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A progress design, costs and financial analysis of a pilot plant for the utilisation of the shrimp by-catch in the Gulf of California (TPI report no. R1002(A))

R 1002(A)

A PROGRESS DESIGN, COSTS AND FINANCIAL ANALYSIS OF A PILOT PLANT FOR THE UTILISATION OF THE SHRIMP BY-CATCH IN THE GULF OF CALIFORNIA

July 1981

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CONVERSION FACTORS

A. Currencies

US$1	=	23.75 pesos
£1	=	47.11 pesos

B. Weights

Throughout this document metric units have been used i.e. 1 tonne = 1000 kgs

The authors wish to make it clear that any mention of a company or its products, and its use in a costing, does not imply a recommendation of that company to the exclusion of others which may be available.

PREFACE

1. This report has not been prepared as an investment profile. Its objectives are simply to provide detailed designs, together with associated capital, operation and production costs for a plant to utilise Mexican shrimp by-catch to produce a range of products. This analysis is primarily intended to assess break-even factory-gate prices for various end product mixes, to permit further assessment of their marketabilities.

2. The report may, therefore, be considered as one of a number of pre-investment studies which will be required before the final project design is determined and implementation takes place. These other studies would include:-
   - further assessment of acceptability and marketability of products in the light of likely break-even factory-gate prices.
   - assessment of ex-factory marketing costs and potential outlets and marketing channels.
   - determination of a viable product mix and prices.
   - required phasing of various elements of the project in the light of market information and the availability of equity and loan capital.
   - a financial analysis for the phased project development on the basis of projected costs and likely revenue, and
   - the preparation of a financing plan.

3. The report outlines an integrated production system producing dry/salted fish cakes, fish silage, canned and frozen products. This does not necessarily imply that in practice such an integrated process is the best commercial option for utilising by-catch. As an alternative, the addition of one or more of the processes to existing fish processing operations may prove a more viable option.

SUMMARY

During 1977-1981, the Instituto Technologico y de Estudios Superiores de Monterrey (ITESM) and the Tropical Products Institute (TPI) carried out a joint technical co-operation programme aimed at developing means of utilizing Mexican shrimp by-catch, particularly that of the Gulf of California. As a result of these studies, practical systems for the recovery and processing of shrimp by-catch into foods for human consumption and animal feed by-products have now been elaborated. On the basis of proposals made by the ITESM/TPI team for the commercial development of by-catch utilization, the Direccion de Fomento Pesquero of the State of Government of Sonora has authorized the funding of a model factory to be operated by ITESM. This document provides details of the process design, including the equipment and labour requirements, and a financial evaluation of likely production costs and break-even factory gate prices for products to permit further evaluation of their marketability.

Section 7.0 describes the process requirements for manufacturing five products for human consumption and an animal feed by-product from by-catch fish. A possible configuration for the plant would be to utilize 2350 tonnes of fish annually to produce 138 tonnes of dry, salted fish cakes, 388 tonnes of frozen, breaded fish sticks and 450-520 tonnes of a canned fish product. With respect to the latter, the plant may be adapted to manufacture either canned fish mince with vegetables ("picadillo"), canned fish paté or canned fish sausages at any point in time depending on the existing requirements. In addition to these items, plant wastes (i.e. heads, guts and deboner waste) could be used to produce an annual yield of 1352 tonnes of wet fish silage for animal feed.

Section 8.0 provides an analysis of costings for the project together with the calculation of break even end product prices.

Establishment and operating costs are identified for the 'main plant', i.e. the plant dealing with raw material intake and evisceration. Subsequent financial appraisals of the main plant enable values to be attached to the two derived intermediate products: eviscerated fish and fish waste.

For each end product under consideration - fish cakes, frozen fish sticks, canned picadillo, canned fish sausage, canned fish paté and silage - establishment and operating costs are identified. Costings are then made for differing combinations of end product lines with appropriate adjustments where cost items are held in common.

From the costings of the main plant and those for end product lines, break-even factory gate prices are calculated for each end product.

Depending upon the combination of end products selected, establishment costs for the entire plant are between 25.1 and 26.8 million pesos. Total annual operating costs, again depending upon the range of end products selected, are between 19.4 and 29.2 million pesos.

Break-even factory gate end product prices, for an assumed raw material (by-catch) cost of 3000 pesos per tonne, are as follows:

Fish cakes	51,000 pesos per tonne
Frozen fish sticks	22,000 pesos per tonne
Canned picadillo	25,000 pesos per tonne

Canned fish sausage	33,000 pesos per tonne
Canned fish paté	26,000 pesos per tonne
Silage	2,000 pesos per tonne.

These prices compare favourably with prices for alternative equivalent products currently marketed in Mexico, but the picture could alter if prices of major inputs, notably by-catch and cans, changed significantly. The financial analysis for the project has also concentrated only on production costs. Marketing requirements and possible associated costs may also influence the viability of the project.

The report may therefore be considered as a precursor to further pre-investment studies which should be considered before the final project design is determined and implementation takes place. These other studies would include:

- further assessment of the acceptability and marketability of products;
- identification of outlets, marketing channels, associated marketing costs and likely end product values;
- determination of an appropriate product mix;
- creation of a phased implementation plan in the light of further market assessment recommended above, capital available, etc;
- analysis of the likely financial performance of the plant; and
- preparation of an investment profile with an associated financing plan.

Finally it is worthy of special note that whilst this report outlines an integrated production system for a range of products this does not imply that in practice such a plant is the best commercial option. Adding one or more of the processes to existing factories may prove a more viable development alternative.

SECTION 1.0 INTRODUCTION

During commercial shrimping operations, large quantities of fish and other marine organisms are caught incidentally and subsequently discarded at sea. This incidental fraction of the trawl is referred to as the shrimp by-catch and represents a global annual loss of several million tonnes of potential human food (FAO estimate, 1975).

Shrimping is particularly extensive in Mexico and, consequently, utilisation of the by-catch in this country would make a significant contribution to the local supply of animal protein foods for human consumption. Indeed, the local amount of by-catch wasted in Mexico is estimated at half a million tonnes annually. Until recently, little information was available regarding the nature of the by-catch in Mexico and no suitable technologies for its retrieval had been described. In May 1977, however, a research and development project was initiated at Guaymas on the Gulf of California with the aim of providing data which would lead to practical recovery of the by-catch. This project has been operated as a joint technical co-operation project between the Technological Institute of Monterrey (ITESM), the Departmento de Pesca (Mexican Fisheries Department) and the ODA Tropical Products Institute (TPI) of the U.K.

Developments realized during the initial phase of the project have resulted in the design of several processes for utilization of the by-catch in dried/salted, canned or frozen forms. On the basis of the development studies, it is now possible to propose industrial operations for converting the by-catch into a variety of products for human

consumption with additional usage of processing wastes as animal feed (fish silage).

SECTION 2.0 THE SHRIMP BY-CATCH RESOURCE

During the period 1977-1980, systematic analyses of the yields and composition of shrimp by-catch in the Gulf of California were undertaken.[1, 2] The mean estimated weight ratio of shrimp:by-catch was 1:9, which indicates that the by-catch is a sizeable fishery resource in the region.

To date, over 100 fish species have been identified in samples of shrimp by-catch taken from the Gulf of California. Thus, there appears to be appreciable variability in the composition of the material. However, although many different species have been classified, there are a limited number which appear frequently in large quantities. These are low-fat demersal species and include:- mojarras (Eucinostomus spp.), flatfishes (Citharichthys spp. and/or Etropus spp.), cabaicuchos (Diplectrum spp.), rayadillo (Orthopristis reddingi), chano (Micropogonias altipinnis) and chivo (Pseudupeneus grandisquamis).

By-catch fish are generally of very small size, the vast majority measuring between 7cm and 17cm in length. The overall mean length is estimated as 12cm. This extremely small size would preclude normal marketing of the by-catch as fresh fish. Observations during these studies have indicated that less than 5% of the fish recovered in the by-catch could be considered for normal commercial sale and that these are already selected for this purpose by the crew.

Despite the large range of species and small size

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1. Young, R.H. & Romero, J.M. (1979) Variability in the yield and composition of by-catch recovered from Gulf of California shrimping vessels. Trop. Sci. 21, 249.

2. Perez Mellado, J. (1980) Analisis de la fauna de acompanamiento de camaron capturado en las costas de Sonora y Sinaloa, Mexico. Tesis de Maestria - ITESM, Guaymas, 98p.

of the fish, other factors indicate that the Gulf of California shrimp by-catch may be a vast resource available for financially viable exploitation. A mean ratio of shrimp by-catch to fish obtained of about 1:9 and a quantity of shrimp landed annually from the Gulf of California of approximately 20,000 tons indicates a potential by-catch yield of 180,000 tons each year compared with an estimated 500,000 tonnes for Mexico as a whole.

SECTION 3.0 RELATION OF SHRIMP BY-CATCH UTILIZATION TO THE GULF OF CALIFORNIA SHRIMPING INDUSTRY

It is not possible to consider the utilization of the shrimp by-catch in isolation from the Gulf of California shrimp fishery. The viability of the industry may influence, or be influenced by, utilization of the shrimp by-catch.

Approximately 180,000 tonnes of shrimp by-catch is caught each year in the Gulf of California by trawlers based at the ports of Puerto Penasco, Mazatlan and Guaymas. The Guaymas shrimp fishing fleet has expanded considerably during the last decade. In the 1970/71 season, 282 vessels were registered as actively fishing in the Gulf, but by 1978/9, the fleet had increased to 429 vessels. Most of the new vessels recruited to the fleet were built in Guaymas and to date continue to be produced at the rate of 15-20 vessels each year. The recent trend in the design of shrimp trawlers has been to produce 22-24 metre (71-80 tonne) vessels fitted with sophisticated radar, communications systems and depth finding equipment. Approximately 35% of the present Guaymas fleet is equipped with fast-freezing and cold storage facilities, capable of handling between 15-25 tonnes of frozen, beheaded shrimp during a single voyage. The cost of building and fitting out a shrimp trawler of this type is between 3-6 million pesos.

The average length of a voyage for one of these vessels is between 3-4 weeks and the cost calculated for a single voyage during the 1976/77 season was 66,024 pesos and has obviously increased since this time.

Not surprisingly, the large, well-equipped shrimp fleets operating from the Gulf ports have had a

very considerable impact upon the shrimp resources of the area. As may be seen in Table 3.1, in the 1970/71 season, when only 282 boats operated out of Guaymas, the total shrimp catch landed was 3,867 tonnes. By 1978/79 there had been a 52% increase in the fishing fleet and the total tonnage of shrimp landed at Guaymas had risen to 4,383 tonnes, representing an increase of only 13.3% on the 1970/71 season's catch. Concomitantly, the actual tonnage of shrimp landed by each boat fell from 13.7 tonnes/boat in the 1970/71 season to 10.2 tonnes/boat in the 1978/79 season. However, the price paid for shrimp for markets outside of Mexico is high and during the 1978/79 season ensured a catch revenue of approximately 488 million pesos for shrimp landed at Guaymas.

Offset against this revenue are the various costs incurred in running the Guaymas-based fleet, estimated at 177 million pesos. If, as seems likely, the overall catch of shrimp continues to fall each season and the fleet continues to expand, the difference between the profits from shrimp sales and total cost of fishing will continue to be reduced, the industry becoming progressively less efficient and less profitable.

In line with conservation measures, ways of improving the profitability of the industry must be considered. For instance, the Guaymas fleet at present uses only a small fraction of its freezing and cold storage capacity. Vessels of 15-25 tonne storage capacity per voyage are handling only 12.2 tonnes of shrimp per season. In the light of this information, slimming the size of the fleet and maximising the use of post-harvest handling and storage capacity at sea should be considered as

methods of improving profitability.

Table 3.1 The Catches of Shrimp Landed at Guaymas Between 1970-1979, Number of Boats Involved in Fishing and the Average Catch per Boat per Season

Fishing season	Total shrimp[1] catch landed (tonnes)	Number of boats fishing	Shrimp catch[1] per boat (tonnes)
1970-71	3866.9	282	13.71
1971-72	4275.1	273	15.66
1972-73	5511.7	274	20.11
1973-74	3242.8	281	11.54
1974-75	4119.4	342	12.04
1975-76	3535.6	444	7.96
1976-77	5177.6	429	12.07
1977-78	4225.4	438	9.65
1978-79	4383.0	429	10.22

SOURCE: Instituto Nacional de Pesca, Mexico
NOTE 1 - beheaded shrimp

At this point, the contribution that a shrimp by-catch industry could make to increasing the profitability of the Gulf shrimp fishing fleets should be examined. A detailed financial analysis of by-catch processing industries[1] has indicated that such industries could be viable even at a raw material cost of 6,000 pesos/tonne (for small by-catch fish).

It is envisaged that by-catch would be sorted, preserved and stored at sea, taking advantage of the spare storage capacity of shrimp trawlers. The by-catch would be sold to the by-catch processing

1 Street, P.R., Young, R.H. and Crean, K. (1980). A technical and economic evaluation of a system to utilise the Mexican shrimp by-catch to produce a dry salted product for human consumption. TPI Report R895- 129 p.

industry, the revenue from the catch offsetting part of the cost incurred during shrimp fishing voyages. Indeed, since currently the by-catch is discarded and since no extra labour would be required on the vessels to sort and store the fish, the purchase of by-catch by a processing industry would constitute virtually a free bonus to vessel owners.

There is no doubt that the shrimp industry of the Gulf of California needs to find ways of restoring its profitability. Utilisation of the by-catch could certainly help in achieving this goal. Discussions with fishermen and fishing co-operatives indicated that they would be more than willing to land sorted by-catch for 6,000 pesos/tonne. Indeed, indications were given that such landings might be attractive at 3000 pesos/tonne.

SECTION 4.0 PROPOSED METHODS OF HANDLING BY-CATCH AT SEA

Adequate handling of by-catch at sea is a major difficulty associated with the utilisation of the resource, particularly for human consumption. Three possible approaches exist:-

(i) Recovery and storage aboard the shrimp vessel;

(ii) use of collector vessels; or

(iii) partial processing at sea.

All of these alternatives have their inherent disadvantages. It is considered by some that recovery and storage aboard shrimping vessels may require much time and effort and therefore influence the efficiency of the shrimping operation. Moreover, in Mexico, there is a wide variation in vessel specification, some employing refrigeration and others using ice. It may thus be difficult to standardise procedures for maintaining good quality raw material. On the other hand, the use of collector vessels would be a costly operation and transfer of by-catch at sea may be problematic under certain conditions. Partial processing at sea would necessitate modifications to the vessel and, again, may affect the shrimping activity.

Despite the drawbacks associated with the recovery of the by-catch and handling aboard the shrimping vessels, it is felt that this represents the most feasible method of handling the material at present. Handling of by-catch at sea may be executed by the use of plastic fish boxes which can be used to store the fish in ice until the vessel returns to

port. Unloading and transfer to the processing plant would then be a relatively straightforward operation, particularly as the plant could be sited near to the landing area. It has been shown that by-catch fish will remain in acceptable condition for up to 3 weeks if properly washed and iced soon after capture (ITESM, unpublished data).

Recent trials to test the feasibility of holding by-catch aboard shrimping vessels have demonstrated the following:-

(i) It is possible for crew members to separate by-catch teleosts, wash and box the material in ice (or freeze them) in between shrimp trawls. Little extra effort is incurred beyond that incurred with normal shrimp sorting.

(ii) Sufficient space is available aboard the vessels to store several tonnes of by-catch fish. Actual shrimp catches are extremely low.

(iii) Good quality by-catch fish may be landed either preserved in ice or by rapid freezing by brine immersion using the facilities of the shrimping vessels.

There appears to be no reason why fishermen in the Guaymas area would not land by-catch for processing. This is because:-

(a) an adequate financial incentive can be provided;

(b) there are no inherent constraints in storage capacity on the fishing vessels; and

(c) no problems of handling at sea exist which would interfere with the shrimping operation.

SECTION 5.0 TECHNOLOGIES DEVELOPED

In view of the nature of the by-catch, which comprises a wide variety of marine organisms, it was thought that conventional technologies were unlikely to be applicable to utilise the bulk of the material to produce human food. Nevertheless, it is now well recognised that fish constitute 80-90% of the by-catch, although the vast majority of these are of extremely small size. With the recent development of mechanical devices capable of separating the fish flesh from the skin and bone (deboners), it is now possible to produce acceptable fish minces from such small by-catch species.

At ITESM, a wide range of food products for human consumption has been developed from deboned fish minces prepared from by-catch. These include the following:-

Salted/dried products
Frozen, breaded fish sticks
Canned fish picadillo
Canned fish pate
Canned fish sausages.

