OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

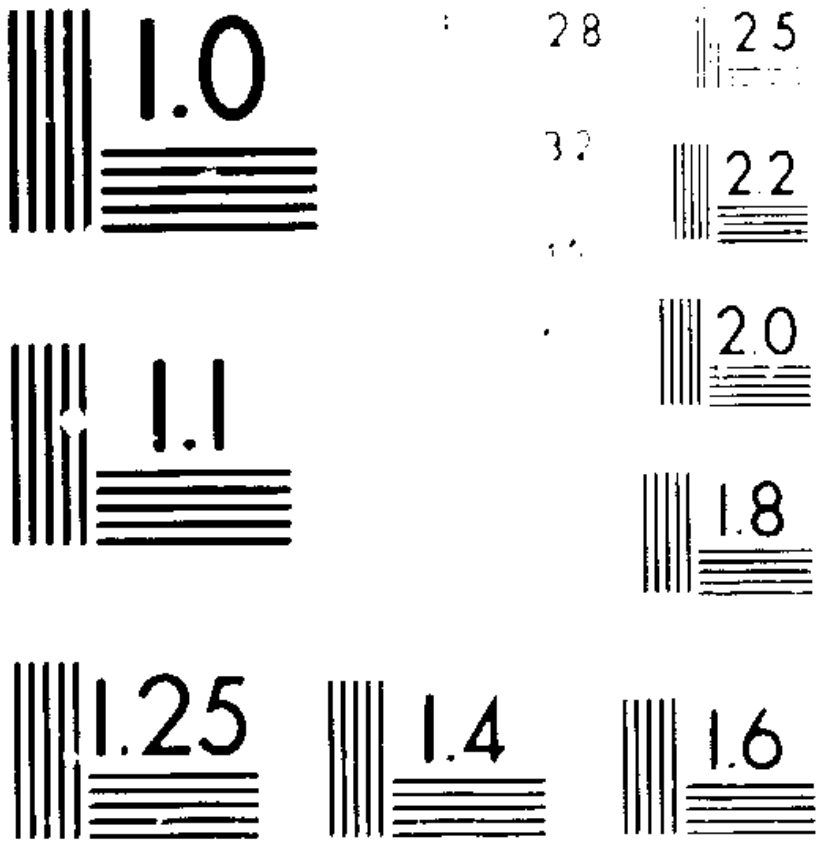
FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org


1.0
2.8
2.5
3.2
2.2
2.0
1.1
1.8
1.25
1.4
1.6

RESTRICTED

DP/ID/SER.A/507
30 March 1984
ENGLISH

13564

ASSISTANCE FOR MEAT CANNERY

SI/PNG/84/801

PAPUA NEW GUINEA

Technical report: Assistance in Evaluating the Conditions for the Establishment of a Meat Canning Plant*

Prepared for the Government of Papua New Guinea
by the United Nations Industrial Development Organization,
acting as executing agency for
the United Nations Development Programme

Based on the work of Isidor Savic
Meat Canning Technologist

United Nations Industrial Development Organization
Vienna

* This document has been reproduced without formal editing.

V.84-84468

TABLE OF CONTENTS

1. INTRODUCTION

The import of canned meats in PNG has reached the stage that an increasing interest for local production has been noticed. The National Planning Office recently received two proposals related to meat canning in the country. Both of them are recommending the installation of a local canning industry, but the contents of the proposals, in terms of their reliability, technical methods and equipment proposed and their impact on the country's livestock development, need further evaluation. Therefore, the National Planning Office has requested that an international consultant be engaged to assist in evaluating the proposals, to assess the possibility of local meat processing and the consumption of canned meat products, as well as local meat production, material supply and imports.

The expert's terms of reference were:

a) to evaluate the existing proposals in terms of reliability and accuracy, technology and equipment, techno-economic viability, benefits and linkages to the rest of the economy;

b) to make comments on the relative merit of the proposals, on the need to establish markets for new brands, the need for import control and the ability of domestic plants to supply the local market with canned meat products;

c) to advise on aspects of up-to-date meat processing technology and compare the situation of the proposed local meat canning industry with the international meat processing industry.

