**Dried**	**Dried/Salted**	**Smoked**	**Salted**
Sales (RM/tonnes)	14,4	18,36	12,6	25,2
Price (RM/per tonnes)	13.000	15.000	16.000	11.000
Revenue	187.200	275.400	201.600	277.200
(-) Variable cost (RM)	144.920	155.426	152.730	157.820
Net profit contribution	42.280	119.974	48.870	119.380
(-) Fixed cost (RM)	45.216	41.901	41.900	42.955
EBIT (Operating surplus)(RM)	-2.936	78.073	6.970	76.425
EBIT percentage of revenue	-2%	28%	3%	28%

The selling price of the dried/salted product is RM 15.00 and RM 11.00 per kilogram for the salted product. Since both dried/salted and salted product give a similar amount RM for the EBIT, both yield 28% EBIT to revenue and the processes are almost the same; both processed products are used for the profitability analysis. Production comprising of 70% dried/salted and 30% of salted product will be used in the calculations of the profitability model. This mix of different processed products is chosen to make the operations more stable.

Assessments method
The financial feasibility of establishing a FOMBE in Malaysia is assessed using both profitability- and sensitivity analysis. A break-even quantity, the net present value of the investment and the internal rate of return for the investment will be calculated.

The sensitivity of factors that may affect the feasibility of the project will be analysed, such as possible changes in variable cost, selling price and investment in equipment.

Financial requirement of the investment

The total financial requirement for FOMBEs to start the project is Ringgit Malaysia (RM) 64,686 (Table 11). The owners of the FOMBEs will self-finance the 30% equity and 70% will be financed through a bank loan from the Agriculture Bank (the SMEs scheme).

Table 11: The financial requirement for FOMBEs

Particulars	Financial requirements
Start-up	
Investment cost	RM 51,686
Working capital	RM 13,000
Total financing required	RM 64,686
Annual operation	
Fixed cost	RM 45,960
Variable cost pr. ton of mixed products	RM 7,191
Variable cost producing 13.068 tons of mixed products	RM 93.974
Total operation producing 13.068 tons of mixed products	RM 145,934

The amount for working capital needed (current assets – current liabilities) is assumed to be RM 13,000.00 based on the cash flows needed to never become negative. It is assumed that the yearly depreciations fairly describe the use of the fixed assets. This means that in year 7 the old equipment is sold for RM 3.068 and new equipment is bought for the same amount or RM 3.068.

Financial assumptions

The project for FOMBEs assumes a constant mixed production of 20.4 tonnes annually for dried/salted and salted product of short mackerels. The market price per kilo of short mackerel for dried/salted mackerel is RM 15.00 and RM 11.00 for salted (Suriza Suboh, personal communication, FDAM, Perlis, 2011). However, this project's average selling price of RM 12.69 per kilo is used based on the product mix's 70/30 price. The assumptions and the financial rate used for the measurement of profitability in the profitability model are shown in Table 12.

The loan interest rate is 4% per annum under the SMEs scheme (Malaysian Agriculture Bank 2011) and the income tax rate is based on the existing Malaysian income tax structure (Inland Revenue Board Malaysia 2011).

Table 12 : Financial rates and assumptions

Particulars		Reference/Sources
Loan	70%	Malaysian Agriculture Bank (SMEs scheme)
Equity	30%	Self-funding.
Loan Interest	4%	Malaysian Agriculture Bank (SMEs scheme)
Income Tax	25%	Malaysian tax structure
Discounted rates	15%	Marginal attractive rate of return
Payment period	10 years	Negotiable
Dividend payment	30% of profit	Negotiable
Debtors	25% of turnover	30 days credit
Creditors	15% of variable cost	30 days credit

The marginal attractive rate of return is assumed to be at 15% based on the best possible alternative investments in the market. Other assumptions come from the author based on his experience.

4.6. Profitability analysis

The profitability model is then fed with the assumptions and information from the detailed investigation returning a net present worth of the total capital and the equity of RM 15,100 and RM 28,700 respectively and IRR of 20% and 36% respectively (Table 13).

Table 13 : FOMBEs – Assumptions and results

		Assumptions and Results						
		2011		**Discounting Rate**		**15%**		
Investment:		$RM		**Planning Horizon**		**10**	**years**	
Buildings		21						
Equipment	100%	31				**Total Cap.**	**Equity**	
Other		0		**NPV of Cash Flow**		**15.1**	**28.7**	
Total		**51.69**		**Internal Rate**		**20%**	**36%**	
Financing:								
Working Capital		13		**Capital/Equity (Internal Value of Shares)**				**6.2**
Total Financing		**64.69**		**after 10 years**				
Equity	100%	30%						
Loan Repayments	100%	10	years	**Minimum Cash Account**		**0**		
Loan Interest	100%	4%						
Operations:			**2012**	**2013**	**2014**	**2015**	**2016**	
Sales Quantity	100%		13.07	13.07	13.07	13.07	13.07	Kton/year
Sales Price	100%		12.69	12.69	12.69	12.69	12.69	K$RM/ton
Variable Cost	100%	7.191	$RM/ton					
Fixed Cost	100%	45.960	$RM/year					
Inventory Build-up			**5**					
Debtors	25%	of turnover						
Creditors	15%	of variable cost						
Income Tax	25%	of taxable profit						
Dividend	30%	of profit						
Depreciation Buildings	4%	of buildings						
Depreciation Equipmer	15%	of equipment for 6 years						
Depreciation Other Co	20%	of other cost						
Loan Management Fee	2%	of loan						

This positive NPV means that this investment is feasible over the planning horizon of 10 years.

The operations statement shows that a yearly EBIT of RM 20,000 for all the operating years. The yearly profits are RM 9,900 in 2012 and 2013 and grow from RM 10,000 in 2013 to RM 10,600 in 2021 (Table 14).