Most of these products have had preliminary testing for consumer acceptability already with very favourable results. For example, central location market testing has demonstrated that salted, dried fish cakes, frozen fish sticks and canned fish picadillo have considerable potential in the marketplace. Acceptability of all these products was rated high and consumers expressed a definite willingness to purchase.[1] Further market testing, of the home

1 ITESM (1980) Central location market testing of three products prepared from shrimp by-catch. Internal Report.

usage type, of salted, dried fish cakes has indicated that the consumer regards the product as "very good" and would generally be prepared to purchase at a minimum price of 5 pesos per cake.[2] "Ease of preparation" and "flavour" were quoted as favoured characteristics of the product and less than 10% of consumers found the product too salty. With regard to canned fish pate and sausages, taste panel testing has shown that these products are very acceptable and compare favourably with existing products in the market.[3]

In addition to the development of these products for human consumption, it has also been demonstrated that processing wastes (heads, guts and deboner waste) may be used to prepare fish silage which may be incorporated as a protein source in animal feeds. The latter has been used successfully in pig feeding trials in Sonora.

However, considerably more work is required to assess the marketability of products, in particular to identify the likely volumes of demand and associated price levels, potential buyers and marketing channels, before investment in the final configuration of the pilot plant is determined.

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2 De Villa & Associates (1980) Study of the market acceptability of new fishery products. Report prepared for Mexican Fisheries Department.

3 ITESM (1981) Unpublished data.

SECTION 6.0 JUSTIFICATION FOR INVESTMENT IN A BY-CATCH INDUSTRY

The industrial utilization of shrimp by-catch in forms developed at ITESM laboratories has a number of features which make it economically and socially desirable. These include:-

(a) utilization of a currently wasted protein resource with a high biological value;

(b) provision of a means of raising fishermen's incomes, which is particularly important given the current financial stresses on shrimping operations in Mexico;

(c) the processing operations create employment;

(d) one of the products - dried/salted fish mince - can potentially at a price well below that of alternative animal proteins in Mexico, thus making a nutritional product more available to the low income groups;

(e) other products manufactured by the proposed industry could replace existing meat products potentially at lower cost and all could be regarded as suitable for children's food due to the complete absence of fish bones;

(f) the ensiled fish waste by-product enhances existing supplies of animal protein feed in Mexico and indications are that it can be marketed at lower cost;

(g) utilization of this currently wasted by-catch resource could make a contribution to increasing the national protein food and animal feed supplies, thus providing

a potential saving in foreign exchange used for imports;

(h) there is much concern regarding by-catch utilization at international level since the same problem exists in many countries. The proposed pilot plant could serve as a model for other regions interested in by-catch processing.

SECTION 7.0 PILOT PLANT FOR SHRIMP BY-CATCH PROCESSING

7.1 The Processing Operation

In this Section the design of an industrial configuration is provided which could produce the potential range of products. The design permits evaluation of likely production costs and break even factory gate prices to effect further market assessment of the products and various product mixes.

7.1.1 Throughput and Product Flow

This industrial configuration was designed to utilize 100% of the landed by-catch. The required input of by-catch fish would be 8 tonnes/day, which could be converted into the following products:-

1. Dried/salted fish mince.
2. Frozen fish sticks.
3. Canned fish picadillo.
4. Canned fish paté.
5. Canned fish sausages.

A by-product - fish silage - could be produced from the plant wastes for use as animal feed. The shrimping vessels supplying the raw material would return 2 tonnes/vessel from each trip of 10 days' duration. This should be well within the capability of any shrimping vessel and would amount to recovery of fish from the final trawls. This would eliminate the need to store fish in holds on ice for extended periods and overcome the resistance of fishermen to storing by-catch early in the voyage when they always feel optimistic about filling their holds with shrimp.

The plant would require the unloading of 4 vessels daily to maintain an adequate raw material supply. A total of 40 vessels might, therefore, be involved in the operation given their average 10-day voyage.

Assuming that manufacturing could proceed for 294 days/year, a plant of this size would utilize a total of 2,350 tonnes of by-catch fish annually and could produce

(net weights):-

138 tonnes/year dried/salted fish mince
388 tonnes/year frozen breaded fish sticks
459 tonnes/year canned fish picadillo[1].
or 514 tonnes/year canned fish sausage[1].
or 514 tonnes/year canned fish paté.[1].

The yearly output of by-product, in the form of wet silage for animal feed, would be 1,323 tonnes.

If by-catch is not available during certain times of the year (e.g. the close season operating in Pacific waters), the plant may use other sources of raw material such as wastes from filleting processes.

The process is illustrated diagramatically in Fig. 7.1 and a materials flow chart is given in Fig. 7.2. The following is a description of the industrial operation.

7.1.2 Stages in the Industrial Process

7.1.2.1 On-Board Handling of the By-Catch

To facilitate factory utilization of the raw material, fish would be sorted from crustaceans and other organisms at sea, then washed and stored in ice in plastic fish boxes. The latter would have a capacity of 70kg. There would thus be a requirement of approximately 50 fish boxes/vessel if fish are iced at a ratio of one part ice to one of fish and 2 tonnes per vessel are to be landed.

The vessel's crew would be required to land the by-catch in acceptable condition. In some cases, rapid freezing at sea would be available, thus

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1. Volumes specified for each canned product refer to those which would apply if only one product is produced during the operating year. If all three were produced, say for one third of the operating year, then volumes per product would be one third of the level specified above.

Fig. 7.1 Flow diagram of an industrial process for shrimp by-catch utilization.

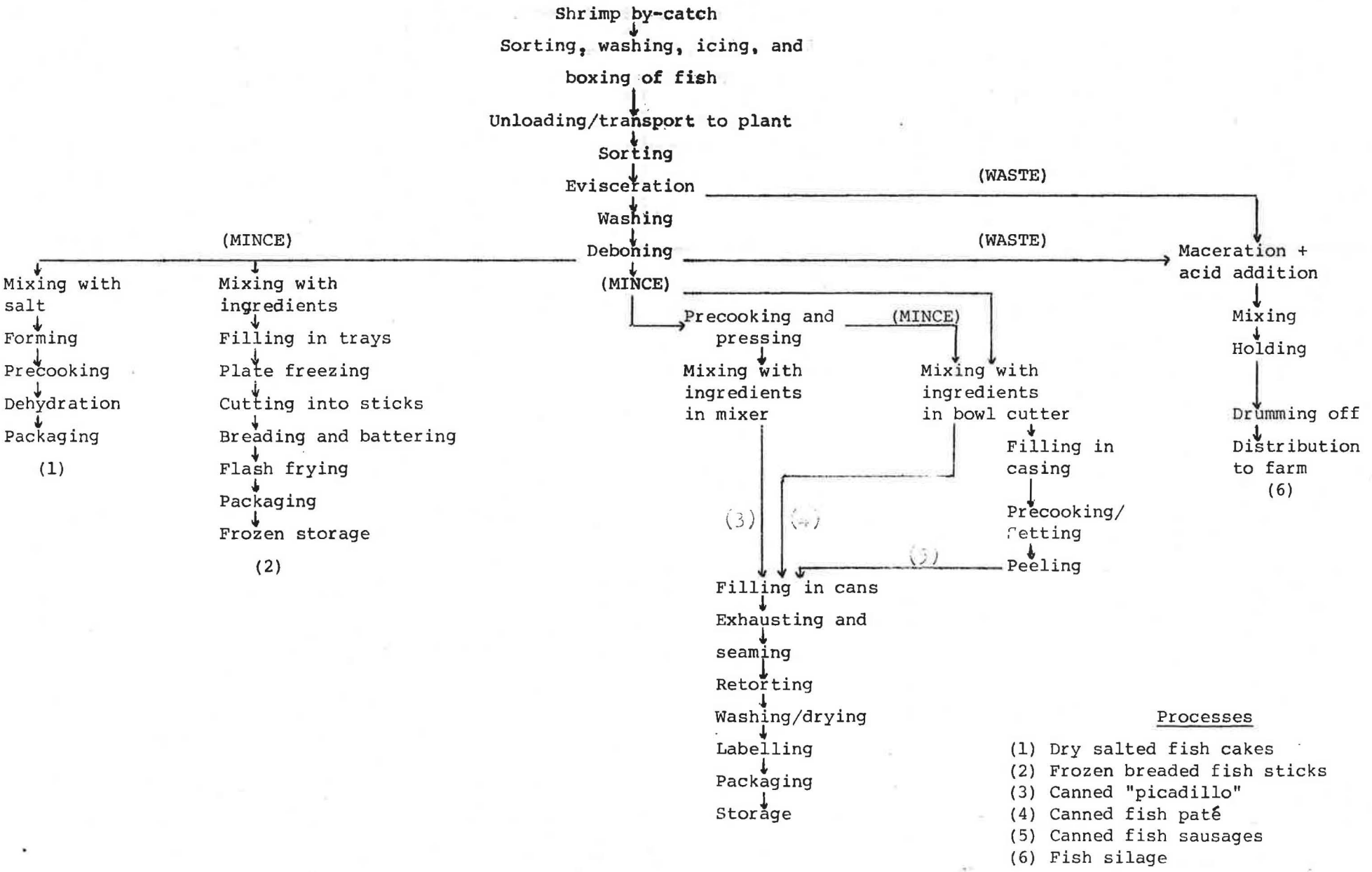
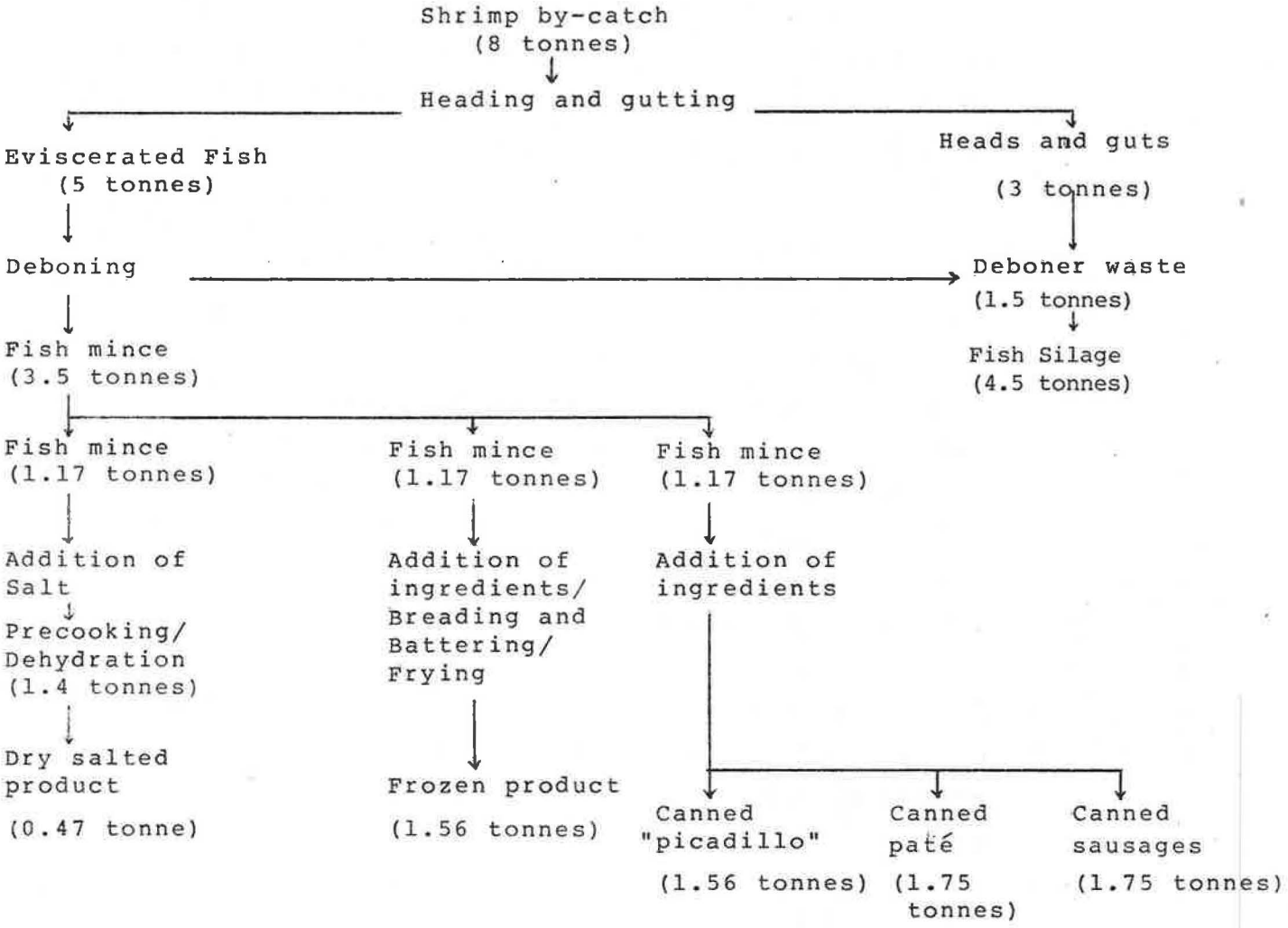


Fig. 7.2 Daily materials flow chart for an industrial process for shrimp by-catch utilization.



reducing storage requirements. If ice is used at a ratio of 1 part ice to 1 part fish, a total of 2 tonnes of ice per vessel per trip would be needed. It is considered that proper icing should be the responsibility of the crew and that any extra costs incurred be recovered from the revenue derived from the sale of raw material.

7.1.2.2 Raw Material Assembly and Buffer Storage

Raw material would be transported from the vessels to the processing plant in a 2-tonne capacity vehicle, making approximately 4 journeys daily. One driver and a labourer would be necessary to carry out loading, unloading, weighing and transportation of fish. The factory would be close to the dock and this would therefore not result in significant thawing of ice.

A cold store of capacity 20 tonnes (at $-30^{o}C$) would be included in the plant both for the storage of frozen minced products (Section 7.1.2.3.4 (vii)), and for buffer storage (if necessary) of raw material. The cold store should be of dimensions 8m x 4m x 3m with standard HEMSEC 100mm rigid polyurethane foam insulation and model ASR 1000-502 air-cooled condensing unit with in-built 10HP motor (Habco Refrigeration Ltd., Hayes, Middlesex). Ten mobile trolleys should also be provided for general in-plant transport of the raw material to the processing intake point.

7.1.2.3 Product Manufacture

The equipment supplies and labour required for the manufacture of minced fish products are fully described in Tables 1.2 to 1.14 of Appendix 1 .

The manufacturing process is considered in terms of a 1-shift (8-hour) day. However, the cooking/ dehydration process for dried, salted fish cakes, including the loading and unloading of the drier and the packing of the end product, would be continuous throughout a 24-hour period and involve a working day of three 8-hour shifts (Section 7.1.2.3.3 (iii)). In addition, the freezing line would demand a 12-hour shift to be worked by some personnel in view of the time required to freeze the fish blocks (Section 7.1.2.3.4 (iii)).

7.1.2.3.1 Evisceration of the Raw Material

Raw material would enter the evisceration stage either by direct delivery from the vessels or from the cold store. Portable platform scales 3901 AAG (Avery Export Ltd., Smethwick Warley) of 500kg total capacity are included for checking raw material weights.

Taking into account:

(a) the small size of the by-catch fish (approximately 60g mean weight); and

(b) the fact that gutting can only be achieved by slicing the fish;

it is estimated that 6 hours will be necessary to complete the heading and gutting of the required 8 tonnes of fish using 13 eviscerators.

Evisceration and beheading of the by-catch raw material would be carried out along a 10m double conveyor belt. Headed and gutted portions would remain on the top belt and wastes placed on the lower belt. The output of beheaded and gutted fish has been estimated at 5 tonnes/day with a waste recovery of 3 tonnes/day. To receive this

waste material, two containers,each of 300kg capacity, would be required. These would be emptied every 30 minutes at the silage plant (Section 7.1.2.3.6). Gutted fish would fall directly into a washing tank of total capacity 1.5 tonnes with a continuous flow of chlorinated water (approximately 1,500 litres/hour). Washed material would be carried from the washing tank by a conveyor (about 3m in length) to the meat and bone separator, which would have a hopper. An inspector would be present to check the quality of the fish and to eliminate any undesirable species.

7.1.2.3.2 Flesh and Bone Separation

Eviscerated fish would be fed directly to a mechanical meat and bone separator. This machine would need to handle a throughput of 700kg/hr. Since the Paoli separation system has proved adequate for use with by-catch fish, it is suggested that a Paoli model 20-8 separator system (Stephen Paoli International Co., Rockford, Illinois) should be included in the plant. This machine in fact has a maximum fish input capacity of 1,400 kg/hr and comprises a model 20 AF separator (15HP motor) and a model 8 grinder (25HP motor) plus an automatic force feed assembly. The deboner would be operated by 2 workers, one being a skilled technician and the other a trained assistant.

Deboned mince would be collected in 70kg plastic fish boxes and fed to the respective processing lines (i.e. drying, freezing or canning). The latter procedure would be carried out by the deboner operators who would also ensure that containers used were washed and steam cleaned immediately after use. Based on an estimated yield of 70% from raw material entering the deboning process,

the output of mince from the deboner would be approximately 3.5 tonnes/day. The deboner waste (bones, scales and skin) would amount to 1.5 tonnes/day. This would be collected in a 200 kg container to be emptied at the silage plant every hour.

For cleaning down the deboning equipment at the end of each shift, water, steam and caustic soda would be required. A 300-litre capacity steam-jacketed tank (Doleschal, Austria: quoted by ABR Machinery Ltd., Milton Keynes) has also been incorporated both for sterilising the deboner cylinder and heating brines for the canning operation (Section 7.1.2.3.5).