In close co-operation with the staff of the Department of Industrial Development, specifically with Mr. David Culverhouse, Assistant Secretary, the expert studied the relevant problems, visited a number of different establishments and institutions and contacted a number of individuals associated with the meat industry. The assistance, which is acknowledged with gratitude, has been vital to the writing of the report. The persons contacted and visits paid are listed in Annex 1.

Provisions were also made for the expert to carry out a short tour to assess the livestock production and meat processing in Lae and Madang. This was completed on 23 and 24 February. Unfortunately, there was insufficient time to extend the investigation to cover more completely livestock and meat marketing problems and possibly elaborate the collected data; the same is true for the evaluation of the basic costs particularly costs of equipment as well as the production costs, and the profitability study of the proposed cannery.

The short preparation time of this report has meant that all aspects of this subject have not been fully investigated and, therefore, the expert is aware that this report is not as complete as he would have liked or as others may have expected. The relative length devoted to the different subjects is not necessarily an indication of the importance attached to these topics.

It is strongly believed that information gained from current experience combined with information and advice received from various sources, the suggestions and conclusion outlined will comply with the requirements and needs of the concerned government bodies.

2. PROJECT PROPOSALS RECEIVED AND BENEFITS OFFERED

2.1 The Department of Industrial Development received two proposals related to the implementation of the meat canning industry in the country. The proposals were submitted by:

1. Huttons Limited, Sydney, Australia and titled:
   "Feasibility study of establishing a meat cannery plant in Papua New Guinea", covering 59 pages and a number of annexes. The proposed cannery would be located in Lae.

2. James Barnes Pty. Ltd., Wagga Wagga, N.S.W., Australia and titled:
   "Meat Canning Proposal, Papua New Guinea", covering 99 pages and three attachments; the proposed cannery would be located in Madang.

Huttons Limited has already an established small goods manufacturing plant and wholesale meat division operating in Lae, PNG, that may provide a basis on which to assess the expansion or introduction of allied industry. At the same time, the company has considerable expertise in many aspects of the Australian meat industry.

James Barnes is a member of the J. Gadsden Group of Companies in Australia. J. Gadsden Australia Ltd. is a major Public Co., with diversified manufacturing facilities in the packaging and food processing industries and is active throughout most states of Australia. Barnes is a specialist canner of beef and mutton based products.

Both Huttons and Barnes are known exporters of Australian canned beef in Papua New Guinea.

2.2 Both project proposals anticipate that with Government assistance, a worthwhile contribution will be made to PNG's economy, i.e. benefits to agriculture, primary and service industries, employment, import balance of payments, technology advancement and manufacturing base. The major benefits as seen by Huttons proposal are as follows.

1. the project will include foreign exchange savings;
2. encouragement for the expansion of pastoral, agricultural and service industries; coastal shipping will benefit; beef, pork and poultry industry will be directly influenced with great room for expansion;
3. 25 - 30 people would be directly employed with a number of jobs being created in support industries;
4. cannery is "natural expansion" or "ideal extension" of Huttons existing invovlement in the PNG meat industry; further investment and development are already envisaged covering cattle breeding, raising and pasture, advisory techniques, boning and packaging of meat;
5. export opportunities are available but will need a lot of work to define and develop.

Barnes also emphasizes numerous benefits which could be summarized as follows:

1. the project is aiming at maximum import replacement;
2. impact on growth in livestock sector of economy;
3. development of national technology skills and labour training;
4. efficient use of local resources;
5. profitability at market prices;
6. in time cannery should be internationally competitive by taking advantage of export opportunities as they arise.

2.3. Comments

It is logical to accept that a well-oriented sufficiently large-scale meat canning factory, acting as a part of the meat processing industry, will influence, first of all, the livestock production development and specially give the producers more confidence. The livestock producers will feel less risk to expand because they will be more conscious that they have an outlet more for their meats and that the risk of holding of finished stock for longer than necessary will be reduced.