Table 14 : FOMBEs - Operations statement

		Operations											
		2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
Operations Statement													
Sales Volume Ktons/y			13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	**131**
Price KUSD/ton			12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	
Revenue			**166**	**166**	**166**	**166**	**166**	**166**	**166**	**166**	**166**	**166**	**1658**
Variable Cost	7		99	94	94	94	94	94	94	94	94	94	**945**
Net Profit Contribution			**66.8**	**71.8**	**71.8**	**71.8**	**71.8**	**71.8**	**71.8**	**71.8**	**71.8**	**71.8**	**713**
Fixed Cost	46		46	46	46	46	46	46	46	46	46	46	**460**
Diverse Taxes	#####												**0**
Operating Surplus (EBITDA)			**21**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**254**
Inventory Movement			5										**5**
Depreciation			5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	5.44	**54.4**
Operating Gain/Loss	**EBIT**		**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**204**
Interest + Loan Man. Fee		0.9	1.8	1.6	1.4	1.3	1.1	0.9	0.7	0.5	0.4	0.2	**10.9**
Profit before Tax		**-0.9**	**18.6**	**18.8**	**19.0**	**19.1**	**19.3**	**19.5**	**19.7**	**19.9**	**20.1**	**20.2**	**193**
Loss Transfer	0	-0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Taxfree Dividend	0%												**0**
Taxable Profit		0.0	17.7	18.8	19.0	19.1	19.3	19.5	19.7	19.9	20.1	20.2	**193**
Income Tax	25%	0	4.42	4.7	4.74	4.8	4.8	4.9	4.9	5.0	5.0	5.1	**48.3**
Net Worth Tax	0.00%												**0**
Profit after Tax		**-0.9**	**14.2**	**14.1**	**14.2**	**14.4**	**14.5**	**14.6**	**14.8**	**14.9**	**15.0**	**15.2**	**145**
Dividend	30%	0.0	4.3	4.2	4.3	4.3	4.3	4.4	4.4	4.5	4.5	4.6	**43.8**
Net Profit/Loss		**-0.9**	**9.9**	**9.9**	**10.0**	**10.1**	**10.1**	**10.2**	**10.3**	**10.4**	**10.5**	**10.6**	**101**

The profit before taxes is profitable for all operating years earning RM 193,000 in the period.

A total of RM 48,300 is estimated to be paid in taxes and RM 43,800 in dividends. The net profit after taxes for the FOMBE is RM 145,000.

The balance sheet shows that the total assets grow from RM 64,000 in year 2012 to RM 144,000 in 2021. The equity grows for the same time from RM 18,500 to RM 120,600 respectively (Table 15).

No long term debts are remaining at the end of the period as the original loan has been repaid in full.

Table 15 : FOMBEs - Balance sheet

Balance Sheet												
Assets	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**TOTAL**
Cash Account	0	12	0	10	21	32	43	55	38	50	61	73
Debtors (Accounts Receivable)	25%	0	41,5	41,5	41,5	41,5	41,5	41,5	41,5	41,5	41,5	41,5
Stock (Inventory)	0	0	5	5	5	5	5	5	5	5	5	5
Current Assets		**12**	**46**	**57**	**68**	**79**	**90**	**101**	**85**	**96**	**108**	**119**
Fixed Assets (Booked Value)		52	46	41	35	30	24	19	41	36	30	25
Total Assets		**64**	**93**	**98**	**103**	**109**	**114**	**120**	**126**	**132**	**138**	**144**
Debts												
Dividend Payable		0,0	4,3	4,2	4,3	4,3	4,3	4,4	4,4	4,5	4,5	4,6
Taxes Payable		0,0	4,4	4,7	4,7	4,8	4,8	4,9	4,9	5,0	5,0	5,1
Creditors (Accounts Payable)	15%	0,0	14,8	14,1	14,1	14,1	14,1	14,1	14,1	14,1	14,1	14,1
Next Year Repayment		4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	0,0
Current Liabilities (Short Term Debt)		**4,5**	**28,1**	**27,5**	**27,6**	**27,7**	**27,8**	**27,9**	**28,0**	**28,1**	**28,2**	**23,7**
Long Term Debt (- next year repayment)		40,8	36,2	31,7	27,2	22,6	18,1	13,6	9,1	4,5	0,0	0,0
Total Debt		**45,3**	**64,3**	**59,2**	**54,8**	**50,4**	**45,9**	**41,5**	**37,0**	**32,6**	**28,2**	**23,7**
Equity (Shareholders Capital)	0	19,4	19,4	19,4	19,4	19,4	19,4	19,4	19,4	19,4	19,4	19,4
Profit & Loss Balance	0	-0,9	9,0	18,9	28,8	38,9	49,0	59,3	69,6	80,1	90,6	101,2
Total Capital		**18,5**	**28,4**	**38,3**	**48,2**	**58,3**	**68,4**	**78,7**	**89,0**	**99,5**	**110,0**	**120,6**
Debts and Capital		**64**	**93**	**98**	**103**	**109**	**114**	**120**	**126**	**132**	**138**	**144**

In 2018 the equipment is fully depreciated so new equipment is assumed to cost the same as the old one did originally. Because of this the yearly total depreciations are RM 5,443, the same for all operating years. As said before the loan is fully repaid in 2021 bearing a total interest cost of RM 9,962 (Table 16).

Table 16 : FOMBEs - Investment and financing

		Investment											
		2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
Investment and Financing			1	2	3	4	5	6	7	8	9	10	
Investment:													
Buildings		21	20	19	18	18	17	16	15	14	13	13	
Equipment		31	26	21	17	12	8	3	26	21	17	12	
Other		0	0	0	0	0	0	0	0	0	0	0	
Booked Value		**52**	**46**	**41**	**35**	**30**	**24**	**19**	**41**	**36**	**30**	**25**	
Depreciation:													
Depreciation Buildings	4%		0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	0,84	**8,4**
Depreciation Equipm.	15%		4,6	4,6	4,6	4,6	4,6	4,6	4,6	4,6	4,6	4,6	**46**
Depreciation Other	20%		0	0	0	0	0						**0**
Total Depreciation			**5,44**	**5,44**	**5,44**	**5,44**	**5,44**	**5,44**	**5,44**	**5,44**	**5,44**	**5,44**	**54,4**
Financing:		**65**											**64,7**
Equity	30%	19,4											**19,4**
Loans	70%	45,3											**45,3**
Repayment	10		4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	4,5	**45,3**
Principal		45,3	40,8	36,2	31,7	27,2	22,6	18,1	13,6	9,1	4,5	0,0	
Interest	4%		1,8	1,6	1,4	1,3	1,1	0,9	0,7	0,5	0,4	0,2	**9,96**
Loan Managem. Fees	2%	0,9											

There is a positive or 0 cash flow all the operating years. The total cash flow before taxes is RM 226,000 and RM 183,000 after tax. After taking into account the interest payments, the repayment of the loan, the dividends paid and the refinancing of the equipment, then the total cash movements amount to RM 73,000 (Table 17).