7.1.2.3.3 Manufacture of Dried, Salted Minces

Of the total daily production of 3.5 tonnes of deboned fish mince, 1.17 tonnes would be fed to the salting and dehydration line. Mince would be processed continuously as received from the meat and bone separator.

(i) Mixing the Fish Mince with Salt

The mince would be batch-mixed with 20% salt. The batches would be of 40kg mince plus 8kg salt. A mixer capable of handling these quantities is the Hobart H600 with 1½ HP motor (Hobart Manufacturing Co. Ltd., London). Mixing would proceed for approximately 5 minutes, after which the final mix would be tipped into a mobile container and transported to the moulder. Two workers would be needed for the mixing operation and for the transport of produce to the moulder.

(ii) Moulding the Salt/Mince Mix

The wet salt/fish mix would be pressed automatically by the moulder into cakes (approximately 8cm diameter; 1cm thick; weight 130g). In practice,

the shape and size could be varied to suit market requirements. A suitable device would be the Square Minimat moulder which can produce up to 3,600 cakes/hour (i.e. 0.47 tonne/hr) and incorporates two 4HP motors (Square Co., Malmo; quoted by Berendsen Ltd., Croydon). This machine may be supplied with a variety of additional forming sets to make different sizes and shapes. Pressed cakes would be carried from the moulder by a conveyor belt (approximately 3m in length) from which they would be removed by hand and packed onto trays by 3 workers for subsequent loading into the cooker/drier. The estimated daily production of formed wet cakes is 1.4 tonnes (from the single 8-hour shift).

(iii) The Pre-Cooking/Dehydration Process

Proper control of this stage of the process is essential to ensure correct flavour and texture characteristics of the product. Wet cakes require careful pre-cooking at 100°C for 1 hour followed by gentle drying for up to 36 hours at 40°C. This would be achieved using an Afos No.60 drying kiln (dimensions 5.4m x 2m x 2.9m), fitted with special controls and recorder and complete with 4 trolleys and 220 stainless steel or nylon-coated trays (Afos Ltd., Hull). The unit could produce approximately one tonne of product per 24 hours and would be programmed to ensure a temperature profile of 1 hour at 100°C followed by 36 hours at 40°C. Drying is carried out by means of forced convection of steam-heated air and the manufacturers indicate that the electrical and steam requirements for the unit are 9kw and 25gm/sec. of steam at 2 Bar pressure respectively.

Whilst formed wet cakes would be produced on a single shift (8-hour day) basis, the pre-cooking/dehydration operation would be continuous over 24

hours and 3 shifts would be worked to load and unload the drier and pack the end product. Formed wet cakes could be buffer-stored if necessary since their high salt content would prevent any deterioration. The estimated daily production of dried/salted cakes is 0.47 tonnes.

(iv) Packaging of End Product

Trolleys emerging from the drier containing dried material would be unloaded by workers onto packing benches. Market tests indicate that it is desirable to pack the cakes in polythene bags with a cardboard base, and including instructions for preparation, in units of two (i.e. 2 cakes/packet). Packs of cakes would be sealed using HM 910 (200 watt) impulse heat sealers with auto-timers (Hulme-Martin Ltd., London): one sealer per packer. These packs would then be stacked in cardboard cartons ready for distribution. A store should be provided for the stock-piling of end product. Due to the sterility and durability of the product, a dry room in the processing building would suffice. Packaging could be carried out by 3 workers.

7.1.2.3.4 Manufacture of Frozen, Breaded Fish Sticks

Under the configuration indicated in Section 7.1.1 of the total daily production of 3.5 tonnes of deboned fish mince, 1.17 tonnes would be fed to the breading and freezing line. Mince would be processed continuously as received from the meat and bone separator.

(i) Mixing of the Fish Mince with Additional Ingredients

The results of market testing of frozen fish sticks in Mexico have indicated that it is desirable to mix the fish mince with flavourings and salts in order to enhance the organoleptic properties of the product. The salts included are normally table

salt, pepper, onion salt and garlic salt. These would be added to represent approximately 1% of the weight of the fish mince. Trisodium polyphosphate solution (0.15g/ml) should also be added to give a concentration of 0.5% (w/w). An additional Hobart H600 mixer (The Hobart Manufacturing Co. Ltd., London), of the type recommended in Section 7.1.2.3.3 (i), is therefore included in the process design for the freezing line. Mixing could be carried out in batches of 50kg and would require one machine operator. The final mix could be emptied into clean plastic boxes for packing into freezing trays.

(ii) Packing the Mince into Freezing Trays

Fish mince would be packed manually into trays ready for freezing into blocks. The trays could be of stainless steel or aluminium and of dimensions 23cm x 15cm x 5cm (Habco Refrigeration Ltd., Hayes, Middlesex). It is estimated that two packers would be required for this operation, which could be carried out on benches. The mince should be covered or glazed to prevent desiccation during freezing.

(iii) The Freezing Process

The fish mince should be fast frozen and a horizontal plate freezer is recommended for this process. Suitable equipment would be a Jackstone Foster Senior 7-station plate freezer Mk.5 (Habco Refrigeration Ltd., Hayes, Middlesex). This freezer has a load capacity of 573 kg for 5cm-thick fish blocks and it is estimated that the number of trays per station would be 40, i.e. a total holding capacity of 280 trays. The evaporation temperature is $-30^{o}C$ and, at this temperature, the freezing

time for the fish blocks is estimated at 3 hours with approximately 20 to 30 minutes more for loading and unloading. The installed power requirement for this freezing unit is 40HP. Two workers would be required for loading and unloading the freezer.

(iv) Slicing the Frozen Fish Blocks

Frozen fish blocks would be removed from the trays with the aid of warm water if necessary. The blocks would then be cut into fish stick portions (approximately 83mm x 24mm x 12mm : weight 25gm) using a band saw. An Excel model 2000 (1HP) band saw has been suggested as a suitable machine for slicing the blocks (Habco Refrigeration Ltd., Hayes, Middlesex). It is anticipated that no extra labour would be required for this operation.

(v) Breading and Battering

Fish sticks would be fed directly to an automatic bread and batter enrobing machine. The Koppens EPR 900 machine (Koppens, Holland : quoted by Interfood Ltd., Hemel Hempstead) would be appropriate in this case. The equipment has a belt width of 900mm and operates using a 2HP motor. The fish sticks are initially coated with a batter pre-mix, which may be supplied by DCA Industries Ltd., Aylesbury, in 10-18 tonne container lots. This mix is normally used at 2¼ parts water to 1 part mix for an average crumb pick-up. Breadcrumbs for fish sticks are supplied commercially by Henry Bright and Sons, Grimsby. It is estimated that the bread and batter mixture would represent about 11% of the weight of each fish stick, giving a total requirement of 145kg/day (43 tonnes/year). The ratio of breadcrumbs to pre-mix may be taken

as approximately 3:1. Thus, the annual requirements for batter pre-mix and breadcrumbs may be estimated as 3-4 tonnes (allowing for dilution with water) and 32 tonnes respectively. Additional labour would be needed to operate this stage of the process (say 1 operator). A conveyor belt (say 3m in length) should be installed between the enrober and the fryer.

(vi) Flash Frying

Breaded fish sticks should be deep fat fried for approximately one minute in order to bind the product and create an attractive golden appearance. Continuous flash fryers are available for this purpose but must be carefully selected to provide minimal energy usage and fire hazard. Suitable equipment in this case would be the Koppens BR 3000/600 electrically heated continuous fryer (Koppens, Holland : quoted by Interfood Ltd., Hemel Hempstead), which is capable of handling a maximum throughput of 450 kg/hr of enrobed products. The unit (total dimensions 5.2m x 2m x 2.6m) is manufactured from stainless steel and has a frying length of 3000mm and a belt width of 600mm. The product is carried through the oil on a lower conveyor belt whilst an additional upper belt serves to maintain the product below the oil surface. Belt velocities may be varied and a sediment removal system is also incorporated. An oil circulating pump continuously filters edible oil via two mesh filters, which can be removed, exchanged and cleaned whilst the unit is in operation. An electrical heating system (88kw) is installed and the circulation of the oil guarantees equal temperatures throughout the frying area. Either manual or automatic lift systems may be supplied to simplify the lifting of upper and lower conveyors for the cleaning operation. It is also recommendable to install a CO_2 fire blanketing system, this consisting of nozzles, sensors and

two CO_2 bottles. Assuming that the total oil uptake by the product is approximately 1% by weight, it is estimated that the daily consumption of edible oil would be 15kg. Fried fish sticks could be fed by a conveyor (say 3m in length) to the packing benches. The estimated daily production of the frozen end-product is 1.32 tons.

(vii) Packaging and Storage of End Product

The final product may be packaged in polythene film in appropriate units (say six fish sticks per pack) and stored in cardboard cartons ready for frozen distribution.[1] Polythene bags would be sealed using HM 910 (200 watt) impulse heat sealers with auto-timers (Hulme-Martin Ltd., London): one sealer per packer. After packaging, the product should be immediately placed in the Hemsec cold store maintained at $-30^{\circ}C$ (Section 7.1.2.2). Packaging could be carried out by 2 workers.

7.1.2.3.5 Manufacture of Canned Products

Of the total daily production of 3.5 tonnes of deboned fish mince, 1.17 tonnes would be fed to the canning line. Mince would be processed continuously as received from the meat and bone separator. In this section, process designs for three types of canned fish mince products are detailed, these being mince with vegetables ("picadillo"), fish paté and fish sausages. The canning line would be flexible so that any of these products could be manufactured. However, any one of these processes would be operated at a given time and some preference may be given to a certain product depending on the progress of market requirements.

A. Manufacture of Canned Fish Mince with Vegetables ("Picadillo")

This is a simulation of a product made from meat

1: Precise packaging requirements may need to be adjusted to meet the requirements of distributors handling the product.

and already marketed commercially in Mexico.[1]

(i) Peeling and Chopping of Vegetables

Whilst the preliminary operations of fish evisceration and deboning are being undertaken, the required quantity of vegetables should be prepared. Based on the total amount of fish mince to be processed, it is estimated that a total of 390kg/day of vegetables would be required, these comprising onions, potatoes, carrots and chillis. The proportions of each can be varied to suit local taste and market requirements. Peeling may be carried out using a Hobart E6128 electric potato peeler (The Hobart Manufacturing Co. Ltd., London). The machine is of 13kg capacity with a 0.5HP electric motor and a peel trap in the base. Peeling time varies from 1-3 minutes per charge. Peeled vegetables may be chopped and diced automatically with the aid of the Hobart H600 mixer (see (iii) below). This mixer may be fitted with a No.12 dicing and chipping attachment and dicing grids of 1/4", 3/8", or 1/2" dimensions (The Hobart Manufacturing Co. Ltd., London). It is also suggested that a No.12 vegetable mincing attachment (The Hobart Manufacturing Co. Ltd., London) be obtained. Peeled and chopped vegetables should be placed in plastic boxes ready for mixing with the pre-cooked fish mince. Two operators would be required to carry out this activity and the following pre-cooking and mixing operations.

(ii) Pre-cooking the Fish Mince

The deboned fish mince should be pre-cooked in order to reduce its initial moisture content and prevent exudation during subsequent canning. This may be achieved by suspending batches of mince (say

1. As with other products however, marketability of canned fish mince - picadillo - would have to be established prior to investment in the proposed industrial configuration.

30-40kg) supported in wire baskets or trays in a covered steam-jacketed vessel containing boiling water or directly injected with steam. The required cooking time would be of the order of a few minutes and the vessel used could be of a similar type to that described in Section 7.1.2.3.2, i.e. a Doleschal 300-litre steam kettle (quoted by ABR Machinery Ltd., Milton Keynes). It should, in fact, be feasible to use the same vessel. The pre-cooked mince should be pressed manually through cheesecloth.

(iii) Mixing Pre-cooked Mince with Vegetables

Pre-cooked mince and chopped vegetables should be mixed in the ratio 3:1 in a Hobart H600 mixer with 1½HP motor (The Hobart Manufacturing Co. Ltd., London). Tomato puree should also be added at this stage, the amount being variable according to market requirements. Mixing should continue for a few minutes until an even distribution is obtained. The mix would then be emptied into plastic containers ready for filling into cans.

(iv) Filling into Cans

The fish mince/vegetable mix should be filled by hand into 8oz 212 x 301 cans leaving a headspace of 3-5mm. The filling weight should be checked against the pre-determined weight using an Avery 1215 BFH balance (Avery Export Ltd., Smethwick Warley). Taking into account the calculated throughput of 12-14 cans/minute for this line, it is estimated that three operators working on a bench could fill and check-weigh the cans. Thus, three balances will also be required. The fillers would also place the lid on each can ready for seaming.

(v) Exhausting and Sealing the Cans

Once filled, the cans may be simultaneously exhausted and seamed. Two MBIA (1 HP) vacuum seamers (The Metal Box Co. Ltd., Gloucester) would be capable of handling the throughput of this canning line. Two operators would be required, one for each seamer. After exhausting and seaming, the cans would be placed in metal baskets ready for retorting.

(vi) Heat Processing

This stage of the process is of critical importance and must be carefully controlled. The canned material must be cooked under a standard pressure and temperature for a sufficient period of time to ensure destruction of the spores of Clostridium Botulinum, if present, in the contents of the centre of the can. On the other hand, it is important not to overcook or the flavour and texture of the product may be damaged. It is recommended that commercial sterilization of the canned mince be carried out in batches using two small vertical retorts of 600-can capacity each (The Metal Box Co. Ltd., Gloucester). The metal baskets containing filled cans would be hoisted into the retorts and heat processing would be effected at 240^{o}F (115-116^{o}C) for 50 minutes. Development studies previously carried out on this product have demonstrated that, under these conditions, commercial sterilization of the product will be achieved whilst an attractive flavour and texture will be retained. After processing, the cans should be cooled rapidly by flooding the retort with cold water under pressure. The seamer operators could also operate the retorts such that no extra labour should be required for this stage of the process. Cans removed from the retort should be

dried as soon as possible, perhaps with the aid of compressed air, and placed on benches ready for labelling and packing. The estimated daily production of canned end-product (net weight) is 1.56 tonnes.

(vii) Labelling and Packing

Cans would be labelled by hand and packed into cardboard cases holding 48 cans each. Two workers would be required for labelling and packing.

(viii) Storage

The packaged product should be maintained in a cool, dry store for 40 days prior to distribution and checked for proper sealing and adequate processing during this period.

B. Manufacture of Canned Fish Paté

(i) Pre-cooking the Fish Mince

The deboned fish mince should be pre-cooked in order to reduce its initial moisture content and prevent subsequent exudation. This may be achieved by suspending batches of mince (say 50kg) supported in wire baskets or trays in a covered steam-jacketed vessel containing boiling water or directly injected with steam. The required cooking time would be of the order of a few minutes and the vessel used could be of a similar type to that described in Section 7.1.2.3.2, i.e. a Doleschal 300-litre steam kettle (quoted by ABR Machinery Ltd., Milton Keynes). It should, in fact, be feasible to use the same vessel. The pre-cooked mince should be pressed manually through cheesecloth.

(ii) The Blending/Emulsifying Operation

In order to acquire adequate blending of the fish mince with starch and fat and to achieve acceptable consistency in the final paté, it is essential to finely comminute and emulsify the ingredients. Equipment capable of performing this operation should, therefore, be carefully selected. In view of the throughput requirement for this line, a large, heavy duty bowl cutter should be installed. A suitable machine would be the Alexanderwerk SSK 100 bowl cutter (J.C. Wetter & Co., London), which is of 100-litre (75kg) capacity per chop, constructed mainly of stainless steel with an aluminium bowl cover and operating on a 35HP motor. Batches of 50kg of cooled, pre-cooked mince should be blended with 25kg of additional ingredients according to the following recipe:-

Pre-cooked fish mince	50kg
Lard	15.75kg
Ground toasted breadcrumbs	6kg
Garlic salt	0.75kg
Ground black pepper	0.5kg
Trisodium polyphosphate	1.65kg of a 0.15g/ml solution
Lime juice	0.5kg

The fat should be blended first with the mince and then the other ingredients added. Blending would proceed for a few minutes until a homogeneous consistency is obtained. The blended paté could then be emptied into plastic containers ready for filling into cans. Two operators would be required to carry out the pre-cooking and blending stages.

(iii) Filling into Cans

The fish paté should be filled by hand into 8oz

211 x 301 or 307 x 113 cans leaving a headspace of 3-5mm. The filling weight should be checked against the pre-determined weight using an Avery 1215 BFH balance (Avery Export Ltd., Smethwick Warley). Taking into account the calculated throughput of 12-14 cans/minute for this line, it is estimated that three operators working on a bench could fill and check-weigh the cans. Thus, three balances will also be required. The fillers would also place the lid on each can ready for seaming.

(iv) Exhausting and Sealing the Cans

Once filled, the cans may be simultaneously exhausted and seamed. Two MBIA (1HP) vacuum seamers (The Metal Box Co. Ltd., Gloucester) would be capable of handling the throughput of this canning line. Two operators would be required, one for each seamer. After exhausting and seaming, the cans would be placed in metal baskets ready for retorting.