Concurrent with the above, the important objective and obligation of the future cannery should be the maximum emphasis on the processing of locally produced meats. With such an emphasis other goals, envisaged by the proposals, may also be achieved. The detailed comments on the impact of the cannery on the national economy are found in the next chapters.

3. ASSESSMENT OF THE PNG'S MEAT INDUSTRY AND MARKETING IN THE LIGHT OF CANNERY NEEDS

3.1. Livestock Industry

Although the surface area of PNG is approximately 470,000 sq. km. only 24,000 of these, or about five per cent, is considered suitable for high production farming. Grasslands comprise only 40,000 sq. km.

For this reason the meat industry in PNG is relatively undeveloped and its growth is likely to be rather slow. The government is conscious of this problem and has initiated a series of integrated measures and projects which are currently underway throughout a great part of the national territory. Although there are untapped opportunities for further cattle, pig and poultry industry development, spectacular results cannot be expected in the near future.

The beef industry has begun to expand during the last decade. The cattle population, which in the year 1970-1977 was about 89,600, reached in 1978 approximately 128,000 head. The present estimation ranges between 140,000 and 150,000 head. Nearly fifty per cent of the national cattle herd is concentrated in the Morobe and Madang areas.

Recorded cattle slaughtering in PNG's slaughterhouses during the years 1980 to 1982 ranged from 14,600 to 15,185 animals. The expected number of beef animal slaughtering in PNG slaughterhouses for the year 1983 is about 14,000. The type, quality and degree of fattening of cattle slaughtered varies widely. It is undoubtedly very important to emphasize that the locally produced beef has started, although in a limited extent, to compete with that which is imported from Australia.

Pigs are raised in a considerable number in PNG and they are considered as an important meat source in many regions of the country. However, pig production as a whole is still to a great extent a backyard enterprise where domestic types of pigs are extensively raised. It is noted that many thousands of pigs are locally home slaughtered at traditional feast and the carcasses butchered distributed and consumed locally without entering meat marketing channels. The intensive piggeries in the vicinity of big cities seems to be prosperous and they are increasing in number and sizes.

3.2, Abattoirs

The slaughterhouse system in PNG is based on a group of about ten relatively small abattoirs, varying somewhat in the scale of operation, material used for construction, type of equipemnt, etc. The slaughter is normally carried out by workers paid by the abattoir management. A fee is charged depending on the species and size of the animals.

These abattoirs are simple but usually well equipped slaughtering places. They do not work regularly. Their current utilization is only about 25 per cent. They are high structure buildings, providing satisfactory ventilation and protection against climatic influences.

Slaughtering is hygienic in design and character. The whole process of slaughtering and dressing is carried out step by step, predominantly on an overhead rail. Their layout is functional and provides a smooth flow of working operations with the least effort, reasonable speed in handling meat, short intervals between operations and at the same time they show a certain degree of adaptability. Briefly, they permit the movement of carcasses from the previous to the next operation with the minimum possibility for contamination and maximum economy in space and equipment. The management and inspection seem also to be on a qutie sufficient level. The general conclusion is that abattoirs, although small-scale in size, may successfully provide an important portion of meat for the future canning plant.

The abbatoirs in Lae, Madang, Goroka and Mount Haten with a shift capacity of 33,000 (20,000 + 5,000 + 3,000 + 5,000) cattle head per annum could become direct suppliers to the projected cannery, no matter where its location will be. The abattoirs in Port Moresby, Rabaul and Bulolo, with the annual throughput of 15,000 (7,500 + 5,000 + 2,500) cattle heads and the total daily chilling capacity of 58 beef carcasses could not be considered as a cannery meat supplier for the reason of distance. It should be once more pointed out that the first group of abattoirs will be able to supply the cannery only intially - in the first years of its operation. However, it is clear that the present system of small abattoirs would not be appropriate if the cannery's local meat supply were quickly considerably increased.

3.3. Livestock and meat marketing

The livestock and meat marketing has an important bearing not only on the livestock production but also on the well-being of the consumers. The marketing of livestock and meat in PNG is complicated by the inadequate development of different regions, by small-scale production, especially of beef, by limited market, by import of frozen meat and some other factors.