Table 17 : FOMBEs - Cash flow statement

Cash Flow												
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Cash Flow												
Operating Surplus (EBITDA)	0	20.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	254
Debtor Changes		-41.5	0	0	0	0	0	0	0	0	0	-41
Creditor Changes		14.8	-0.75	0	0	0	0	0	0	0	0	14
Cash Flow before Tax	0	-5.75	25.1	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	226
Paid Taxes		0.0	4.4	4.7	4.7	4.8	4.8	4.9	4.9	5.0	5.0	43
Cash Flow after Tax	0	-5.75	20.7	21.2	21.1	21.1	21	21	20.9	20.9	20.8	183
Interest + Loan Man. Fee	0.9	1.8	1.6	1.4	1.3	1.1	0.9	0.7	0.5	0.4	0.2	11
Repayment	0.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	45
Net Cash Flow	-0.9	-12.1	14.5	15.2	15.3	15.5	15.6	15.7	15.9	16.0	16.1	127
Paid Dividend		0.0	4.3	4.2	4.3	4.3	4.3	4.4	4.4	4.5	4.5	39
Financing - Expenditure (W.Cap	13							-27.6				-15
Cash Movement	12.1	-12.1	10.3	11.0	11.1	11.1	11.2	-16.3	11.4	11.5	11.6	73
(changes in Cash Account)												

For a further study on the profitability, the total cash flow from operations (after taxes) is RM 183,000 and RM 127,000 for the net cash flow. Using 15% as the discounting rate the NPV of the total cash flows will first become positive in the year 2019 ending in RM 15,000 in 2021 having an IRR of 36%. For the NPV of the equity cash flows it is first positive in 2016 and goes to RM 29,000 in 2021 (Table 18).

Table 18 : FOMBEs - Profitability statement

Profitability													
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total
Profitability Measurements													
NPV and IRR of Total Cash Flow													
Cash Flow after Taxes		0	-5,75	20,68	21,16	21,1	21,1	21	21	20,9	20,9	20,8	183
Loans		-45,3											
Equity		-19,4											
Total Cash Flow & Capital		-64,7	-5,75	20,68	21,16	21,1	21,1	21	21	20,9	20,9	20,8	118
NPV Total Cash Flow	15%	-56	-61	-47	-35	-24	-15	-7	-1	5	11	15	
IRR Total Cash Flow							5%	11%	15%	17%	19%	20%	
NPV and IRR of Net Cash Flow													
Net Cash Flow		-0,9	-12,1	14,5	15,2	15,3	15,5	15,6	15,7	15,9	16,0	16,1	127
Equity		-19,4											
Net Cash Flow & Equity		-20,3	-12,1	14,5	15,2	15,3	15,5	15,6	15,7	15,9	16,0	16,1	107
NPV Net Cash Flow	15%	-18	-27	-17	-9	-1	6	12	17	21	25	29	
IRR Net Cash Flow							23%	28%	31%	34%	35%	36%	

The sensitivity of the profitability and internal rate of return is of importance. Sales price, sales quantity and variable costs are analysed for sensitivity of the IRR for equity (Table 19).

Table 19 : FOMBEs impact analysis in sales price, sales quantity and variable cost

Impact Analysis							
Change		Sales Price		Sales Quantity		Variable cost	
		36%		36%		36%	
-50%	50%	NA	50%	NA	50%	177%	
-40%	60%	NA	60%	NA	60%	144%	
-30%	70%	NA	70%	NA	70%	114%	
-20%	80%	NA	80%	1%	80%	86%	
-10%	90%	-8%	90%	19%	90%	60%	
0%	100%	38%	100%	38%	100%	38%	
10%	110%	77%	110%	52%	110%	13%	
20%	120%	123%	120%	68%	120%	NA	
30%	130%	173%	130%	85%	130%	NA	
40%	140%	226%	140%	103%	140%	NA	
50%	150%	281%	150%	121%	150%	NA	

It can be seen that just a small decrease in the price of the products leaves the IRR negative and when the decrease is more than 10% no IRR can be calculated since the cash flow of equity is negative every year. From the graph shown in figure 5, it is evident that the project is highly sensitive to a small decrease in sales price. This is also the case for the sales quantity even if it is not quite as sensitive. An increase of 20% in the variable cost also means that the IRR of the equity cannot be calculated since every cash flow is negative but at that point the IRR for the total cash flow is -5%.