(v) Heat Processing

This stage of the process is of critical importance and must be carefully controlled. The canned material must be cooked under a standard pressure and temperature for a sufficient period of time to ensure destruction of the spores of Clostridium Botulinum, if present in the contents of the centre of the can. On the other hand, it is important not to overcook or the flavour and texture of the product may be damaged. It is recommended that commercial sterilization of the canned mince be carried out in batches using two small vertical retorts of 600-can capacity each (The Metal Box Co. Ltd., Gloucester). The metal baskets

containing filled cans would be hoisted into the retorts and heat processing would be effected at 245°F (118-119°C) for 45 minutes. Development studies previously carried out on this product have demonstrated that, under these conditions, commercial sterilization of the product will be achieved whilst an attractive flavour and texture will be retained. After processing, the cans should be cooled rapidly by flooding the retort with cold water under pressure. The seamer operators could also operate the retorts such that no extra labour should be required for this stage of the process. Cans removed from the retort should be dried as soon as possible, perhaps with the aid of compressed air, and placed on benches ready for labelling and packing. The estimated daily production of canned end-product (net weight) is 1.75 tonnes.

(vi) Labelling and Packing

Cans would be labelled by hand and packed into cardboard cases holding 48 cans each. Two workers would be required for labelling and packing.

(vii) Storage

The packaged product should be maintained in a cool, dry store for 40 days prior to distribution and checked for proper sealing and adequate processing during this period.

C. Manufacture of Canned Fish Sausages

(i) The Blending/Emulsifying Operation

In order to acquire adequate blending of the fish mince with starch and fat and to achieve an acceptable sausage consistency in the final product, it is

essential to finely comminute and emulsify the ingredients. Equipment capable of performing this operation should, therefore, be carefully selected. In view of the throughput requirement for this line, a large, heavy duty bowl cutter should be installed. A suitable machine would be the Alexanderwerk SSK100 bowl cutter (J.C. Wetter & Co., London), which is of 100-litre (75kg) capacity per chop, constructed mainly of stainless steel with an aluminium bowl cover and operating on a 35HP motor. Batches of 50kg of fish mince should be blended with 23.5kg of additional ingredients according to the following recipe:-

Fish mince	50kg
Lard	7.5kg
Maize starch	7.5kg
Ground toasted breadcrumbs	1.9kg
Wheat flour	1.9kg
Gelatine	0.7kg
Salt	0.75kg
Ground pepper	0.75kg
Sugar	0.75kg
Trisodium polyphosphate	1.7kg of a 0.15g/ml solution

The mince should be blended firstly with the fat and trisodium polyphosphate solution until the fat is no longer apparent. The remainder of the ingredients should be added in the order starch, bread, flour, gelatine, sugar, salt and pepper with 1 minute cutting between each addition. Blending should proceed for a few minutes until a homogeneous consistency is obtained. The sausage mix could be emptied into plastic containers ready for feeding the filling machine. Two operators would be required to carry out this stage of the process.

(ii) Filling into Casings

The sausage mix should be filled into cellulose casings (Oppenheimer Casings Ltd., London) of 15mm diameter. This procedure should be carried out automatically using an Alexanderwerk AFA70 filling and linking machine (J.C. Wetter & Co., London). The equipment is constructed of stainless steel with a 3HP electric motor and has a capacity of 70 litres (approximately 65kg). Casings are supplied in boxes of 400 sticks (16m length each) and each stick should fill with approximately 4kg of sausage mix. Taking into account the required throughput, it is estimated that 438 casing sticks would be used daily.

(iii) Boiling and Skinning

The sausages should be set by boiling in water for 15 minutes. This may be carried out in batches using a 300-litre capacity steam-jacketed tank (Doleschal, Austria : quoted by ABR Machinery Ltd., Milton Keynes). It should be feasible to use the same vessel as quoted in Section 7.1.2.3.2. After boiling, the sausages require slight cooling and the casings should then be removed prior to filling into cans. Removal of casings may be a manual operation and it is estimated that four operators should be capable of carrying out the filling, boiling and skinning stages.

(iv) Filling into Cans

Sausages should be filled by hand into 4½oz 202 x 212 cans (about six sausages per can). Boiling hot brine (3% salt w/v) should be added to completely fill the can. The brine may be prepared and maintained hot with the aid of a 300-litre capacity steam-jacketed tank (Doleschal, Austria : quoted

by ABR Machinery Ltd., Milton Keynes). This should be installed in addition to that recommended in Section 7.1.2.3.2. A headspace of 3-5mm should be left in the cans. The filling weight of each can would be checked against the pre-determined weight using an Avery 1215 BFH Balance (Avery Export Ltd., Smethwick Warley). Taking into account the calculated throughput of 25 cans/minute for this line, it is estimated that five operators working on a bench could fill and check-weigh the cans. Thus, five balances will also be required. The fillers should also place the lid on each can ready for seaming.

(v) Exhausting and Sealing the Cans

Once filled, the cans may be simultaneously exhausted and seamed. Two MBIA (1HP) vacuum seamers (The Metal Box Co. Ltd., Gloucester) would be capable of handling the throughput of this canning line. Two operators would be required, one for each seamer. After exhausting and seaming, the cans would be placed in metal baskets ready for retorting.

(vi) Heat Processing

This stage of the process is of critical importance and must be carefully controlled. The canned material must be cooked under a standard pressure and temperature for a sufficient period of time to ensure destruction of the spores of Clostridium Botulinum, if present in the contents of the centre of the can. On the other hand, it is important not to overcook or the flavour and texture of the product may be damaged. It is recommended that commercial sterilization of the canned mince be carried out in batches using two small vertical retorts of 600-can capacity each (The Metal Box Co. Ltd., Gloucester). The metal baskets containing filled cans would be

hoisted into the retorts and heat processing would be effected at 245°F (118-119°C) for 50 minutes. Development studies previously carried out on this product have demonstrated that, under these conditions, commercial sterilization of the product will be achieved whilst an attractive flavour and texture will be retained. After processing, the cans should be cooled rapidly by flooding the retort with cold water under pressure. The seamer operators could also operate the retorts such that no extra labour should be required for this stage of the process. Cans removed from the retort should be dried as soon as possible, perhaps with the aid of compressed air, and placed on benches ready for labelling and packing. The estimated daily production of canned end-product (net weight) is 1.75 tonnes.

(vii) Labelling and Packing

Cans would be labelled by hand and packed into cardboard cases holding 48 cans each. Two workers would be required for labelling and packing.

(viii) Storage

The packaged product should be maintained in a cool, dry store for 40 days prior to distribution and checked for proper sealing and adequate processing during this period.

7.1.2.3.6 Processing of Plant Wastes

Waste in the process derives from heading and gutting (3.0 tonnes/day) and deboning (1.5 tonnes/day). The total waste material of 4.5 tonnes/day would be continuously collected from the fish cake plant by 2 workers. There are two options for utilizing these wastes:-

(a) sale as raw material for fish meal manufacture;

(b) processing into liquid fish hydrolysate (fish silage).

It is likely that fish meal plants will be situated in close proximity to the site of the by-catch plant, such that option (a) may prove to be the more convenient. However, development work has shown that the wastes may be readily processed into fish silage and that this represents a good protein source for pigs and poultry. The sale of fish silage could contribute to the profitability of the by-catch plant and, thus, the following details a suitable process for its manufacture.

Fish silage could be produced using a BPN liquid fish protein plant LFP 300 (BP Nutrition Ltd., Stepfield). The model currently available has a capacity of just over 1 ton per day so that four plants would be required for the by-catch factory. However, the manufacturers have indicated that a single unit of the appropriate capacity could be available in the future. The LFP 300 plant comprises a polypropylene tank (1.3 cu.m./300 gallon capacity) sunk in the ground and surmounted by a metal grill which supports the drive unit of a model 150 Vaughan chopper pump with 5HP motor. The pump operates submerged in the liquid fish broth in the tank. The metal grill (2m x 2m) is suitably designed for bedding in concrete. The fish wastes are dropped through the grill and hydrolysis initiated by the addition of acid. Formic acid (85% v/v) is recommended for ensiling at a concentration of 3.5%. The acid may also be supplied in drums by BP Nutrition Ltd. under the trade name "Bioaid", or it may be obtained locally. The acid is transferred from the drums in which it

is supplied to the process vessel by a submerged centrifugal pump and a flow meter is also provided.

On addition of raw material and acid, the chopper pump is started and the mixture re-circulated continuously via a 3-way valve until a liquid slurry is formed. At this stage, which should be completed within 24 hrs., the mixture may be pumped out of the tank into containers for despatch, enabling the plant to be re-loaded. Suitable containers would be steel drums of 200-litre capacity and coated on the interior edges with an acid-resistant resin. The product could be distributed to farmers in the same drums which would be returned to the plant when empty. A stock of some 50 drums may be required. The entire silage plant could be operated on a 1 shift/day basis by 2 labourers and a supervisor.

7.1.3 Product Handling Within the Plant

The plant buildings could be designed to incorporate the following areas:-

(a) Reception area including cold store; leading to

(b) the preliminary processing area, including inspection, evisceration, washing and mechanical deboning, with an exit point to a separate silage manufacturing area for plant wastes, and leading to

(c) three separate product lines

(i) a salting and dehydration (fish cake) line leading into a dry store;

(ii) a freezing (fish stick) line leading into the cold store;

(iii) a canning line, interchangeable to produce either "picadillo", fish pate or fish sausages, and leading into the dry store.

(d) The silage processing plant with an exit to an external covered area for storage of full silage drums.

(e) Separate toilet facilities and an office area should be included.

In general, raw material would enter from one end of the building and products leave from the other. A fork lift truck plus a driver and labourer are incorporated to facilitate the handling of raw material and the loading and unloading of supplies and end products.

It is estimated that the entire plant could be established within an area of 3000 m^2. The building requirements and ancillary details are given in Appendix 1, Table 1.1.

7.1.4 General Services Within the Plant

The plant has been designed and costed (Section 8.0) as though constructed on an industrial estate in Guaymas where electricity, water and sewage disposal facilities are readily available. The service requirements for plant operation are described below and the corresponding breakdown and calculations are given in Tables 1.10 to 1.12 of Appendix 1.

7.1.4.1 Water Requirements

The estimated daily water usage for the various consuming processes in the plant are estimated to be:-

(i) for washing gutted fish - 12,000 litres/day

(ii) for cleaning the deboner - 1,000 litres/day

(iii) for boiler and general services - 25,000 litres/day

(iv) for general cleaning - 4,000 litres/day.

The total daily supply required is, therefore, some 42,000 litres which, even assuming that all the water is consumed in a single shift, could be provided by the connection of a 1.5 litre/second supply.

7.1.4.2 Energy Requirements

The plant requires fuel for vehicles, fuel oil for the production of steam for the pre-cooking/dehydration and canning operations and electricity for the various processing machines.

(i) Steam

Boiler plant would be required in order to supply steam for the heat exchanger of the drier, for the canning operation and for the steam-jacketed tanks. The canning line would provide by far the major demand for steam. A mobile steam-cleaning unit is included in the processing equipment for general plant cleaning duties. Based on the total thermal energy requirements of the steam-consuming plant, it is calculated that a boiler capable of producing 300lb of steam/hour is required and that a total of 60 gallons/day of fuel oil would be needed to operate the boiler (Appendix 1, Table 1.11).

(ii) Electricity

The electricity utilization of each consuming process is calculated and shown in Appendix 1, Table 1.10. The total maximum usage for the plant is

estimated at 517,634 kwh/year, broken down as follows:-

	Kwh/year
Preliminary plant (up to and including deboning)	54,291
Salting/drying plant	257,413
Freezing plant	151,827
"Picadillo" plant	9,608
Paté plant	35,518
Sausage plant	46,207
Silage plant	7,896

(iii) Vehicle Fuel

Minimal quantities of fuel are required for the collection of raw material and for the fork lift truck amounting to 1,529 gallons/year. (Appendix 1, Table 1.11).

SECTION 8.0 FINANCIAL EVALUATION OF ALTERNATIVE INDUSTRIAL SYSTEMS TO UTILIZE SHRIMP BY-CATCH

8.1 Introduction

The following Section reviews the cost implications of industrial systems considered technically viable for the utilization of shrimp by-catch, as described in the previous Section. The financial analysis is not intended to be part of an investment profile, but rather the objective is to evaluate the break even factory gate prices for end products in order to permit further assessment of their marketability. The analysis provides estimates of break even factory gate selling prices for differing combinations of production lines. This, after further market assessment, will permit additional pre-investment analysis to determine the most appropriate product mix, the required industrial configuration and its associated financial performance. Supporting data for the financial analyses are provided in Appendix 1.

The approach used is as follows:

(i) Establishment and operating costs are identified for the 'main plant' i.e. that dealing with raw material intake and initial processing (evisceration).

(ii) Subsequent financial appraisals of the main plant costs enable values to be attched to the two derived intermediate products i.e. eviscerated fish and fish waste. These values are used in subsequent calculations of break even prices for end products itemised below.

(iii) For each end product considered, i.e. fish cakes, frozen fish sticks, canned picadillo, canned fish sausage, canned fish pate and silage, establishment and operating costs are first identified.

(iv) Costings are then made for differing combinations of end product lines with appropriate adjustments where cost items are held in common (e.g. for equipment used jointly by different production lines).

(v) From the production line costings, break even factory gate selling prices have been derived in conjunction with input costs of intermediate products from the main plant.

Section 8.2 details the costings for the main plant and shows the calculation of values for intermediate products. Section 8.3 covers the costings for individual end product lines whilst Section 8.4 discusses the costings for combinations of end product lines, financial appraisals and the calculation of end product prices.

8.2 Costings for the Main Plant

The following financial evaluation of the main plant reviews establishment and operating costs (8.2.1), followed by the calculation of values for derived products i.e. eviscerated fish and fish waste (8.2.2).

8.2.1 Establishment and Operating Costs: Main Plant

8.2.1.1 Establishment Costs

Establishment costs for the main plant are shown in Appendix 1 Tables 1.1, 1.2.1 and 1.3 and a summary is shown in Table 8.1. The major cost item is that for buildings and site preparation, but this feature arises in part because of allowances made for building space needed for end product lines. Processing equipment costs are relatively small since the bulk of such equipment is considered separately under individual production lines.

8.2.1.2 Operating Costs

Operating costs for the main plant are shown in detail in Appendix 1 Tables 1.6 to 1.8 and 1.10 to 1.14 and are summarised in Table 8.2. From the Table it can be seen that the major cost item is for raw materials at 7,056,000 pesos (60% of the total), followed by labour at 3,268,896 pesos (27% of the total) and other consumeables 1,204,038 pesos (10% of the total). Raw material costs are based upon an assumed price of 3000

TABLE 8.1 TOTAL ESTABLISHMENT COSTS SUMMARY[1]: MAIN PLANT

	ITEM	COST (pesos)	%
1.	Building & Site Preparation Costs[2]	8,206,770	58
2.	Processing Equipment Costs[3]	2,873,613	20
3.	Other Establishment Costs[4]	3,185,050	22
	TOTAL	14,265,433	100

NOTES 1 - Excluding Working Capital
2 - Source Table 1.1 , Appendix 1
3 - Source Table 1.2.1, Appendix 1
4 - Source Table 1.3 , Appendix 1

TABLE 8.2 TOTAL ANNUAL OPERATING COSTS: MAIN PLANT

	CATEGORY	ANNUAL COST (Pesos)	%
1.	Personnel[1]	3,268,896	27.5
2.	Electricity[2]	20,308	0.2
3.	Fuel & Oil[3]	27,522	0.2
4.	Water[4]	32,383	0.3
5.	Other Consumables [5]	1,204,038	10.1
6.	Insurance [6]	137,120	1.2
7.	External Maintenance	130,000	1.1
8.	Raw Materials[7]	7,056,000	59.5
	TOTAL	11,876,267	100.0

NOTES 1 - Source Table 1.9.1 , Appendix 1
2 - Source Table 1.10 , Appendix 1
3 - Source Table 1.11 , Appendix 1
4 - Source Table 1.12 , Appendix 1
5 - Source Table 1.13.1, Appendix 1
6 - Source Table 1.14 , Appendix 1
7 - Raw material (shrimp by catch) costed as follows:
8 tonnes/day @ 3000 pesos/tonne x 294 days
= 7,056,000

pesos per tonne paid to fishermen for delivery to the plant. (Sensitivity of final end product prices for differing raw material costs are included in Section 8.4.2). For the second most important item, labour costs, the largest element is that for management at 42% of the total (Appendix 1 Table 1.9.1).