Genrally speaking the length of marketing channels and particularly the number of middlemen are basic factors determining the efficiency of the link between the producer (or importer) and the ultimate consumer of meat or meat products. For PNG the meat marketing channels vary in length and nature, but they are usually short or moderately extended.

However, the livestock and meat marketing in PNG seems to be in the process of essencial changes and restructuring. The practice of meat marketing in the form of selected cuts appears to be increasing. Looking very broadly at the current and particularly the near future market situation and at the risk of over simplification, it can be said that the PNG beef industry has and particularly will have three primary outlets for the cuts of carcasses: (a) hindquarters - as table meat, (b) forequarters - as boneless meat for industrial or kitchen processing and (c) flanks for minced meat production. The situation with pork has much similarity on which a comparison with beef may be based; the chances for industrial processing of pork are relatively more favourable. Head meats, tripe and other meat by-products are also valuable potential raw materials and with the meat industry gorwth, their processing will become increasingly attractive.

In PNG imported (frozen) or locally produced meats are usually sold in food shops and supermarkets; locally slaughtered pork is sometimes sold in public markets places. It is likely that a proportion of higher quality meat, especially beef, is directly sold on the internal luxury market for hotels and restaurants at a higher price. In contrast to the lack of encouragement to the small butcher for opening his permanent meat shop, it seems there is more incentive for the sale of meat in supermarkets or mini-markets.

A wholesale meat market is very limited in PNG. The reasons for it are the insufficient local meat especially beef supply, meat production shortage, the lack of public refrigerated stores, the lack of more regular transport connections through the country, etc.

The striking discrepancies between the retail price for meat and the price paid for the live animal and the lack of the relating prices and margins more closely to the quality of meat and meat products show importance of the further development of the meat marketing system in PNG.

Unless the peculiarities of the livestock and meat marketing in PNG are properly understood, the upgrading of the meat industry is unlikely to meet with success. However, the establishemnt of a meat cannery, able to cover the country's needs, is likely to have the profound influence on livestock and meat marketing development and may essentially contribute to livestock production.

3.4. Canned meat marketing

The PNG canned meat market has reached in excess of 10,000 tonnes per annum in time of high primary industry returns (coffee, cocoa ...); in recent years with modest returns, the market has stabilized at 8,800 tonnes per annum (with an import cost of about 16 million kina) and is likely to increase in the coming years with further rural development. Thus the absorption capacity for canned meat products of the PNG market may be accepted to range between 8-10,000 tonnes and it is in full agreement with both cannery proposals.

The second essential characteristic is that the market is becoming increasingly price conscious with the trend to consumption of cheaper canned packs instead of more expensive canned beef products; this fact is, in principle, accepted by both cannery proposals. The following table shows clearly such a trend:

		tonnes*
PNG Consumption	1980	1982
Corned meat loaf	2,626 (33 %)	3,727 (45 %)
Corned beef	3,971 (51 %)	2,884 (37 %)
Other canned meat	1,257 (15 %)	1.451 (18 %)

* extracted from Barnes proposals

If the same trend was to continue in the next decade, the corned beef would be substantially reduced in the PNG market. However, it is more likely that this trend, remaining still clear, will be reduced in the coming years, so as somewhat slower decrease of corned beef consumption should be expected. This fact should be taken seriously into account in selecting products caregories and types for the projected cannery. It is worth noting that the trend to cheaper meats and meat products is today world-wide, even in such countries as the USA.

The established proven PNG market for canned beef of about 8 - 10,000 tonnes annually would doubtlessly be an appropriate volume for the establishment of a sufficiently large-scale and economically sound meat-canning plant in this country.

4. EVALUATION OF THE PROPOSALS IN TERMS OF THE PRODUCTIVITY STRATEGY

4.1. Strategy of product selection

There are marked differences in product range selection envisaged by Barnes and Hutton's proposals. Barnes proposal covers major varieties of canned meat products presently found on the PNG market; it is said that in order to adequately satisfy major consumer demands, the company has selected the following main categories of canned meat products:

a) corned beef;
b) meat and cereal (corned beef loaf, luncheon meat and minced loaf); and
c) meat and vegetable (braised steak and onion and braised beef and gravy).