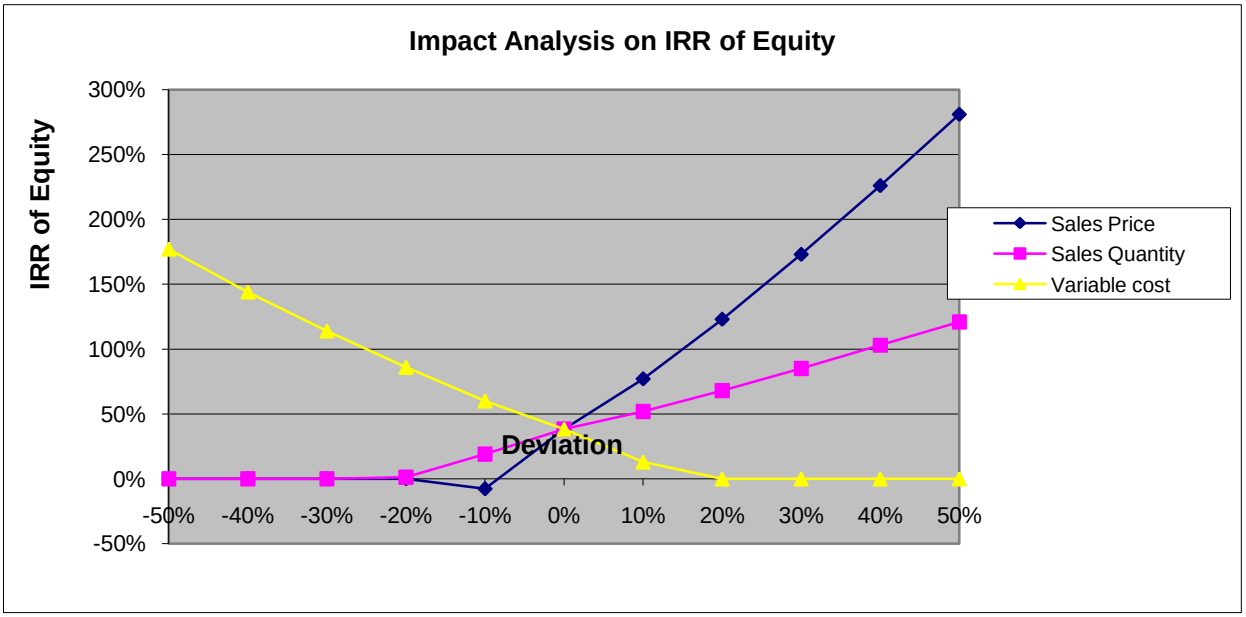

Figure 6 : FOMBEs impact analysis on IRR and equity

From the detailed investigation calculations, a break-even point (BEP) can be found. The formula for deriving the BEP in quantity is:

Contribution margin = *Revenue – variable cost*
= *RM 12,686 – RM 7,191*
= *RM 5,495*
Break even (quantity) = *Total fixed cost ÷ contribution margin*
= *RM 45,960 ÷ RM 5,495*
= *8.36 tons*

For the FOMBEs the selling price of the mix-product is at RM 12,686 per ton of the dried/salted and salted short mackerel products. The variable cost of the production is RM 7,191 per ton and the net contribution margin is therefore RM 5,495. The BEP analysis using assumptions on variables and fixed costs shows the quantity of BEP is 8.36 tons. For every ton after the first 8.36 tons a profit of RM 5,495 is added.

5. DISCUSSION

The Malaysian fisherman as a stakeholder remains as one of the most important actors in the Malaysian economy and his struggle for survival has proven to be challenging.

In this study the author has examined data on the Malaysian capture fisheries. During the study period weaknesses have been found that need to be looked at by FDAM, DOF and other related agencies working to enhance the fisheries sector in Malaysia. The Malaysian marine capture fisheries are categorized into three grades; I, II and III. This is very ambiguous. The definition of the fish grades are not well defined neither according to the size and quality nor the price. For instance, sardines and mackerel are considered as grade III fish due to their small size. The definition becomes very vague because the species are small in size and grades III only looks at the size but not the species. In terms of quality all fish start out with the same quality provided the catch is well preserved from harvesting to the table. Although the quality may differ in terms of methods used to catch the fish (purse seiners or trawlers) advance preservation technology on-board the fishing vessels should be able make the quality of the catch equally good. The grading process of the same species of fish mixes grade II and grade III fish and this affects the price that the fisherman gets. Based on the author's visits at an Icelandic fishing company he found that in Iceland the grades of fish are first defined by individual species and then by size.

In most countries in the Asian region including Malaysia, species harvested or caught as by-catch constitute more than 30 species of small pelagic and demersal fish which is normally smaller than 25 cm in size. This fish is an important supply of protein to the marginal community due to its low commercial value and is normally consumed fresh. Due to seasonality the traditional processors do not have the capability to increase production. At this juncture, a formation of FOMBEs in Malaysia is a crucial opportunity to strengthen the industry's production capacity. The current increase of food prices globally can become a great advantage for FOMBEs in Malaysia and a reason for them to produce better quality fish products from available resources.

Today traditional small scale processors of cured (dried/salted/smoked) products in Malaysia operate from the home and have only limited access to information, infrastructure and facilities regarding the surrounding environment of the domestic and international demand for fisheries products. In the State of Perlis, due to low local demand for smoked short mackerel the processors have stopped producing the product instead of trying to see if they can export the products (Suriza Suboh, personal communication with FDAM staff in Perlis 2011). The demand for ready-to-eat products (healthy food) is increasing globally due to changes for the younger consumer preferences. This also holds true for smoked fish. The traditional small scale processors of croaker fish in Rompin, Pahang do not process the by-product of the fish swim bladder (the fish-maw) although it can fetch a good price in Hong Kong (Rosnani Bidin, personal communication Rompin, Area Fisherman Association). There is a barrier in the flow of information between small scale processors and the consumers regarding the preferences of the latter. Icelandic fisheries companies process all the by-product and export it globally, like dried fish head/backbone, skin, liver etc. Small Icelandic family business companies processing salted and smoked salmon, herring and arctic charr have yields higher than 80% because the raw materials used are in fillet form and from fish that are bigger in size.

In Malaysia during high season, the wife or the family members process the fish as dried or salted, as that is the most common way to preserve the fish. The product is sold to local dealers or directly to consumers. The revenue from the business normally goes towards sustaining the livelihood of the family. The traditional processors lack knowledge for doing business calculations regarding processing fisheries products. The cost of raw material is not calculated as the fish is brought back from one of the family members who is a fisherman. Also the yields that are important for the final out-put are not calculated. Because of this lack of knowledge the fishing industry does not grow as it could in the country. Often the traditional processors are only processing the fish on a part time basis. During high season when the catch is in abundance they process the excess from the catch just to compliment the family resources.