8.2.2 Calculation of Break Even Values for Intermediate Products: Eviscerated Fish and Fish Waste

A break even valuation, i.e. internal factory price, for eviscerated fish depends upon:

(a) The opportunity cost of capital
(b) Processing costs including raw material costs at this opportunity cost of capital
(c) The opportunity cost of fish waste

The approach adopted is:

(a) taking the opportunity cost of capital to be 20% (the current commercial rate) a net present value (NPV) of costs is calculated (Appendix 2 Table 2.2), using two assumptions for the price of raw materials, i.e. 3000 and 5000 pesos per tonne.
(b) to calculate the value of an annuity which would cover the NPV of costs calculated in (a) above.
(c) to deduct the opportunity cost of fish waste from the annuity in (b) to obtain the internal factory price for eviscerated fish supplied to production lines. The opportunity cost used for fish waste is the factory gate value for supplies to fish meal production plants, the current rate being 500 pesos per tonne.

Using this methodology the break even value/internal factory price for eviscerated fish is shown in Table 8.3 for two assumed prices of raw material. At a raw

TABLE 8.3 BREAK EVEN VALUES - INTERNAL FACTORY PRICE FOR EVISCERATED FISH

		FOR RAW MATERIAL (-BY CATCH-) PRICED AT	
		3000 pesos/tonne	5000 pesos/tonne
(1)	NPV of Processing Costs[1]	70,983,402	93,278,049
(2)	Annuity Factor[2]	4.675	4.675
(3)	Annuity (Pesos)[3]	15,183,615	19,952,523
(4)	Value of Fish Waste[4]	661,500	661,500
(5)	Net Value of Eviscerated Fish[5]	14,522,115	19,291,023
(6)	Tons of Eviscerated Fish produced	1,029	1,029
(7)	Break Even Value per tonne	14,113	18,747

NOTES: 1 - At 20% cost of capital Appendix 2 Table 2.2
2 - From standard tables
3 - NPV in (1) divided by Annuity factor
4 - Valued at an opportunity cost of 500 pesos per tonne (Section 8.2.2), 1,323 tonnes per annum
5 - Row (3) minus Row (4).

material price of 3000 pesos per tonne, the price which is currently said to be sufficient to induce supplies, eviscerated fish cost/price to end product lines is 14,113 pesos per tonne. If a pessimistic view is taken with regard to raw material pricing and a cost of 5000 pesos per tonne is assumed, the eviscerated fish cost price rises to 18,747 pesos per tonne. It can be seen that the sensitivity to raw material price variations is quite strong stemming from the importance of raw material costs in total operating costs (Table 8.2).

8.3 Establishment and Operating Costs for End Product Lines

The following Section summarises the establishment and operating costs for individual production lines under consideration. Detailed data relating to these costs are provided in Appendix 1 Tables 1.2 to 1.14. The end products to be considered are:

(i) fishcakes
(ii) frozen fish sticks
(iii) canned picadillo (fish mince)
(iv) canned fish sausage
(v) canned fish paté
(vi) silage

In each case establishment costs are taken as processing equipment costs only, other items such as building and site preparation being allocated to the main plant.

8.3.1 Fish Cake Production : Establishment and Operating Costs

The establishment costs for fish cakes total 2,685,575 pesos (Appendix 1 Table 1.2.2), major items being the cooker/dryer at 1,136,010 pesos (58% of the total) and the moulder at 521,410 pesos (27%)[1]

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[1] Here and in subsequent Sections, costs quoted for the complete production line include allowance for contingencies, freight, installation and commissioning, whilst individual items are quoted at f.o.b. prices.

Operating costs are shown in Table 8.4 from which it can be seen that major items include other consumables at 786,185 pesos (47% of the total) followed by labour at 697,143 pesos (42%). The bulk of other consumables is formed by packaging costs followed by salt (Appendix 1 Table 1.13.2).

8.3.2 Frozen Fish Stick Production : Establishment and Operating Costs

The establishment cost for frozen fish stick production is 3,981,459 pesos (Appendix 1 Table 1.2.3). The major cost items are the plate freezer at 1,013,570 pesos, the flash fryer (together with associated equipment e.g. conveyor, lift etc) at 908,840 pesos and the bread and batter enrober at 608,661 pesos accounting for 35%, 31% and 21% respectively of the total.

Operating costs shown in Table 8.5 indicate that other consumables are the major item at 1,510,583 pesos (61% of the total) followed by labour at 877,275 pesos (35%). Other consumables form a higher proportion of costs than in the case of fish cakes mainly because of the cost of the breading mixture applied prior to frying (Appendix 1 Table 1.13.2).

8.3.3 Canned Picadillo Production : Establishment and Operating Costs

The establishment costs for canned picadillo production are 2,570,323 pesos (shown in detail in Appendix 1 Table 1.2.4), major items being the canning line at 1,177,750 pesos and the boiler at 259,110 pesos (required for canning operations), accounting for 63% and 14% respectively of the total.

Operating costs are shown in Table 8.6 the major item being other consumables at 5,025,288 pesos or 85% of the total. The only other item of significance is labour at 769,196 pesos or 13% of the total. Within

TABLE 8.4 TOTAL ANNUAL OPERATING COSTS: FISH CAKE PRODUCTION

	CATEGORY	ANNUAL COST	%
1.	Personnel[1]	697,143	42.0
2.	Electricity[2]	95,964	5.8
3.	Fuel & Oil[3]	51,455	3.1
4.	Water[4]	3,822	0.2
5.	Other Consumables [5]	786,185	47.3
6.	Insurance[6]	26,520	1.6
7.	External Maintenance	-	-
	TOTAL	1,661,089	100.0

NOTES 1 - Source Table 1.9.2 , Appendix 1
2 - Source Table 1.10 , Appendix 1
3 - Source Table 1.11 , Appendix 1
4 - Source Table 1.12 , Appendix 1
5 - Source Table 1.13.2, Appendix 1
6 - Source Table 1.14 , Appendix 1

TABLE 8.5 TOTAL ANNUAL OPERATING COSTS: FROZEN FISH STICK PRODUCTION

	CATEGORY	ANNUAL COST	%
1.	Personnel[1]	877,275	35.3
2.	Electricity[2]	56,601	2.3
3.	Fuel & Oil[3]	-	-
4.	Water[4]	3,822	0.2
5.	Other Consumables [5]	1,510,583	60.7
6.	Insurance[6]	39,317	1.6
7.	External Maintenance	-	-
	TOTAL	2,487,598	100.0

NOTES 1 - Source Table 1.12 , Appendix 1
2 - Source Table 1.10 , Appendix 1
3 - Source Table 1.11 , Appendix 1
4 - Source Table 1.12 , Appendix 1
5 - Source Table 1.13.2, Appendix 1
6 - Source Table 1.14 , Appendix 1

the other consumable category, which is substantially larger than that for either fish cakes or frozen fish sticks, cans and sauce and vegetables account for 72% and 20% respectively of the total, (Appendix 1 Table 1.13.2). Overall cans are a major item of total operating costs at 61% of the total, and can pricing/specification is thus the most important element in the determination of ultimate end product prices.

8.3.4 Canned Fish Sausage Production : Establishment and Operating Costs

Establishment costs for canned fish sausage production are 3,742,813 pesos (Appendix 1 Table 1.2.5). These costs are considerably higher than those for canned picadillo as a result of additional items required for sausage production itself. Major equipment items are the canning line at 1,177,750 pesos and the mixer/bowl cutter at 565,320 pesos accounting for 43% and 21% respectively of the total.

Operating costs are shown in Table 8.7 and again other consumables form the major item at 10,006,375 pesos (88% of the total) with labour forming a further 11% of the total at 1,201,511 pesos. Cans are again the major item within other consumables comprising 62% of the total, but sausage skins add significantly to costs (20% of the total), followed by fats and spices (9%). Other consumable costs are higher for sausage production than for any other production line under consideration reflecting the relative complexity of the end product.

8.3.5 Canned Fish Paté Production : Establishment and Operating Costs

Establishment costs for canned fish paté are 3,011,167 pesos (Appendix 1 Table 1.2.6) and are identical to those for fish sausage production excluding those items

TABLE 8.6 TOTAL ANNUAL OPERATING COSTS: CANNED PICADILLO PRODUCTION

	CATEGORY	ANNUAL COST	%
1.	Personnel[1]	769,196	13.0
2.	Electricity[2]	3,582	0.1
3.	Fuel & Oil[3]	34,927	0.6
4.	Water[4]	47,775	0.8
5.	Other Consumables [5]	5,025,288	85.1
6.	Insurance[6]	25,382	0.4
7.	External Maintenance	-	-
	TOTAL	5,906,150	100.0

NOTES 1 - Source Table 1.9.2 , Appendix 1
2 - Source Table 1.10 , Appendix 1
3 - Source Table 1.11 , Appendix 1
4 - Source Table 1.12 , Appendix 1
5 - Source Table 1.13.2, Appendix 1
6 - Source Table 1.14 , Appendix 1

TABLE 8.7 TOTAL ANNUAL OPERATING COSTS: CANNED FISH SAUSAGE PRODUCTION

	CATEGORY	ANNUAL COST	%
1.	Personnel[1]	1,201,511	10.6
2.	Electricity[2]	17,226	0.2
3.	Fuel & Oil[3]	34,927	0.3
4.	Water[4]	47,775	0.4
5.	Other Consumables [5]	10,006,375	88.2
6.	Insurance[6]	36,960	0.3
7.	External Maintenance	-	-
	TOTAL	11,344,774	100.0

NOTES 1 - Source Table 1.9.2 , Appendix 1
2 - Source Table 1.10 , Appendix 1
3 - Source Table 1.11 , Appendix 1
4 - Source Table 1.12 , Appendix 1
5 - Source Table 1.13.2, Appendix 1
6 - Source Table 1.14 , Appendix 1

specifically required for the formation of sausages. Major items are the canning line and the mixer/bowl cutter accounting for 54% and 26% respectively of the total.

Operating costs are shown in Table 8.8 and are similar in composition to other canned products with other consumables comprising the bulk at 6,855,515 pesos (89% of the total), and labour at 769,196 pesos (10%). Again the major item within other consumables is the cost of cans themselves at 80% of the total, together with fats and spices at 14%. Can costs represent a particularly large proportion of total operating costs - 71% - in this option because of relatively high costs per can which in turn relate to the can shape specification.

8.3.6 Silage Production : Establishment and Operating Costs

Establishment costs for silage production are 1,474,275 pesos (Appendix 1 Table 1.2.7), no breakdown of individual items being available since the quotation is for a complete plant.

Operating costs shown in Table 8.9 largely comprise other consumables at 1,544,026 pesos (84% of the total) and labour at 264,828 pesos (15%). The major item within other consumables is formic acid at 98% of the total (Appendix 1 Table 1.13.2).

8.3.7 Characteristics of End Product Costings

Before considering combinations of end product lines this Section briefly examines the major features of individual end product line costings. Table 8.10 shows the total establishment and operating costs for each end product.

TABLE 8.8 TOTAL ANNUAL OPERATING COSTS : CANNED FISH PATÉ PRODUCTION

	CATEGORY	ANNUAL COST	%
1.	Personnel[1]	769,196	9.9
2.	Electricity[2]	13,241	0.2
3.	Fuel & Oil[3]	34,927	0.5
4.	Water[4]	47,775	0.6
5.	Other Consumables [5]	6,855,515	88.5
6.	Insurance[6]	29,735	0.4
7.	External Maintenance	-	-
	TOTAL	7,750,389	100.0

NOTES 1 - Source Table 1.9.2 , Appendix 1
2 - Source Table 1.10 , Appendix 1
3 - Source Table 1.11 , Appendix 1
4 - Source Table 1.12 , Appendix 1
5 - Source Table 1.13.2, Appendix 1
6 - Source Table 1.14 , Appendix 1

TABLE 8.9 TOTAL ANNUAL OPERATING COSTS : SILAGE PRODUCTION

	CATEGORY	ANNUAL COST	%
1.	Personnel[1]	264,828	14.5
2.	Electricity[2]	2,944	0.2
3.	Fuel & Oil[3]	-	-
4.	Water[4]	3,822	0.2
5.	Other Consumables [5]	1,544,026	84.4
6.	Insurance[6]	14,558	0.8
7.	External Maintenance	-	-
	TOTAL	1,830,178	100.0

NOTES 1 - Source Table 1.9.2 , Appendix 1
2 - Source Table 1.10 , Appendix 1
3 - Source Table 1.11 , Appendix 1
4 - Source Table 1.12 , Appendix 1
5 - Source Table 1.13.2, Appendix 1
6 - Source Table 1.14 , Appendix 1

With regard to establishment costs, it can be seen that silage production requires the lowest investment at 1.5 million pesos, followed by fish cakes, canned picadillo and paté which require similar investment levels in the range 2.6 to 3 million pesos. Frozen fish sticks and fish sausage represent the higher cost options in the region of 3.7 to 4 million pesos.

In terms of operating costs the picture is rather different, since all canned products involve substantially higher costs than those for other end products, particularly in the case of canned fish sausage where operating costs total 11.3 million pesos approximately. Fish cakes, frozen fish sticks and fish silage all represent items with relatively low operating costs in the range 1.7 to 2.5 million pesos.

The main reason for higher operating costs for canned products is the cost of cans themselves, although other items, notably sausage skins in the fish sausage option, are also quite significant.

8.4 Costings and Financial Analyses for Combinations of End Product Lines

This Section begins with a description of costing of combinations of end product lines utilising information in Section 8.3. The analysis is not a recommendation to the most appropriate product mixes. These can only be finally determined after further market assessment. The analysis is included simply to provide an indication of the range of financing requirement for associated industrial configurations and to indicate likely break-even factory gate prices relating to various product mixes. To varying degrees equipment and other cost items may be shared between different end product lines and hence costs and subsequent financial appraisals are adjusted accordingly. Financial appraisals themselves are presented in Section 8.4.2. The Section draws together the results of financial appraisals both for end product combinations and those of the main plant in order to derive break even factory gate prices.

8.4.1. Costings for Combinations of End Product Lines

Given that six end products are under consideration it is clear that a wide range of combinations is possible, however it is also apparent that fish silage would be produced whatever the combination of other end products, (unless fish waste is sold to fish meal producers). For costing purposes it has therefore been assumed that fish silage is produced in conjunction with each of the combined options of end products identified below.

With regard to end products for human consumption the approach used for devising combinations of end products has been to progressively introduce complexity in terms of the number of products produced and also the relative cost/degree of processing arising from production. The joint options selected are as follows:

(I) Two lines producing fish cakes and one line producing frozen fish sticks.

(II) One line producing each of the following: fish cakes, frozen fish sticks and canned picadillo.

(III) One line producing each of the following: fish cakes, frozen fish sticks and canned fish sausage.

(IV) One line producing each of the following: fish cakes, frozen fish sticks, and canned fish paté

(V) One line producing each of the following: fish cakes, frozen fish sticks, and all three canned products.

The first option (I) represents the lowest cost alternative unless fish cake alone was produced. Leaving aside the possibilities for sharing of costs between end product lines the operating costs for fish cake and frozen fish sticks are the lowest for end products for human consumption, which more than offset the higher establishment costs for the two in comparison to some

of the canned products. Options (II), (III) and (IV) represent intermediate combinations since in each case three products: fish cake and frozen fish sticks together with one each of the canned items are considered. The final option (V) allows the greatest flexibility in end product output since it includes fish cake and frozen fish sticks together with the capacity to produce all three canned items. In the case of this option data presented for operating costs below assume that the canning line produces each end product for one third of the year.

Establishment and operating costs for the five options are summarised in Table 8.11. Fish silage is also included as a separate item in the Table since it is produced in conjunction with any of the options listed.

With one exception capital costs for combined options are only marginally lower than those for the sum of individual product line costs, an indication that opportunities for sharing of equipment between lines is relatively small. The exception to the above is provided by option (V) with regard to canned products since the canning line itself can be shared between all of the canned products, (so long as it is assumed that each end product is produced for one third of the year). Overall the range of capital costs between options specified is relatively small, the lowest being option (II) at approximately 9 million pesos in comparison to the most expensive option (V) at approximately 10.7 million pesos, (Table 8.11).

Operating costs for combined options are even closer to the combined cost of individual end product lines than is the corresponding case with capital costs, since again the opportunities for sharing of cost items between lines is very small. (In the case of option V operating costs have been taken as the average for

options (II) and (IV) since it is assumed that each product will be produced for one third of operating time). The range between operating costs for the combined options specified is larger than in the case of capital costs primarily because option (I) comprising fish cake and frozen fish sticks includes end products where operating costs are substantially lower than in the case for canned products which are included in options (II) to (V).

Establishment and operating costs held in common for each of the combined end product options are summarised below:

Option (I) The equipment items jointly shared between three production lines (two lines producing fish cake and one producing frozen fish sticks), is the mobile steam cleaner costed at one third of 78,000 pesos for each line.

The two fish cake lines also share the steam sterilising tank costed at one half of 19,500 pesos for each line.

In both cases insurance costs per line are adjusted accordingly under operating costs. The two fish cake production lines also share a single line supervisor costed at one half of 120,723 pesos per line.

Total savings for establishment costs arising from items held in common for this option are 241,313 pesos, including allowance for contingencies, freight, installation and commissioning.

Total savings for operating costs arising from items held in common for this option are 128,118 pesos.

Option (II) The equipment item jointly shared between the three production lines (fish cakes, frozen fish sticks and canned picadillo), is the mobile steam cleaner costed at one third of 78,000 pesos per line.