In the same section, p.23-24, of the proposal it is added that the cannery will be looking at other meat products such as poultry and pork for which the supply looks promising.

Huttons proposal is more cautious on market preferences and envisages only two main products: corned beef and corned meat loaf (Section 7, p. 27). However, the company also declares that new products will be researched with consumer testing in the various market areas. (Section 4 p. 23-24), looking at the same time at the possibility of other meat and vegetable products in the future (Section 7, p. 30).

4.1.1. Comments

Present day technology affords the meat processor very effective and economical means of canning a wide variety of meat products which do not require long-term research and for which market preferences are nearly worldwide. Therefore, it would be highly desirable if the list of products selected were more extended and more precisely defined. Particularly, it is suggested to make a greater effort to re-examine the possibility of increasing the share or/and enlarge the number of types and brands in each category of non-corned beef products.

4.2. Selection of shape and size of cans

The can is an essential factor in the preservation of meat by canning. It is also an essential factor in pricing the finished products. It is most important for the success of the canning operation to use good quality, reliable cans and properly adjusted closing machines.

For each product there is a particular kind of can plate that is best suited and cheapest. The specification includes the weight of the steel. base plate, the amount of tin coating and the enamel (if any). However, also the shape of the can and the way it opens are important. As far as corned beef is concerned, it has been traditionally marketed in tapered cans with a key.

The meat cannery must adhere closely to can manufacturer's recommendations on tolerances for can seam dimensions. The can manufacturer assists the cannery in the selection of the most efficient can for specific products and in the selection, operation and maintenance of closing machines.

In the case of the projected meat canning plant both proposals include their views and solutions of the can supply problem. However, disagreements appear as far as the shape of corned beef cans is concerned.

Barnes project proposal (Section 3, p. 16) has selected three different sizes and two different shapes of cans which would be used for the selected product types:

a) 340 g round, 99 x 43 mm no key (for minced meat and loaf) and 340 g round, 99 x 43 mm key can (for corned beef and corned meat loaf);
b) 340 g taper, 79 x 61 x 92 key cans (for corned beef and luncheon meat) and
c) 425 g round, no key cans (for braised meat products).

Thus it is envisaged to pack corned beef both in 340 g tapered, keyed and 340 round keyed cans, while luncheon meat would be packed only in 340 g tapered cans. The intention is also to utilize lithographed cans.

Huttons proposal (Section 4, p. 22 - 23) includes only round, not tapered, cans without a key but having the advantage of especially designed litho-label.

As it can be seen there are marked differences in the shapes of the cans proposed by Barnes and those suggested by Huttons. Barnes proposal envisages the predominant proportion of corned beef production in tapered keyed cans. From the following table it is visible that in a

Tapered cans (in '000) used for corned beef in the course of five years (Barnes)

Product	Y1	Y2	Y3	Y4	Y5	Total
Corned beef						
PNG production	6,534	7,722	8,910	9,088	9,270	41,524
*shortfall (import)	9,347	8,041	6,732	6,047	5,047	36,514
Cereal packs	660	780	900	992	1,042	4,374
Total	16,541	16,543	16,542	16,427	16,353	82,412

*shortfall in tonnes divided by 340 g.

Period of five years 45,898,000 tapered cans will be necessary to satisfy Barnes PNG corned beef and cereal packs (luncheon meat) production, but including the shortfall from the import - which will also be in tapered cans - the total will reach 82,406,000 cans.

However, from the following table it is visible

Barnes expected annual production of corned beef in round(99x53) and tapered cans (in tonnes)

Can	Y1	Y2	Y3	Y4	Y5
round	326	367	408	478	518
tapered	2,222	2,,625	3,029	3,190	3,152

That Barnes envisages the corned beef production also in round cans. This fact offers to Barnes an opportunity for market preference investigation and possible future gradual replacement of tapered cans, if the results obtained will allow it. It would be highly desirable to do it as soon as possible.