The best quality fisheries products will be produced from fresh fish. Good quality means that the fish has to be preserved correctly from harvesting at sea until it has reached the processors and the same goes for the chain from the processors to the consumers. Harvesting by trawlers can affect the quality of the smaller fish which are pressed at the cod end of the trawl net. The by-catch species mostly harvested by trawl nets is the croaker fish, threadfin bream, large head hair tail, rays and other small demersal species. In Malaysian fisheries, the small and medium size bottom trawlers operate within the coastal areas. The bottom trawlers affect the sea bed and damage the biodiversity of the aquatic life. Today responsible and sustainable fisheries are very important as the fish stocks keep on declining due to overfishing. From the environmental perspective Perlis was chosen as a site location for the FOMBEs profitability calculations and not Perak. This was done both because the fishing gears used in Perlis are more environmentally friendly and the harvest of the target species is more consistent.

The quality of catch also depends on the post-harvest handling procedures. If the fish is chilled immediately after harvesting then it is likely to be of good quality for producing fisheries products. In the long run the processors need a constant supply of raw materials and in Malaysia short mackerel will be the best choice since it is the most harvested species. Among the fisheries product that are popular dried/salted in the domestic market are croaker fish, mackerels and scads. Dried croaker is popular in domestic and regional markets due to its white flesh. Fish with high oil content such as round scads and mackerels are suitable for smoking and the products are popular in the Japanese market. All the ten species chosen for the first gate in the Stage-Gate plan have possibilities to be produced as quality and value added products. Even if the short mackerel was chosen for the FOMBE calculations the croaker fish can be an interesting alternative or a second product to be introduced to the production of either the FOMBE or for the traditional processors.

6. CONCLUSIONS AND RECOMMENDATIONS

The project tried to look for the best opportunities in fish processing for the FOMBEs (family owned micro-business enterprises) in West Malaysia. This was done by using a particular low value fish species for value creation. The systematic Stage-Gate model procedure was used as a tool to find out the best output options for micro-businesses owned by the fishermen families.

The first level of the Stag-Gate model is ideation. The ideation process reveals all the required information regarding the main issues of the low value catches in West Malaysia. It looks at types of species, the average ex-vessel price, harvesting methods, and the most harvested locations in West Malaysia. The trawls and the fish purse seiners harvest most of the catch of the capture fisheries and those are landed in Perak, Perlis, Selangor and Pahang. Perlis was chosen as a selected area because the short mackerel is landed there mostly by purse seiners and also that there the ex-vessel price for the short mackerel is the lowest at RM 3.00 per kilogram (Suriza Suboh, personal contact from FDAM Perlis, Malaysia, 2011).

To find out the feasibility of the project, assumptions and information are used for calculations and are simulated with the profitability model. The results from the simulation are that this investment should be undertaken and a FOMBE established producing from 40 tons of short mackerel a year. Because of the sensitivity to changes in sales price, sales volume and variable cost it is recommended to double check the assumptions that were partly decided on after short interviews with FDAM and AFA staff in Malaysia and redo the calculations if deemed necessary. The break-even point (BEP) is the minimum production output for FOMBEs. At that point all costs have been covered but no profit made. The BEP for the FOMBE is 8,352 tons annually. The project must achieve an IRR based on the expected return on investment and the NPV cash inflows must correspond to the expected IRR. If the decision criteria are set at IRR 20%, thus achieving positive NPV in cash inflows at the end of the planning horizon, then this project should proceed. In this project FOMBEs achieved IRR of equity of 20% at the end of the planning horizon. The sensitivity analysis shows that the project is sensitive to the sales price, sale volume and the variable cost. If the sales price is reduced by 8.5% the IRR will be 0% and the project not viable.

This study shows the opportunities in establishing FOMBEs in Malaysia working on projects adding value from low value fish. The opportunities for the FOMBEs do not only lie in processing short mackerel but it is also likely that it can be profitable to process both croaker fish and round scad. This has to be looked into more closely. It is the opinion of the author that it can be profitable for the FOMBEs to process quality trash fish for fish sauce, dried and salted products. The World Bank reported in December 2010 that the global increase of food price index had risen by 17%. For the FOMBEs this should raise awareness of the possibilities of producing products fit for export and higher domestic markets.

Today there is a good opportunity to establish FOMBEs in Malaysia by using the SME funds that are provided by the government. For this the traditional processors in Malaysia need tore structure their operations and form a cluster of FOMBEs. With changes of consumers' preferences like ready-to-eat and prepared products there are great opportunities for FOMBEs in Malaysia.

FDAM and the research institute MARDI should focus on the development of the value addition of the specific individual species such as scads, mackerels, sardines, croakers and threadfin bream which have high commercial value at domestic and international markets. FDAM and MARDI have to collaborate and provide technical assistance to the traditional processors as well as to the future FOMBEs in capacity building. Research and development regarding the value creations of fisheries products in accordance with high quality standards is very crucial. Greater collaborations between Malaysian fisheries authorities and international communities, like Iceland Marine Research Institute, Icelandic Food and Biotech research and Development (MATIS) and higher learning institutions is of great importance for the benefits of the fisherman and the country in fisheries economics.

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APPENDICES

Appendix 1: Quantity (metric tonnes) of landings of marine fish by states and fishing gears in West MALAYSIA, 2009

Fishing gears	Trawls	Fish Purse	Anchovy	Other	Drift/Gill net	Other	Total
States		Seine	Purse seine	Purse Seine		Gears	
Perlis	57,335	95,565	0	89	24,921	337	178,247
Kedah	54,751	5,188	7,472	426	19,231	19,418	106,486
Pulau Pinang	16,868	1,940	0	3,952	11,725	8,305	42,790
Perak	139,856	59,718	838	22,294	22,576	12,804	258,086
Selangor	104,860	6,163	0	13	11,450	8,864	131,350
Negeri Sembilan	0	0	0	17	517	76	610
Melaka	0	0	0	0	1,415	276	1,691
Johor Barat	5,675	0	0	0	3,944	679	10,298
Kelantan	19,373	26,107	1,436	0	2,689	9,286	58,891
Terengganu	14,609	42,494	1,106	0	11,477	14,633	84,319
Pahang	88,907	19,524	519	156	1,665	3,567	114,338
Johor Timur	45,741	26,894	0	0	1,298	3,383	77,316
Total	**547,975**	**283,593**	**11,371**	**26,947**	**112,908**	**81,628**	**1,064,422**
Percentage (fishing gears)	**51.48**	**26.64**	**1.07**	**2.53**	**10.61**	**7.67**	**100**