The fish cake and canned picadillo lines also share the steam sterilising tank costed at one half of 19,500 pesos for each line.

TABLE 8.10 SUMMARY OF ESTABLISHMENT AND OPERATING COSTS FOR INDIVIDUAL END PRODUCT LINES

END PRODUCT	ESTABLISHMENT COSTS - Pesos [1]	OPERATING COSTS - Pesos [2]
Fish Cakes	2,685,575	1,661,089
Frozen Fish Sticks	3,981,459	2,487,598
Canned Picadillo	2,570,323	5,906,150
Canned Fish Sausage	3,742,813	11,344,774
Canned Fish Paté	3,011,167	7,750,389
Silage	1,474,275	1,830,178

NOTES 1 - Source Appendix 1 Tables 1.2.2 to 1.2.7
2 - Source Tables 8.4 to 8.9

TABLE 8.11 SUMMARY OF ESTABLISHMENT AND OPERATING COSTS - COMBINED END PRODUCT OPTIONS AND SILAGE

OPTION	END PRODUCTS	TOTAL OPERATING COSTS: PER OPTION[1] (Pesos)	TOTAL OPERATING COSTS: PER OPTION + FISH SILAGE & MAIN PLANT[2] (Pesos)	TOTAL ESTABLISHMENT COSTS: PER OPTION[3] (Pesos)	TOTAL ESTABLISHMENT COSTS: PER OPTION + FISH SILAGE AND MAIN PLANT[4] (Pesos)
(I)	Fish Cake and Frozen Fish Sticks	5,682,658	19,389,103	9,111,296	25,180,082
(II)	Fish Cake and Frozen Fish Sticks and Canned Picadillo	10,053,250	23,759,695	8,996,045	25,064,831
(III)	Fish Cake and Frozen Fish Sticks and Canned Fish Sausage	15,491,869	29,198,314	10,253,441	26,322,227
(IV)	Fish Cake and Frozen Fish Sticks and Canned Fish Paté	11,897,748	25,604,193	9,463,700	25,532,486
(V)	Fish Cake and Frozen Fish Sticks all Canned Items	12,783,152	26,481,597	10,696,419	26,765,205
Fish Silage		1,830,178	-	1,474,275	-

NOTES:
1. Excluding cost of eviscerated fish for options (I) to (V) and cost of fish waste for silage. Source - Appendix 2 Table 2.3
2. Main Plant operating costs from Table 8.2 plus operating cost for silage plus operating cost per option.
3. Source - Appendix 2 Table 2.1
4. Main Plant establishment costs from Table 8.1 plus establishment cost of silage plus establishment cost per option.

In both cases insurance costs per line are adjusted accordingly under operating costs.

Total savings for establishment costs arising from items held in common for this option are 241,312 pesos including allowance for contingencies, freight, installation and commissioning.

Total savings for operating costs arising from items held in common for this option are 2,384 pesos.

Option (III) The equipment item shared between all three production lines (fish cake, frozen fish sticks and canned fish sausage), is the mobile steam cleaner costed at one third of 78,000 pesos for each line.

The fish cake and canned fish sausage line also share the steam sterilising tank costed at one half of 19,500 pesos for each line.

Insurance costs are adjusted accordingly for each line under operating costs.

Total saving for establishment costs arising from items held in common for this option are 241,312 pesos, including allowance for contingencies, freight, installation and commissioning.

Total savings for operating costs arising from items held in common for this option are 2,388 pesos.

Option (IV) The equipment item shared between all three production lines (fish cakes, frozen fish sticks and canned fish paté), is the mobile steam cleaner costed at one third of 78,000 pesos for each production line.

Insurance costs are adjusted accordingly for each line under operating costs.

Total savings for establishment costs arising from items held in common for this option are 214,500 pesos, including allowance for contingencies, freight, installation and commissioning.

Total savings for operating costs arising from items held in common for this option are 2,125 pesos.

Option (V) The equipment item shared between all three production lines (fish cake, frozen fish sticks and canned fish products), is the mobile steam cleaner costed at one third of 78,000 pesos for each line.

The fish cake and canned fish product lines also share the steam sterilising tank costed at one half of 19,500 pesos for each line.

Insurance costs are adjusted accordingly for each line under operating costs.

The savings indicated above for both establishment and operating costs are offset however, since the canned product line establishment costs are higher than the average for individual canning lines.

With regard to establishment costs for the canned product line, the canning line itself plus associated equipment (conveyor, boiler, compressor) together with packing benches and scales may be used in common for all products[1], but additional items not held in common between all three products are also needed, e.g. vegetable peeler, dicing and chopping attachments, sausage filler and brine kettle etc. As such, establishment costs are raised for the canned product line above the average for individual canned product lines and additional establishment costs for Option V as a whole are 706,071 pesos.

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[1]So long as production is limited to one end product at any point in time.

Higher insurance costs, stemming from the additional items of equipment noted above more than offset savings made elsewhere between end product lines such that operating costs overall are raised by 9,590 pesos for the option.

8.4.2 Financial Appraisals for Alternative End Product Combinations

Using the forgoing costings, break even prices for end products for human consumption will depend upon:

(a) the opportunity cost of capital
(b) processing costs for each end product within each combination of end products option, at this opportunity costs of capital, excluding eviscerated fish costs.
(c) the internal factory price for supplying eviscerated fish to end product lines.

For fish silage the break even price calculation is similar except that processing costs are calculated net of the opportunity cost of fish waste.

The approach adopted is similar to that used for the main plant appraisal, (Section 8.2.1) i.e.

(a) taking the opportunity cost of capital to be 20%, NPVs of cost are calculated for each end product within each combination of products option, (for details of NPVs see Appendix 2 Table 2.3).
(b) to calculate the value of an annuity which would cover the NPVs of costs calculated in (a) above.
(c) to add the internal factory valuation for eviscerated fish inputs required for each end product to the annuity of processing costs, (except in the case of fish silage where an opportunity cost for fish waste is added to the annuity of processing costs).

Illustrating the above methodology, Table 8.12 shows the derivation of end product break even prices. From the Table it can be seen that the break even price for fish cakes under different product combinations is closely similar, i.e. a little over 51,000 pesos per tonne. Frozen fish sticks are around 22,000 pesos per tonne. Of the canned products, picadillo is the cheapest at approximately 25,000 pesos per tonne followed by paté and fish sausage at around 26,000 and 33,000pesos per tonne respectively.

The annuity value of intermediate product inputs i.e. eviscerated fish (with the exception of fish silage), is of varying importance in the determination of break even prices. For fish cakes it represents the major element of costs to be covered at around 68% of the total (for raw material priced at 3000 pesos per tonne). Since eviscerated fish costs are themselves highly sensitive to raw material costs, fish cakes are quite sensitive to variations in the latter, examples of such sensitivity being shown in Table 8.13.

Frozen fish stick break even prices are somewhat less dependent on raw material/eviscerated fish costs, the latter forming around 57% of the total, but sensitivity to variable raw material costs is still considerable (Table 8.13).

Canned product prices are the least sensitive to raw material/eviscerated fish costs the latter varying from 28% of cost/price for canned fish sausage to 36% for paté and 43% for picadillo. Prices of canned products are however highly sensitive to the cost of cans themselves (stemming from can specification e.g. shape) and the number required (stemming from can size). Thus for example, can costs are more significant for paté in comparison to picadillo because the specified can shape is more expensive (both products use the same number of cans). On the other hand, cost of cans for fish sausage

TABLE 8.12 CALCULATION OF BREAK EVEN PRICES FOR END PRODUCTS WITHIN SELECTED COMBINATIONS OF END PRODUCT LINES

END PRODUCT	END PRODUCT OPTION NUMBER	NPV OF OPERATING COST[1] (Pesos)	ANNUITY VALUE[2] (Pesos)	TONNES OF END PRODUCT[3]	ANNUITY VALUE PER TONNE[4] (Pesos)	MAIN PLANT MATERIALS VALUE PER TONNE OF END PRODUCT[5] (Pesos)	TOTAL BREAK-EVEN PRICE PER TONNE OF END PRODUCT[6] (Pesos)
Fish Cakes	(I)	20,574,285	4,400,917	276	15,945	35,020	50,965
Fish Cakes	(II) (III) & (V)	10,585,076	2,264,187	138	16,407	35,020	51,427
Fish Cakes	(IV)	10,599,112	2,267,190	138	16,429	35,020	51,449
Frozen Fish Sticks	(I) TO (V)	17,253,120	3,690,507	388	9,512	12,478	21,990
Canned **Pic**adillo	(II)	30,488,286	6,521,559	459	14,208	10,556	24,764
Canned Fish Sausage	(III)	57,658,586	12,333,387	515	23,948	9,409	33,357
Canned Fish Paté	(IV)	39,740,699	8,500,684	515	16,506	9,409	25,915
Canned Products	(V)	43,913,978	9,393,364	496	18,938	9,763	28,701
Fish Silage	-	10,148,419	2,170,785	1,323	1,641	500	2,141

NOTES:
1 - At 20% opportunity cost of capital
2 - Column 1 divided by annuity factory = 4.675 (from standard tables)
3 - Volumes of end product established in Section 7
4 - Column 2 divided by column 3
5 - From Table 8.3 break even valuation of eviscerated fish at 3000 pesos per tonne raw material costs; calculated via the ratio of eviscerated fish per tonne end product, for each product/option. For silage the opportunity cost of fish waste is used.
6 - Column 4 plus column 5

TABLE 8.13 BREAK EVEN PRICES PER TONNE FOR END PRODUCTS WITH VARYING RAW MATERIAL COSTS

END PRODUCT	END PRODUCT OPTION NUMBER	RAW MATERIAL COSTED AT: 3000 pesos per tonne	5000 pesos per tonne
Fish Cakes	(I)	50,965	62,464
" "	(II) (III) &(V)	51,427	62,926
" "	(IV)	51,449	62,948
Frozen Fish Sticks	(I) TO (V)	21,990	26,088
Canned Picadillo	(II)	24,764	28,230
Canned Fish Sausage	(III)	33,357	36,446
Canned Fish Paté	(IV)	25,915	29,004
All Canned Products	(V)	28,701	31,905

is higher than that for picadillo owing to the requirements for a larger number of cans per unit of end product.

With regard to option (V) prices for all canned items are based on an average of establishment and operating costs and are rather above the average for individual end product lines for reasons noted in Section 8.4.1.

SECTION 9.0 CONCLUSIONS RELATING TO FINANCIAL COSTINGS

9.1.1. Pricing of End Products

A summary of break even factory gate prices for end products is shown in Table 9.1 together, where possible, with current (July 1981) retail prices for equivalent end products in Mexico.

From the Table it can be seen that all products are competitively priced in comparison to equivalent items available on the market, but no strict comparison is possible since wholesale and retail costs/margins have to be added to product prices from the project and in some cases no direct equivalent currently on the market is available for comparison. The effect of allowing for distribution/marketing costs is also likely to be uneven between the end products specified particularly in the case of frozen fish sticks where refrigerated trucks would be a requirement. It must therefore be emphasised again that this report cannot be used as a recommendation to produce these products. Before this can be done and an appropriate product mix determined further analysis is recommended, concerning acceptability, market volume, potential outlets, marketing channels and marketing costs and likely end product prices.

Additional factors may also influence the pricing of end products from the project. In the costing, a 294 day operating year has been assumed, however, since a closed season for shrimp fishing is currently in operation in the Gulf of California, problems could arise with raw material availability. Raw material/by-catch could be obtained during the closed season from other fishing activities but even if the required volumes were available it may be necessary to give consideration to pricing, i.e. prices may be higher than those allowed for in the costings in this Report. This factor may be particularly important given the varying degrees of sensitivity to raw material prices for the various end products, (Section 8.4.2.).

TABLE 9.1 COMPARATIVE PRICES OF END PRODUCTS & EQUIVALENT PRODUCTS ON THE MARKET

PRODUCT	PROJECT PRICE[1] (Pesos)	RETAIL PRICE OF EQUIVALENT[2] (Pesos)
Fish Cakes	5.10-6.30	7.12-29.64[3]
Frozen Fish Sticks	2.20-2.61	n.a.
Canned Picadillo	2.48-2.82	7.88
Canned Fish Sausage	3.34-3.64	7.78-21.74
Canned Fish Paté	2.59-2.90	9.94-13.24[3]
Canned Fish	-	4.38- 6.52[4]

NOTES:
1 - Factory gate price per 100 grammes end product derived from Table 8.13
2 - Retail price per 100 grammes of equivalent end product, June 1981
3 - Meat product
4 - Mexican sardines

A second factor relates to the marketability of the end products. Whilst some consumer testing has been carried out on the range of products for human consumption there is no comprehensive information available on the acceptability of these products and hence on their marketability. Table 9.1 indicates the probability that products could be quite price competitive with direct alternatives, even allowing for substantial distribution costs and margins, but marketing requirements could themselves impose additional costs. Specifications by distributors relating to required/desired can size and type and/or other packaging material could add to costs over and above those allowed for in the financial costings in this study.

Of the two broad factors - variability of raw material availability/pricing and canning/packing requirements, the first will have a more substantial effect on fish cake and frozen fish stick prices, whilst the second would weigh more heavily on pricing of canned products.

Pricing of fish silage is insensitive to both raw material pricing and also packaging requirements. At an ex-factory price of 2,141 pesos per tonne (or 17.84 pesos per kg protein equivalent) the product would appear to be quite competitive with alternative livestock feed materials available in Mexico. However, marketing of the material might require familiarisation of potential buyers with the product, given its novel nature.

9.1.2 Further Pre-Investment Evaluation

Given the restricted nature of the financial analysis carried out for this study it is recommended that serious consideration be given to additional work prior to any decision to implement the project. Additional steps, necessary to provide a full financial evaluation, would include:

- further market evaluation
- determination of viable product mixes and likely product prices
- financial evaluation of the finally proposed plant or plants.

Further consideration could also be given to the structure of development of the by-catch industry. This study has concentrated on the establishment of a plant specifically to handle by-catch; however, all of the processes outlined could be integrated, separately or jointly, into existing fish processing plants where by-catch is available. This approach could considerably reduce capital and overhead costs and hence factory gate break even prices and hence may provide a more viable option for developing an industry to utilize by-catch.

APPENDIX 1 : MAIN PLANT AND INDIVIDUAL END PRODUCT LINE COST DATA

Table

1.1 Building & Site Preparation Cost Summary - Main Plant

1.2.1 Processing Equipment Costs : Raw Material Intake & Preparation - Main Plant

1.2.2 Processing Equipment Costs : Fish Cakes

1.2.3 " " " : Frozen Fish Sticks

1.2.4 " " " : Canned Picadillo

1.2.5 " " " : Canned Fish Sausage

1.2.6 " " " : Canned Fish Pate

1.2.6 " " " : Silage

1.3 Other Establishment Costs Summary: Main Plant

1.4.1 Total Establishment Costs Summary: Main Plant

1.4.2 Total Establishment Costs : End Product Lines

1.5.1 Replacement Schedule and Residual Values : Main Plant

1.5.2 Replacement Schedule : End Product Lines

1.6 Main Plant Salaries for Monthly Paid Staff

1.7 Main Plant Wages for Weekly Paid Staff

1.8 Wage Costs for Main Plant Daily Paid Labour & Labour for End Product Lines

1.9.1 Total Personnel Costs : Main Plant

1.9.2 Total Labour Costs : End Product Lines

1.10 Electricity Utilisation & Costs : Main Plant & End Product Lines

1.11 Fuel Oil & Vehicle Fuel Costs : Main Plant & End Product Lines

1.12 Water Use & Cost : Main Plant & End Product Lines

1.13.1 Other Consumable Cost Items : Main Plant

1.13.2 Other Consumable Cost Items : End Product Lines

1.14 Insurance Costs : Main Plant & End Product Lines

TABLE 1.1 BUILDING AND SITE PREPARATION COST SUMMARY - MAIN PLANT

	ITEM	COST (PESOS)[1]
1.	Land - 3000 m^2	
	546 pesos m^2 at Industrial Estate Guaymas	1,638,000
2.	Site preparation - filling, levelling etc	325,000
3.	Connection of services - (sewage & electricity included in 1)	
	water connection charge for a 1 litre/sec. supply	70,200
4.	Buildings - 1300 m^2	5,070,000
	Steel frame building, block filled walls, tiled floors, walls tiled to 6 feet costed at 3,900 pesos m^2 & to enclose separate areas for:	
	(i) Raw material reception	
	(ii) Office	
	(iii) Toilets	
	(iv) Workshop	
	(v) Fish cake production	
	(vi) Frozen fish stick production	
	(vii) Canned production	
	(ix) Silage production	
	(x) End product store	
5.	Concrete loading and unloading area	
	1000 m^2 at 325 pesos m^2	325,000
6.	Fences and gates	32,500
	Sub Total	7,460,700
	10% for contingencies	746,070
	TOTAL	8,206,770

NOTE 1 - All costs estimated for construction of industrial buildings in the Guaymas area on an existing industrial estate.