APPENDIX 2:QUANTITY (METRIC TONNES) OF LANDINGS OF MAJOR MARINE CAPTURE FISHERIES BY FISHING GEAR GROUP AND SPECIES IN WEST MALAYSIA, 2009 (DOF 2009)

Fishing gears / **Species**	**Trawls**	**Fish Purse Seine**	**Anchovy Purse seine**	**Other Purse Seine**	**Drift/Gill net**	**Other Gears**	**Total**
Threadfin bream	19,281	49	0	0	1,941	6,302	27,573
Tiger tooth croaker	18,806	29	0	0	0	23	18,858
Goatfish	11,575	30	0	0	48	108	11,761
Croaker/jewfish	11,790	18	292	2,416	5,516	519	20,551
Temenggong/lara bara	10,455	31	0	0	0	4	10,490
Indian mackerel	13,490	22,574	35	0	9,285	1,513	46,897
Short mackerel	19,504	55,124	98	1	53,866	0	128,593
Yellow tail scad	4,032	10,032	0	0	780	1,268	16,112
Hard tail scad	6,653	16,470	0	0	462	889	24,474
Sea cat fish	3,255	27	1,041	426	2,743	953	8,445
Ox eye scad	6,769	11,392	0	0	179	37	18,377
Spanish mackerel	3,103	248	0	1	2,467	891	6,710
Large head hair tail	5,728	164	22	0	416	33	6,363
Rays	5,717	8	34	17	831	1,358	7,965
Yellow stripe scad	5,484	5,674	0	0	157	448	11,763
Fringe scale sardine	488	14,325	139	0	96	421	15,469
Long tail tuna	653	19,550	0	0	153	662	21,018
Kawa-kawa	117	14,670	0	0	480	1,148	16,415
Round scad	2,986	61,963	0	0	16	1,632	66,597
Small yellow tail scad	1,849	3,129	0	0	13	0	4,991
Barracuda	2,478	216	0	9	205	217	3,125
Anchovy	185	119	7,685	0	5,411	0	13,400
Trash fish	211,029	16,128	1,654	12,928	1,627	5,419	248,785
Miscellaneous fish	26,997	19,033	262	259	5,762	1,509	53,822
Total	**392,424**	**271,003**	**11,262**	**16,057**	**92,454**	**25,354**	**808,554**
Excluding molluscs, crustaceans and sea shells							

APPENDIX 3: AVERAGE EX-VESSEL PRICE (MALAYSIAN RINGGIT) PER KILOGRAM OF FISH BY SPECIES FROM MARINE CAPTURE FISHERIES, PENINSULA MALAYSIA 2009 (DOF 2009)

Month/Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dis	Average
Threadfin bream	5.29	5.08	4.99	5.26	5.12	5.20	5.10	4.74	5.14	5.00	5.26	5.30	5.12
Tiger tooth croaker	1.14	1.11	1.19	1.09	1.26	1.11	1.13	1.07	1.21	1.17	1.18	1.08	1.15
Goatfish	1.96	1.93	1.94	1.98	1.97	1.84	1.93	1.92	1.91	1.92	2.09	1.70	1.93
Croaker/jewfish	3.32	3.28	3.20	3.23	3.23	3.23	3.20	3.63	3.35	3.36	3.50	3.33	3.32
Temenggong/lara bara	1.38	1.66	1.53	1.44	1.48	1.58	1.44	1.53	1.57	1.37	1.48	1.45	1.49
Indian mackerel	6.68	6.61	6.56	6.59	6.61	6.75	6.51	6.34	6.47	6.25	6.73	6.18	6.52
Short mackerel	3.51	3.22	3.02	3.26	3.36	3.61	3.36	3.54	3.84	3.87	3.96	3.75	3.53
Yellow tail scad	5.54	5.38	5.35	5.87	5.84	5.87	5.97	5.45	5.75	5.30	5.92	5.59	5.65
Hard tail scad	4.06	3.84	3.79	3.99	4.01	4.14	4.04	3.79	3.99	3.80	4.07	3.98	3.96
Sea cat fish	4.25	4.22	4.21	3.98	4.05	4.16	4.09	4.02	4.19	4.05	4.07	4.21	4.13
Ox eye scad	3.55	3.23	3.56	3.41	3.30	3.41	3.41	3.44	3.49	3.26	3.39	3.33	3.40
Spanish mackerel	13.12	13.29	13.54	13.29	13.35	13.25	13.33	13.15	13.60	13.29	13.58	13.04	13.32
Large head hair tail	2.99	2.96	2.86	2.99	2.90	2.87	2.82	2.87	3.00	2.77	2.73	2.85	2.88
Rays	5.27	5.20	4.95	4.91	5.07	5.02	5.02	5.18	5.31	5.31	5.65	5.84	5.23
Yellow stripe scad	4.38	4.31	4.25	4.25	4.26	4.32	4.26	4.32	4.30	3.95	3.75	3.65	4.17
Fringe scale sardine	3.18	2.92	2.79	2.90	3.01	2.96	2.92	2.82	3.00	3.05	2.68	2.61	2.90
Long tail tuna	6.20	5.96	5.60	5.94	5.77	5.78	5.70	6.01	5.94	5.39	5.51	5.88	5.81
Kawa-kawa	5.62	5.32	5.06	5.43	5.20	5.25	5.10	5.17	5.30	4.72	5.04	4.60	5.15
Round scad	4.71	4.54	4.75	4.45	4.54	4.59	4.60	4.53	4.31	4.33	4.04	4.08	4.46
Small yellow tail scad	4.78	4.42	4.74	4.74	4.75	4.90	5.19	5.06	5.27	4.72	5.23	5.02	4.90
Barracuda	6.05	5.64	5.48	5.33	5.43	5.40	5.37	5.64	5.80	5.42	5.16	5.52	5.52
Anchovy	5.02	5.58	5.22	4.54	6.47	5.47	5.13	5.55	5.64	5.35	5.76	5.68	5.45
Trash fish	0.55	0.55	0.56	0.52	0.56	0.56	0.56	0.58	0.59	0.56	0.58	0.61	0.57
Miscellaneous fish	2.48	2.45	2.56	2.72	2.74	2.73	2.68	2.55	2.78	2.77	2.65	2.56	2.64

APPENDIX 4: PROCESSED PRODUCT FROM MARINE CAPTURE FISHERIES, PENINSULA MALAYSIA , 2000-2009 (METRIC TONNES)

Methods of Processing	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Salted/Dried	4,391	4,586	3,511	4,141	3,510	3,386	4,807	7,307	8,969	13,461
Dried Anchovies	5,564	4,467	7,665	6,586	7,685	5,885	5,952	8,381	13,226	13,360
Dried Prawns	442	346	251	351	251	1,610	1,768	1,550	990	1,349
Dried Cuttle fish	184	313	139	140	139	69	93	431	1,376	739
Dried Jelly fish	615	630	81	218	81	310	332	653	462	1,800
Dried Shell fish	122	56	0	0	0	580	113	570	428	1,162
Smoked Fish	14	22	0	0	0	0	0	0	183	58
Fertilizer	14,610	11,572	14,109	12,997	14,109	12,712	12,718	27,108	18,687	18,625
Fish Meals	170,807	183,859	206,529	196,392	206,529	112,178	154,563	161,239	143,010	211,682
Shrimp Paste	3,271	2,783	1,943	2,880	1,943	1,400	1,645	9,995	26,575	27,305
Pickled Prawn	54	54	105	50	105	14	26	54	38	216
Fermented Anchovies	173	549	707	1,157	707	706	1,100	4,266	2,193	4,309
Fish Ball	7,235	9,083	9,731	9,605	9,731	11,517	11,094	24,554	16,470	17,407
Fish Cake	815	966	191	314	191	532	247	2,818	509	434
Fish Paste(Otak-Otak)	247	205	112	363	112	496	662	1,938	2,048	1,824
Fish Surimi	1,105	1,107	1,467	1,665	1,467	7,565	1,685	3,802	2,615	3,993
Fish Crackers	8,904	15,494	18,459	22,667	18,460	24,741	25,760	43,869	46,135	54,808
Prawns/Cuttlefish Crackers	18	52	58	16	14	19	14	43	77	88
Satay Fish	1,210	1,574	1,498	1,543	1,498	316	315	2,117	2,344	2,729
Frozen Cuttlefish	1,497	1,185	966	821	966	1,460	1,000	4,752	1,713	6,398
Frozen Prawns/Mussels	1,562	923	572	1,077	762	2,064	982	10,388	4,669	4,012
Moruku	0	0	5,868	8,957	5,868	5,874	76	31	35	52
Nugget	0	0	71	231	71	0	0	1	17	10
Fish Steamed	1,519	1,930	2,340	2,602	2,340	3,848	3,849	4,371	3,932	5,951
Total	**224,359**	**241,755**	**276,373**	**274,773**	**276,539**	**197,282**	**228,801**	**320,238**	**296,701**	**391,772**

APPENDIX 5: DISPOSITION OF MALAYSIAN CAPTURE FISHERIES ACCORDING TO SPECIES

Species/Method	consumed Fresh	salted/dried	smoked	Fermented	surimi	satay fish	steamed/ boiled	fish crackers	fish ball	fish cake	nugget	otak-otak	fish meals	feed mills	fertilizer
Threadfin bream	x				x										
Tiger tooth croaker	x	x			x								x	x	x
Goat fish	x	x												x	
Croaker/jewfish	x	x			x				x	x	x			x	
Temenggong/lara bara	x														
Indian mackerel	x						x								
Short mackerel	x	x	x	x			x							x	
Yellow tail scad	x	x													
Hard tail scad	x	x													
Sea cat fish	x														
Ox-eye scad	x				x		x	x				x			
Spanish mackerel	x	x													
Large head hair tail	x	x												x	
Rays	x	x													
Yellow striped scad	x	x													
Fringe scale sardine	x		x		x			x				x	x	x	x
Long tail tuna	x														
Kawa-kawa	x														
Round scad	x				x			x							
Small yellow tail scad	x	x				x							x	x	x
Barracuda	x				x				x	x	x				
Anchovy		x		x											
Trash fish													x	x	x
Miscellaneous fish					x				x	x	x	x			

APPENDIX 6: ASSESSMENTS OF SPECIES ALTERNATIVES

Alternatives criteria	Tiger tooth croaker	Goat fish	Croaker/jewfish	Short mackerel	Hard tail scad	Ox-eye scad	Large head hair tail	Yellow striped scad	Fringescale sardine	Round scad
1.Price of raw material	1.0	0.9	0.6	0.4	0.3	0.5	0.8	0.2	0.7	0.1
2.Yields of flesh	0.5	0.3	0.7	0.7	0.6	0.6	0.4	0.5	0.6	0.8
3.Quality of catch	0.5	0.5	0.7	0.8	0.7	0.6	0.4	0.7	0.8	0.8
4.Quantity of grade II and III	0.6	0.2	0.7	1.0	0.8	0.5	0.1	0.3	0.4	0.9
5.Market familiarity	0.7	0.6	0.8	0.8	0.6	0.6	0.5	0.6	0.6	0.7
6.Suited for drying	0.8	0.7	0.8	0.7	0.7	0.5	0.5	0.7	0.7	0.8
7.Suited for salting	0.5	0.4	0.8	0.6	0.7	0.5	0.6	0.7	0.7	0.9
8.Suited for smoking	0.3	0.3	0.3	0.8	0.6	0.7	0.4	0.4	0.9	0.9
9.Use of By-product	0.2	0.2	0.6	0.4	0.4	0.5	0.3	0.4	0.3	0.5
Total	**5.1**	**4.1**	**6.0**	**6.2**	**5.4**	**5.0**	**4.0**	**4.5**	**5.7**	**6.4**
Ranking			3	2						1