TABLE 1.2.1 PROCESSING EQUIPMENT COSTS: RAW MATERIAL INTAKE AND PREPARATION - MAIN PLANT

	ITEM	COST (PESOS)	OBSERVATION
A.	Raw Material intake		
	(i) Platform Scales	16,250	Avery 3901 AAG quote
	(ii) Coldroom	516,700	20 tonne, Jackson Foster quote
B.	Raw Material Preparation		
	(i) Conveyors	92,950	20 metres in total
	(ii) Waste Container	19,500	10 of 300 kg capacity each
	(iii) Washing Tank	19,500	
	(iv) Deboner	1,425,000	Paoli quotation
	Sub Total (1)	2,089,900	
	Contingencies 10%	208,990	
	Sub Total (2)	2,298,890	
	Cif 15%	344,834	
	Install and Commission 10%	229,889	
	TOTAL COST	2,873,613	

TABLE 1.2.2 PROCESSING EQUIPMENT COSTS: FISH CAKES

	ITEM	COST (PESOS)	OBSERVATIONS
(i)	Mixer	147,740	Hobart H600 quotation
(ii)	Moulder	521,410	Square Co quotation
(iii)	Conveyor	21,450	
(iv)	Steam Sterilizing Tank	19,500	
(v)	Cooker/Dryer	1,136,010	AFOS quotation
(vi)	Packing Benches	9,750	
(vii)	" Sealers	11,160	HM 910 Hulme Martin Quotation
(viii)	" Scales	8,125	
(ix)	Mobile Steam Cleaner	78,000	
	Sub Total (1)	1,953,145	
	Contingencies 10%	195,315	
	Sub Total (2)	2,148,460	
	Cif 15%	322,269	
	Install & Commission 10%	214,846	
	TOTAL COST	2,685,575	

TABLE 1.2.3 PROCESSING EQUIPMENT COSTS: FROZEN FISH STICKS

	ITEM	COST (PESOS)	OBSERVATIONS
(i)	Mixer	147,740	Hobart H600 quotation
(ii)	Trays & Covers	82,440	
(iii)	Plate Freezer	1,013,570	Jackson Foster quotation
(iv)	Band Saw	27,320	Excel Model 2000 quotation
(v)	Bread & Batter Enrober	608,661	Koppens EPR 900 quotation
(vi)	Conveyor, Lift & Sundries	449,570	Koppens quotation
(vii)	Flash Fryer	459,270	Koppens BR 3600 quotation
(viii)	Packing Benches	9,750	
(ix)	" Sealers	11,160	HM 910 Hulme Martin quotation
(x)	" Scales	8,125	
(xi)	Mobile Steam Cleaner	78,000	
	Sub Total (1)	2,895,606	
	Contingencies 10%	289,561	
	Sub Total (2)	3,185,167	
	Cif 15%	477,775	
	Install & Commission 10%	318,517	
	TOTAL COST	3,981,459	

TABLE 1.2.4 PROCESSING EQUIPMENT COSTS: CANNED PICADILLO

ITEM	COST(PESOS)	OBSERVATIONS
(i) Steam Sterilizing Tank	19,500	
(ii) Conveyor	21,450	
(iii) Vegetable Peeler	37,595	Hobart 6128 Model quotation
(iv) Dicing & Chopping Attachments	39,810	Hobart quotation
(v) Mixer	147,740	Hobart H600 quotation
(vi) Canning Line	1,177,750	Metal Box quotation
(vii) Boiler	259,110	Metal Box quotation
(viii) Compressor	47,110	Metal Box quotation
(ix) Packing Benches	9,750	
(x) " Scales	31,510	Avery Model 1215 BFH quotation
(xi) Mobile Steam Cleaner	78,000	
Sub total (1)	1,869.325	
Contingencies 10%	186,933	
Sub total (2)	2,056,258	
Cif 15%	308,439	
Install & Commission 10%	205,626	
TOTAL COST	2,570,323	

TABLE 1.2.5 PROCESSING EQUIPMENT COSTS: CANNED FISH SAUSAGE

ITEM	COST (PESOS)	OBSERVATIONS
(i) Mixer-Bowl Cutter	565,320	Alexanderwerk SSK 100 quotation
(ii) Filler	270,885	Alexanderwerk AF 70 quotation
(iii) Steam Sterilizer Tank	19,500	
(iv) Ice Machine	60,000	Scotsman quotation
(v) Conveyor	21,450	
(vi) Canning Line	1,177,750	Metal Box quotation
(vii) Boiler	259,110	Metal Box quotation
(viii) Compressor	47,110	Metal Box quotation
(ix) Brine Kettle	60,000	Doleschal quotation
(x) Packing Benches	9,750	
(xi) Packing Scales	31,510	Avery Model 1215 BFH quotation
(xii) Mobile Steam Cleaner	78,000	
Sub Total (1)	2,722,045	
Contingencies 10%	272,205	
Sub total (2)	2,994,250	
Cif 15%	449,138	
Install & Commission 10%	299,425	
TOTAL COSTS	3,742,813	

TABLE 1.2.6. PROCESSING EQUIPMENT COSTS: CANNED FISH PATÉ

ITEM	COST (PESOS)	OBSERVATIONS
(i) Mixer-Bowl Cutter	565,320	Alexanderwerk SSK 100 quotation
(ii) Conveyor	21,450	
(iii) Canning Line	1,177,750	Metal Box quotation
(iv) Boiler	259,110	Metal Box quotation
(v) Compressor	47,110	Metal Box quotation
(vi) Packing Benches	9,750	
(vii) Packing Scales	31,510	Avery Model 1215 BFH quotation
(viii) Mobile Steam Cleaner	78,000	
Sub Total (1)	2,189,940	
Contingencies 10%	218,994	
Sub Total (2)	2,408,934	
Cif 15%	361,340	
Install and commission 10%	240,893	
TOTAL COST	3,011,167	

TABLE 1.2.7 PROCESSING EQUIPMENT COSTS: SILAGE

ITEM	COST (PESOS)	OBSERVATIONS
(i) Silage Plant	942,200	B.P. Quote for complete plant
(ii) Drums	130,000	
Sub Total (i)	1,072,200	
Contingencies 10%	107,220	
Sub Total (2)	1,179,420	
Cif 15%	176,913	
Install and commission 10%	117,942	
TOTAL COST	1,474,275	

TABLE 1.3 OTHER ESTABLISHMENT COST SUMMARY: MAIN PLANT

	ITEM	COST (PESOS)	OBSERVATIONS
1.	2 tonne pick-up truck	450,000	For raw material collection
2.	Fork lift truck	450,000	For general plant use
3.	Tools for mechanic/fitter	65,000	Hand tools pillar drill etc.
4.	Fish boxes	893,750	2,500 boxes (heavy duty plastic)
5.	Processing hand tools	19,500	Knives etc.
6.	Protective clothing	85,000	Coats hats,gloves boots etc
7.	Initial spare parts inventory	195,000	
8.	Fuel oil tank	3,250	
9.	Fire protection equipment	13,000	
10.	Establishment consultancy services	500,000	
11.	Office equipment & furniture	130,000	Including typewriter, filing system etc.
12.	Pre-operation expenses	65,000	Administrative support, pre-investment control
13.	Company formation	26,000	Legal taxes and fees
	Sub total	2,895,500	
	10% for contingencies	289,550	
	TOTAL	3,185,050	

TABLE 1.4.1 TOTAL ESTABLISHMENT COST SUMMARY[1] : MAIN PLANT

	ITEM	COST (PESOS)
1.	Building & site preparation costs[2]	8,206,770
2.	Processing equipment costs[3]	2,873,613
3.	Other establishment costs[4]	3,185,050
		14,265,433

NOTES 1 - Excluding Working Capital
2 - Source Table 1.1
3 - Source Table 1.2.1
4 - Source Table 1.3

TABLE 1.4.2 TOTAL ESTABLISHMENT COSTS[1] : END PRODUCT LINES

PRODUCTION LINE	TOTAL ESTABLISHMENT/CAPITAL COSTS (PESOS)
Fish Cakes	2,685,575
Frozen Fish Sticks	3,981,459
Canned Picadillo	2,570,323
Canned Fish Sausage	4,390,437
Canned Fish Paté	3,011,167
Silage	1,474,275

NOTE 1 - Sources Tables 1.2.2 to 1.2.7

TABLE 1.5.1 REPLACEMENT SCHEDULE AND RESIDUAL VALUES : MAIN PLANT

	ITEM	LIFE	REPLACEMENT COST (PESOS)		RESIDUAL VALUE
			YEAR 5	YEAR 10	YEAR 15 (PESOS)
1.	Land	∞	-	-	1,638,000
2.	Buildings	30	-	-	2,535,000
3.	Scales (x2)	10	-	32,500	-
4.	Processing equipment	10	-	2,087,141[1]	-
5.	Pick-up truck	5	495,000[2]	495,000[2]	-
6.	Fork lift truck	10	-	495,000[2]	-
	TOTAL	-	495,000	3,109,691	4,173,000

NOTES

1. - Conveyors, deboner.
2. - Including 10% contingency allowance for spares etc.

TABLE 1.5.2 REPLACEMENT SCHEDULE: END PRODUCT LINES

	PRODUCT LINE	REPLACEMENT COST (PESOS) YEAR 10
(1)	Fish Cakes[1]	768,000
(2)	Frozen Fish Sticks[2]	1,132,601
(3)	Canned Picadillo[3]	324,595
(4)	Canned Fish Sausage[4]	935,655
(5)	Canned Fish Paté[5]	664,770
(6)	Silage[6]	-

NOTES

1. - Conveyor, Mixer, Moulder and Mobile Steam Cleaner
2. - Mixer, Band Saw, Mobile Steam Cleaner, Bread and Batter Enrober and Conveyor
3. - Conveyor, Mixer, Mobile Steam Cleaner, Vegetable Peeler and attachments
4. - Conveyor, Mixer-bowl cutter, Mobile Steam Cleaner and Filler
5. - Conveyor, Mixer-bowl cutter, Mobile Steam Cleaner
6. - Nil

TABLE 1.6 MAIN PLANT SALARIES FOR MONTHLY PAID STAFF

JOB	PESOS/MONTH BASE SALARY	SOCIAL 1 CHARGES	TOTAL COST PESOS/MONTH	TOTAL COST 2 PESOS/YEAR
1. General Manager	60,000	8,625	68,625	883,500
2. Production supervisor	25,000	3,593.8	28,593.8	368,125
3. Managers P.A. 3	8,000	1,150	9,150	117,800
TOTAL	-	-	-	1,369,425

NOTES 1- Social charges include:

IMSS at 9,375% of basic salary
INFONAVIT at 5% of basic salary

2- Includes 4 weeks additional wages for Aguinaldos

3- Managers Personal Assistant (P.A.) to act as secretary and office manager.

TABLE 1.7 MAIN PLANT WAGES FOR WEEKLY PAID STAFF

JOB	PESOS/WEEK BASE SALARY	SOCIAL [1] CHARGES	TOTAL COST PESOS/WEEK	TOTAL ANNUAL [2] COST PESOS
1. Clerk/bookeeper	1,721,2	247.4	1,968.6	109,252
2. Storekeeper	1,721.2	247.4	1,968.6	109,252
3. Mechanic/Fitter	1,901.9	273.4	2,175.3	120,723.2
4. Driver	1,455.6	209.2	1,664.8	92,392
5. Inspector	1,721.2	247.4	1,968.6	109,252
6. Deboner Technician	1,721.2	247.4	1,968.6	109,252
7 Deboner Assistant	1,200.0	172.5	1,372.5	76,170
8. Fork Lift Truck Driver	1,445.6	209.2	1,664.8	92,392
TOTAL	-	-	-	818,685.2

NOTES 1 - Social charges include:

IMSS at 9.375% of basic wage

INFONAVIT at 5% of basic wage

2 - Includes 4 weeks additional wages for AGUINALDOS

TABLE 1.8 WAGE COSTS FOR MAIN PLANT DAILY PAID LABOUR & LABOUR FOR END PRODUCT LINES

PRODUCTION UNIT	BASE SALARY PER EMPLOYEE PER WEEK (PESOS)	SOCIAL [1] CHARGES PER EMPLOYEE PESOS/ WEEK	TOTAL COST PER EMPLOYEE PER WEEK (PESOS)	TOTAL NUMBER EMPLOYED	WEEKS WORKED PER YEAR	TOTAL COST PER YEAR PESOS [2]
Main Plant:						
Raw Material Handling etc						
Raw Material Collection	1,200	172.5	1,372.5	2	49	144,105
Evisceration	1,200	172.5	1,372.5	13	49	936,682.5
TOTAL	-	-	-	15	-	1,080,787.5
End Products:						
Fish Cake Production						
Line Supervisor	1,901.9	273.4	2,175.3	1	52	120,723.2
Mixing and Moulding	1,200	172.5	1,372.5	2	49	144,105
Dryer operation and Packing	1,200	172.5	1,372.5	6	49	432,315
TOTAL	-	-	-	9	-	697,143.2
Frozen Fish Stick Production						
Line Supervisor	1,901.9	273.4	2,175.3	1	52	120,723.2
Mixing	1,200	172.5	1,372.5	1	49	72,052.5
Packing Freezer Trays	1,200	172.5	1,372.5	2	49	144,105
Freezing Breading battering [3]	1,200	172.5	1,372.5	3	49	324,236.3
Packing [3]	1,200	172.5	1,372.5	2	49	216,157.5
TOTAL	-	-	-	9	-	877,274.5
Canned Picadillo Production						
Line Supervisor	1,901.9	273.4	2,175.2	1	52	120,723.2
Peeling Chopping Mixing	1,200	172.5	1,372.5	2	49	144,105
Filling cans	1,200	172.5	1,372.5	3	49	225,157.5
Sealing cans	1,200	172.5	1,372.5	2	49	144,105
Packing	1,200	172.5	1,372.5	2	49	144,105
TOTAL	-	-	--	10	-	769,195.7
Canned Fish Sausage Production						
Line Supervisor	1,901.9	273.4	2,175.2	1	52	120,723.2
Blending Emulsifying	1,200	172.5	1,372.5	2	49	144,105
Filling and Skinning	1,200	172.5	1,372.5	4	49	288,210
Filling cans	1,200	172.5	1.372.5	5	49	360,262.5
Sealing cans	1,200	172.5	1,372.5	2	49	144,105
Packing	1,200	172.5	1,372.5	2	49	144,105
TOTAL	-	-	-	16	-	1,201,510.7
Canned Fish Patê Production						
Line Supervisor	1,901.9	273.4	2,175.2	1	52	120,723.2
Mixing Precooking	1,200	172.5	1,372.5	2	44	144,105.
Filling cans	1,200	172.5	1,372.5	3	49	225,157.5
Sealing cans	1,200	172.5	1,372.5	2	49	144,105
Packing	1,200	172.5	1,372.5	2	49	144,105
TOTAL	-	-	-	10	-	769,185.7
Fish Silage Production						
Line Supervisor	1,901.9	273.4	2,175.2	1	52	120,723.2
Production Labourers	1,200	172.5	1,372.5	2	49	144.105
TOTAL	-	-	-	3	-	264,828.2

NOTES 1. Social charges calculated as in Table 1.7

2. Includes 4 weeks additional wages for AGUINALDOS

3. Operations worked one and a half shifts per day, numbers employed refer to number of workers per shift / half shift.

TABLE 1.9.1 TOTAL PERSONNEL COSTS: MAIN PLANT

	CATEGORY	ANNUAL COST (PESOS)[4]
1.	Monthly Paid Staff[1]	1,369,425
2.	Weekly Paid Staff[2]	818,685
3.	Daily Paid Staff[3]	1,080,786
	TOTAL	3,268,896

NOTES 1 - Source Table 1.6
2 - Source Table 1.7
3 - Source Table 1.8
4 - Totals to the nearest peso

TABLE 1.9.2 TOTAL LABOUR COSTS[1] : END PRODUCT LINES

END PRODUCT LINE	ANNUAL COST (PESOS)[2]
Fish Cakes	697,143
Frozen Fish Sticks	877,275
Canned Picadillo	697,143
Canned Fish Sausage	841,248
Canned Fish Paté	697,143
Silage	264,828