Criteria and weights in selection of the most important species

Criterion	Percentage	Weight
Price of raw material	17.5%	1.0
Yields of flesh	14.0%	0.8
Quality of catch	14.0%	0.8
Quantity of grade II and III	12.3%	0.7
Market familiarity	10.5%	0.6
Suited for drying	8.8%	0.5
Suited for salting	8.8%	0.5
Suited for smoking	8.8%	0.5
Use of by-product	5.3%	0.3
Total	100.0%	5.7

Calculation of Criteria and weights (example):

Importance of weight of raw materials =1.0
Importance of price of raw materials =17.5%
Weighting (Importance) of species =1/5.7
=0.1754
~0.18

APPENDIX 7: WEIGHTING OF SPECIES (ASSESSMENTS CRITERIA X CRITERIA WEIGHT)

Alternatives	Weight	Tiger tooth croaker		Goat fish		Croaker		Short mackerel		Hard tail scad		Ox-eye scad		Large head hair tail		Yellow striped scad		Fringescale sardine		Round scad	
Price of raw material	**0.175**	10	**1.8**	9	**1.6**	6	**1.1**	4	**0.7**	5	**0.9**	5	**0.9**	8	**1.4**	2	**0.4**	7	**1.2**	1	**0.2**
Yields of flesh	**0.140**	5	**0.7**	3	**0.4**	7	**1.0**	7	**1.0**	6	**0.8**	6	**0.8**	4	**0.6**	5	**0.7**	6	**0.8**	8	**1.1**
Quality of catch	**0.140**	5	**0.7**	5	**0.7**	7	**1.0**	8	**1.1**	6	**0.8**	6	**0.8**	4	**0.6**	7	**1.0**	8	**1.1**	8	**1.1**
Quantity of grade II and III	**0.123**	6	**0.7**	2	**0.2**	7	**0.9**	10	**1.2**	5	**0.6**	5	**0.6**	1	**0.1**	3	**0.4**	4	**0.5**	9	**1.1**
Market familiarity	**0.105**	7	**0.7**	6	**0.6**	8	**0.8**	8	**0.8**	7	**0.6**	6	**0.6**	5	**0.5**	6	**0.6**	6	**0.6**	7	**0.7**
Suited for drying	**0.088**	8	**0.7**	7	**0.6**	8	**0.7**	7	**0.6**	5	**0.4**	5	**0.4**	5	**0.4**	7	**0.6**	7	**0.6**	8	**0.7**
Suited for salting	**0.088**	5	**0.4**	4	**0.4**	8	**0.7**	6	**0.5**	5	**0.4**	5	**0.4**	6	**0.5**	7	**0.6**	7	**0.6**	9	**0.8**
Suited for smoking	**0.088**	3	**0.3**	3	**0.3**	3	**0.3**	8	**0.7**	7	**0.6**	7	**0.6**	4	**0.4**	4	**0.4**	9	**0.8**	9	**0.8**
Use of By-product	**0.053**	2	**0.1**	2	**0.1**	6	**0.3**	4	**0.2**	5	**0.3**	5	**0.3**	3	**0.2**	4	**0.2**	3	**0.2**	5	**0.3**
Total			**6.14**		**4.91**		**6.70**		**6.93**		**5.67**		**5.56**		**4.65**		**4.82**		**6.49**		**6.81**

APPENDIX 8: FOMBES INVESTMENT COST SUMMARY FOR PRODUCTION OF MIXED PRODUCT DRIED/SALTED AND SALTED SHORT MACKEREL

Items	**Quantity**	**Unit Price (RM)**	**RM**	**Sources/Rationale**
Buildings (Store, processing & office – 40 m²)	1	Lump sum	20,000	Estimation
Drying racks	105m²	50	5,225	ILO-WEP 1982
Fish tubs	30	250	7,500	Estimation
Stainless cutting tables (2' x 5')	1	2,500	2,500	Estimation
Cold room for storage finished product (capacity 1 ton)	1	6,000	6,000	Estimation
Cold room for storage raw materials (capacity 1 ton)	1	8,000	8000	Estimation
Contingencies (5%)			2,461	Estimation
Total investment cost			**51,686**	

APPENDIX 9: FOMBES FIXED COST AND VARIABLE COST SUMMARY FOR PRODUCTION OF MIXED PRODUCT DRIED/SALTED AND SALTED SHORT MACKEREL

Items	Quantity	Unit Price (RM)	RM	Sources/Rationale
Fixed Cost				
Land (Renting 250m² -drying area and buildings)	250m²	1	3,000	Estimation
Electricity bills		250	3,000	Calculated rates (National Electricity board)
Telephone bills		100	1,200	Estimation
Maintenance and repair cost (5% of investment cost			2,584	Estimation
Insurance (1.5% of investment cost)			775	Estimation
Operation supervisor	1	1,500	18,000	Calculated estimation
Accounting clerk	1	1,000	12,000	Calculated estimation
Contributions to employee provident funds (12% from basic monthly wages)			3,600	Employee Provident Fund, Malaysia, 2011
Employee insurance (1% from basic monthly wages)			300	Estimation
License and other fees			1,500	Estimation
Total fixed cost			**45,960**	
Variable cost				
Raw materials (fish)-200 days operations	200 kg	3.00	120,000	FDAM, Perlis
Water bills- RM 300/month			3,600	Calculated estimation (Perlis water board)
Electricity bills- RM 600/month			600	Calculated estimation (National Electricity Board)
Labour- 200 days operation	3	30	18,000	Calculated estimation
Overtime- (2 workers) 200 days operation	4 hrs	5	8,000	Calculated estimation
Packaging-Styrofoam box 20kg/box	1,021	3	3,062	Calculated estimation
Salt- (35% intake)	14 tons	600	8,400	ILO-WEP 1982
Marketing cost –RM0.20 per kg	20.412 kg		4,082	Calculated estimation
Total variable cost			**189,744**	
Assumption based on ILO-WEP 1982				
Yields of production: Dried – 40% (moisture content -30%) Dried/Salted – 51% (moisture content- 45%) Smoke – 35% (moisture content -20%) Salted- 70% (moisture content -60%)				

APPENDIX 10: PROFITABILITY ASSESSMENT MODEL