NOTE 1 - Source Table 1.8

2 - Totals to the nearest peso

TABLE 1.10 ELECTRICITY UTILISATION & COSTS: MAIN PLANT AND END PRODUCT LINES

PRODUCTION UNIT	UNIT H.P	KWH EQUIVALENT	ASSUMED LOAD FACTOR	% UTILISATION	CONSUMPTION PER HOUR KW	HOURS USED PER YEAR	TOTAL KWA PER YEAR	TOTAL COST PER YEAR-PESOS	
Main Plant:									
(i) Cold Room	11	8.20	0.6	50	2,460	7056	17,358		
(ii) Conveyor	3	2.24	0.6	75	1.008	2352	2,371		
(iii) Deboner-Separator	15	11.18	0.6	75	5.031	2352	11,833		
(iv) Deboner-Grinder	25	18.64	0.6	75	8.388	2352	19,729		
(v) Lighting & Other	-	-	-	-	-	-	3,000		
TOTAL							54,291	20.308	1
End Products:									
Fish Cake Production									
(i) Mixer	1.5	1.12	0.6	75	0.504	2352	1,185		
(ii) Moulder	2	1.49	0.6	75	0.671	2352	1,577		
(iii) Dryerfans & Conveyors	80.5	60.00	0.6	100	36,000	7056	254,016		
(iv) Sealers		0.60	0.6	75	0.270	2352	635		
TOTAL							257,413	95,964	2
Frozen Fish Sticks Production									
(i) Mixer	1.5	1.12	0.6	75	0.504	2352	1,185		
(ii) Conveyor	3	2.24	0.6	75	1.008	2352	2,371		
(iii) Plate Freezer	60	44.74	0.6	75	20.133	2352	47,353		
(iv) Band Saw	1	0.75	0.6	75	0.338	2352	794		
(v) Bread, Batter Enrober	8	6.00	0.6	75	2.700	2352	6,350		
(vi) Flash Fryer	118	88.00	0.6	75	39.600	2352	93,139		
(vii) Sealers	0.8	0.60	0.6	75	0.270	2352	635		
TOTAL							151,827	56,601	2
Canned Picadillo									
(i) Mixer	1.5	1.12	0.6	75	0.504	2352	1,185		
(ii) Conveyor	3	2.24	0.6	75	1.008	2352	2,371		
(iii) Peeler	0.5	0.37	0.6	75	0.225	2352	529		
(iv) Canning Line	2	1.49	0.6	75	0.671	2352	1,577		
(v) Compressor	5	3.73	0.6	75	1.678	2352	3,946		
TOTAL							9,608	3,582	2
Canned Fish Sausage									
(i) Mixer-Bowl Cutter	35	26.10	0.6	75	11,745	2352	27,624		
(ii) Conveyor	3	2.24	0.6	75	1.008	2352	2,371		
(iii) Filler	5.5	4.10	0.6	75	1.845	2352	4,339		
(iv) Skinner	8	6.00	0.6	75	2.700	2352	6,350		
(v) Canning Line	2	1.49	0.6	75	0.671	2352	1,577		
(vi) Compressor	5	3.73	0.6	75	1.678	2352	3,946		
TOTAL							46,207	17,226	2
Canned Fish Paté									
(i) Mixer-Bowl Cutter	35	26.10	0.6	75	11,745	2352	27,624		
(ii) Conveyor	3	2.24	0.6	75	1.008	2352	2,371		
(iii) Canning Line	2	1.49	0.6	75	0.671	2352	1,577		
(iv) Compressor	5	3.73	0.6	75	1.678	2352	3,946		
TOTAL							35,518	13,241	2
Silage									
(i) Silage Plant/TOTAL	10	7.46	0.6	75	3,357	2352	7,896	2,944	2

NOTES 1- Standing charge 34.45;First 90KW at 0.6125 pesos/KW; Subsequent 180KW at 0.4271 pesos/KW
Subsequent units at 0.3728 pesos/KW

2- At 0.3728 pesos/KW

TABLE 1.11 FUEL OIL AND VEHICLE FUEL COSTS: MAIN PLANT AND END PRODUCT LINES

PRODUCTION UNIT	UNIT	NUMBER OF UNITS	COST PER UNIT	ANNUAL COST (PESOS)
Main Plant				
Truck	gals	941	18.00	16,938
Fork Lift	"	588	18.00	10,584
TOTAL				27,522
Fish Cake Production	"	10,395	4.95	51,455
Frozen Fish Stick Production	-	-	-	-
Canned Picadillo Production	"	7,056	4.95	34,927
Canned Fish Sausage Production	"	7,056	4.95	34,927
Canned Fish Paté Production	"	7,056	4.95	34,927
Silage Production	-	-	-	-

TABLE 1.12 WATER USE AND COST: MAIN PLANT & END PRODUCT LINES

PRODUCTION UNIT	UNIT	DAILY USE	ANNUAL COST	ANNUAL COST PESOS
Main Plant				
Washing gutted fish	Litres	12,000	3,528,000	
Cleaning deboner	"	1,000	294,000	
General cleaning	"	4,000	1,176,000	
TOTAL			4,998,000	32,383[1]
Fish Cake Production	"	2,000	588,000	3,822[2]
Frozen Fish Stick Production	"	2,000	588,000	3,822[2]
Canned Picadillo Production	"	25,000	7,350,000	47,775[2]
Canned Fish Sausage Production	"	25,000	7,350,000	47,775[2]
Canned Fish Paté Production	"	25,000	7,350,000	47,775[2]
Silage Production	"	2,000	588,000	3,822[2]

NOTES 1 - At 221 pesos for the first 50,000 litres ($50m^3$)
Remainder at 6.5 pesos per m^3
2 - Costed at 6.5 pesos per m^3

TABLE 1.13.1 OTHER CONSUMABLE COST ITEMS: MAIN PLANT

		UNIT	QUANTITY	PESOS PER UNIT	ANNUAL COST PESOS
MAIN PLANT					
(i)	Spares, Lubricants	-	-	-	325,000
(ii)	Fish Boxes	-	500	357.5	178,750
(iii)	Protective Clothing	-	-	-	85,000
(iv)	Office Expenses	-	-	-	130,000
(v)	Caustic Soda	-	-	-	19,110
(vi)	Ice	kg	784,000	0.46	356,720
	TOTAL				1,094,580
Total + 10% Contingencies					1,204,038

TABLE 1.13.2 OTHER CONSUMABLE COST ITEMS: END PRODUCT LINES

	UNIT	QUANTITY	PESOS PER UNIT	ANNUAL COST PESOS
END:LINE PRODUCT				
Fish Cakes				
(i) Salt	kg	67,620	2.60	175,812
(ii) Packing Materials	kg	138,180	3.00	538,902
(iii) Protective Clothing	-	-	-	45,000
TOTAL				714,714
TOTAL + 10% Contingencies				786.185
Frozen Fish Sticks				
(i) Flavouring and Salt	kg	3,880	4.00	15,523
(ii) Breading Mixture	kg	334,500		648,176
(iii) Frying Oil	kg	4,410	30.00	132,300
(iv) Packing Materials	kg	179,634	3.00	538.902
(v) Saw Blades	blade	2	1296.00	2,592
(vi) Protective Clothing	-	-	-	35,000
TOTAL				1,370,901
TOTAL + 10% Contingencies				1.507.991
Canned Picadillo				
(i) Sauce & Vegetables	kg	114,700	8.0	917,280
(ii) Cans	can	1,834,560	1.79	3,284,193
(iii) Cartons	carton	18,346	15.55	285.280
(iv) Labels	label	1,834,560	0.02	36,691
(v) Protective Clothing	-	-	-	45,000
TOTAL				4,568,444
TOTAL + 10% Contingencies				5,025,288
Canned Fish Sausage				
(i) Fats & Spices	kg	170,520	5.00	852,600
(ii) Sausage Casings	box	322	5,770.00	1,857,850
(iii) Cans	can	3,528,000	1.60	5,650,939
(iv) Salt	kg	23,520	2.60	61,152
(v) Cartons	carton	35,280	15.55	548,604
(vi) Labels	label	3,528,000	0.02	70,560
(vii) Protective Clothing	-	-	-	55,000
TOTAL				9,096,705
TOTAL + 10% Contingencies				10,006,375
Canned Fish Paté				
(i) Fates & Spices	kg	170,520	5.00	852,600
(ii) Cans	can	1,834,560	2.73	5,012,715
(iii) Cartons	carton	18,346	15.55	285,280
(iv) Labels	label	1,834,560	0.02	36.691
(v) Protective Clothing	-	-	-	45,000
TOTAL				6,232,286
TOTAL + 10% Contingencies				6,855,515
Silage				
(i) Formic Acid	litre	48,100	28.60	1,375,660
(ii) Drums	drum	50	260.00	13,000
(iii) Protective Clothing	-	-	-	15,000
TOTAL				1,403,660
TOTAL + 10% Contingencies				1,544,026

TABLE 1.14 INSURANCE COSTS: MAIN PLANT & END PRODUCT LINES

PRODUCTION UNIT	INSURED VALUE	INSURANCE CHARGE PER ANNUM (PESOS)
Main Plant		
Buildings	5,070,000	
Plant	2,873,613	
Minor Equipment	1,105,000	
Spares	280,000	
TOTAL	9,328,613	92,120[1]
Vehicles	900,000	45,000[2]
Fish Cake Production	2,685,575	26,520[1]
Frozen Fish Stick Production	3,981,459	39,317[1]
Canned Picadillo Production	2,570,323	25,382[1]
Canned Fish Sausage Production	3,742,813	36,960[1]
Canned Fish Paté Production	3,011,167	29,735[1]
Silage Production	1,474,275	14,558[1]

NOTES 1 - Insured at 0.9875% of protected value per annum.
2 - Insured at 5% of protected value per annum.

APPENDIX 2 : COSTING DATA & FINANCIAL COST FLOWS FOR MAIN PLANT PRODUCT AND END PRODUCTS WITHIN COMBINED END PRODUCT OPTIONS

Table

2.1 Establishment Costs for Combined End Product Options

2.2 Financial Costings : Main Plant

2.3 Financial Costings : End Products within Combined End Product Options

TABLE 2.1 ESTABLISHMENT COSTS FOR COMBINED END PRODUCT OPTIONS (PESOS)

	FISH CAKES	FROZEN FISH STICKS	CANNED PICADILLO	CANNED FISH SAUSAGE	CANNED FISH PATÉ	ALL CANNED	TOTAL
Option I	5,201,337	3,909,959	-	-	-	-	9,111,296
" II	2,600,669	3,909,959	2,485,417	-	-	-	8,996,045
" III	2,600,669	3,909,959	-	3,742,813	-	-	10,253,441
" IV	2,614,075	3,909,959	-	-	2,939,667	-	9,463,700
" V	2,600,669	3,909,959	-	-	-	4,186,453	10,697,081

TABLE 2.2 FINANCIAL COSTINGS: MAIN PLANT (PESOS)

PLANT/COST CATEGORY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Main Plant (1)																
Establishment	14,265,433	-	-	-	-	495,000	-	-	-	-	3,109,641	-	-	-	-	(4 173 000)
Working Capital		989,689	-	-	-	-	-	-	-	-	-	-	-	-	-	(989,689)
Operating		11,876,267	11,876,267	11,876,267	11,876,267	11,876,267	11,876,267	11,876,267	11,876,267	11,876,267	11,376,267	11,876,267	11,876,267	11,876,267	11,876,267	11 876,267
TOTAL	14,265,433	12,865,956	11,876,267	11,876,267	11,876,267	12,371,267	11,876,267	11,876,267	11,876,267	11,876,267	14,985,908	11,876,267	11,876,267	11,876,267	11,876,267	6 713,578
Main Plant (2)																
Establishment	14,265,433	-	-	-	-	495,000	-	-	-	-	3,109,641	-	-	-	-	(4,173,000)
Working Capital	-	1,381,689	-	-	-	-	-	-	-	-	-	-	-	-	-	(1,381,689)
Operating	-	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267	16,580,267
TOTAL	14,265,433	17,961,958	16,580,267	16,580,267	16,580,267	17,075,267	16,580,267	16,580,267	16,580,267	16,580,267	19,689,908	16,580,267	16,580,267	16,580,267	16,580,267	11,025,578

Notes: 1 Main Plant operating costs assuming raw material price = 3000 pesos per tonne

2 " " " " " " " " = 5000 " " "

TABLE 2.3 FINANCIAL COSTINGS: END PRODUCTS WITHIN COMBINED END PRODUCT OPTIONS (PESOS)

LINE/OPTION/COST CATEGORY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fish Cakes																
(I)																
Establishment	5,201,337	-	-	-	-	-	-	-	-	-	1,432,000	-	-	-	-	-
Working Capital	-	266,231	-	-	-	-	-	-	-	-	-	-	-	-	-	(266,231)
Operating	-	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3 194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777
TOTAL	5,201,337	3,461,008	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	3,194,777	4,626,777	3,194,777	3,194,777	3,194,777	3,194,777	2,928,546
(II)(III) & (V)																
Establishment	2,600,669	-	-	-	-	-	-	-	-	-	716,000	-	-	-	-	-
Working Capital		138,354	-	-	-	-	-	-	-	-	-	-	-	-	-	(138,354)
Operating		1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250
TOTAL	2,600,669	1,798,604	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	1,660,250	2,376,250	1,660,250	1,660,250	1,660,250	1,660,250	1,521,896
(IV)																
Establishment	2,614,075	-	-	-	-	-	-	-	-	-	716,000	-	-	-	-	-
Working Capital	-	138,365	-	-	-	-	-	-	-	-	-	-	-	-	-	(138,365)
Operating	-	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383
TOTAL	2,614,075	1,798,748	1,660,383	1,660 ,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	1,660,383	2,376,383	1,660,383	1,660,383	1,660,383	1,660,383	1,522,018
Frozen Fish Sticks																
(I) to (V)																
Establishment	3,909,959	-	-	-	-	-	-	-	-	-	1,081,601	-	-	-	-	-
Working Capital	-	231,540	-	-	-	-	-	-	-	-	-	-	-	-	-	(231,540)
Operating	-	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482
TOTAL	3,909,959	3,010,022	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	2,778,482	3,859,083	2,778,482	2,778,482	2,778,482	2,778,482	2,546,942
Canned Picadillo																
(II)																
Establishment	2,485,417	-	-	-	-	-	-	-	-	-	272,595	-	-	-	-	-
Working Capital	-	491,592	-	-	-	-	-	-	-	-	-	-	-	-	-	(491,592)
Operating	-	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102
TOTAL	2,485,417	6,390,694	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	5,899,102	6,171,697	5,899,102	5,899,102	5,899,102	5,899,102	5,407,510

TABLE 3.3 (continued)

LINE/OPTION/COST CATEGORY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Canned Fish Sausage (III)																
Establishment	3,742,813	-	-	-	-	-	-	-	-	-	935,655	-	-	-	-	-
Working Capital	-	945,328	-	-	-	-	-	-	-	-	-	-	-	-	-	(945,328)
Operating	-	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932
TOTAL	3,742,813	12,289,259	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	11,343,932	12,279,587	11,343,932	11,343,932	11,343,932	11,343,932	10,398,604
Canned Fish Paté (IV)																
Establishment	2,912,065	-	-	-	-	-	-	-	-	-	612,770	-	-	-	-	-
Working Capital	-	645,807	-	-	-	-	-	-	-	-	-	-	-	-	-	
Operating	-	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679
TOTAL	2,912,065	8,395,486	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	7,749,679	8,362,449	7,749,679	7,749,679	7,749,679	7,749,679	7,103,872
All Canned Products (V)																
Establishment	4,186,453	-	-	-	-	-	-	-	-	-	1,108,800	-	-	-	-	-
Working Capital	-	695,368	-	-	-	-	-	-	-	-	-	-	-	-	-	(695,368)
Operating	-	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420
TOTAL	4,186,453	9,039,788	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	8,344,420	9,453,220	8,344,420	8,344,420	8,344,420	8,344,420	7,649,052
Silage																
Establishment	1,474,275	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Working Capital	-	152,515	-	-	-	-	-	-	-	-	-	-	-	-	-	(152,515)
Operating	-	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178
TOTAL	1,474,275	1,982,693	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,830,178	1,677,663

APPENDIX 3 LIST OF MANUFACTURERS AND SUPPLIERS CONSULTED

Company	Address	Tel.
ABR Food Machinery Co Ltd.	Denbigh Rd Bletchley Milton Keynes UK MK1 1DQ	(0908)-76421
Afos Ltd	Manor Estate Anlaby Hull UK HU10 6RL	(0482)-52152
Avery Export Ltd	Smethwick Worley West Midlands UK B66 2LP	(021)-558-1112 (021)-558-2161
BP Nutrition Ltd	Stepfield Witham Essex UK CM8 3AB	(0376)-513651
DCA Industries Ltd	Gatehouse Road Aylesbury Bucks UK HP19 3DL	(0296)-27272
Habco Refrigeration & Air Conditioning Contractors Ltd	Western Chambers Station Road Hayes Middlesex UK UB3 4BL	(01)-848-3666 (4 lines)
Henry Bright & Sons Ltd	Fraser Street Grimsby South Humberside DN32 8AH UK	(0472)-59807
The Hobart Manufacturing Co Ltd	Hobart Corner New Southgate London N11 1QW UK	(01)-368-1212
Hulme-Martin Ltd	6 Brownlow Mews Guilford Street London EC1N 2LD UK	(01)-242-5448 (01)-242-2967
Interfood Ltd	Interfood House Eastman Way Hemel Hempstead Herts UK HP2 7DU	(0442)-69461
J C Wetter & Co	23 Middle St West Smithfield London EC1A 7JE	(01)-606-8936 (3 lines)
Metal Box Ltd	Queens House Forbury Road Reading Berks UK RG1 3JH	(0734)-581177

Company	Address	Tel
Oppenheimer Casing Co Ltd	320-324 Kilburn High Rd London NW6 2QP UK	(01)-328-2211
S Berendsen Ltd	Berendsen House 159 Stafford Road Croydon Surrey UK CRO 4NN	(01)-680-9535
Stephen Paoli International Co	2531 South Eleventh St Rockford Illinois 61108 USA	(815)-965-0621 (815)-965-0622