In opposition to Barnes, Huttons proposal, suggesting not tapered and no key cans, aims at economical advantage assuming that with a good marketing strategy and in good standard quality of products, both the company and consumers may benefit. Huttons proposal recognizes that a change from tapered to round cans for corned beef may cause some marketing problems but it is believed that these should not be insurmountable. It is likely to be true.

4.3. Cannery's import meat procurement

Due to the present limited size and expected growth of the PNG meat industry, the meat canning plant will be critically dependent on meat in the long term. Huttons proposal envisages that the initial local supply will cover only a quite small percentage (5 - 15 per cent) of the cannery meat requirement. This could likely be the reason why this proposal is starting with a relatively small production in the first and second year. The predominant portion of the cannery's meat procurement will be dependenc upon the import.

Barnes proposal, envisaging a more voluminous total of canned meat production, does not indicate the local meat supply as an important source; the proposal states that it is unlikely that the cannery will be capable of financing local meat in the short term. The envisaged total meat requirement of Barnes cannery is as follows.

Y1	Y2	Y5	Y10	
3,947	4,783	5,583	7,260	tonnes

For the purpose of the proposal, Barnes has assumed the worst situation by importing total meat requirements for the ten year period. However, it would be more desirable that the company by broadening the selected programme of canned meat products and allowing more flexibility in their formulations, meet requirements assuming not the worst but really respected situation in local meat procurement. There is not much doubt that local beef and pork production will be able to contribute a small, perhaps very small portion of the cannery's meat requirements already in the first year or years; it will happen if the programme of the cannery includes the local meat supply not as a possibility but as a necessity.

The cannery's meat procurement is the central and the most critical problem in establishing the projected meat cannery. It represents the basis for the techno-economic viability of proposals and is of special importance for the potential net savings in foreign exchange; but first of all it has a decisive role for future meat industry development in the country. Therefore, it should be pointed out once more that the product selection and product composition of the projected cannery should be in maximum accordance with the present and future development of the beef, pork and poultry industry in this country. In other words, the cannery should start to process local beef and pork and perhaps poultry already from the first year.

It is established practice that meat canners generally buy only special types, parts, trimming etc., from the meat industry, furnishing instructions on methods of production and control of quality and delivery times, etc. This is an important way of influencing meat industry growth. Both proposals seems to be essentially lacking in such an approach.

4.4. Production and sale volume (total market demand)

Assuming that in the coming years fresh meat demand will be increased in preference to canned meats, Barnes (Section 3, p. 17 to 18) has accepted the canned meat market for 1982 as an average sale performance over the next decade. On such a basis Barnes envisages the following sales in tonnes:

	1982	Y1	Y2	Y3	Y4	Y5	Y10
Corned beef	5,776	2,548	2,992	3,437	3,568	3,670	4,262
meat and cereal	1,060	798	1,136	1,008	1,109	1,169	1,533
meat and veg.	967	785	871	959	1,057	1,110	1,517
Total	7,753	4,131	4,765	5,404	5,734	5,949	7,212
Barnes share against, 1982		53,3 %				76,7 %	93 %

Huttons proposal (p.7) is starting with Y1 production of only 2,715 tonnes and is gradually increasing it:

Y1	Y2	Y3	Y4	Y5
2,715	3,140	3,490	4,525	5,375 tonnes

Thus, both proposals count on import of meat canned products to replace the shortfall of the proposed cannery. Barnes expects that the approval would be granted by the Government for the shortfall to be produced at J. Barnes canning plant in Australia under brand licence from the PNG cannery; the same price increase, which is expected for the local cannery's products, would be valid for the imported products. The envisaged Barnes shortfall in tonnes is as follows:

	Y1	Y2	Y3	Y4	Y5	Y10
corned beef	3,178	2,734	2,289	2,158	2,056	1,464
Total	3,662	2,988	2,351	2158	2,056	1,464

In the same manner Huttons proposal envisaged the local production and shortfall as follows:

	Y1	Y2	Y3	Y4	Y5
Local production	2,715	3,140	3,490	4,525	5,375
Huttons import	2,300	2,125	1,975	1,400	750
Other import	3,785	3,535	3,335	2,875	2,675
Total import	6,085	5,660	5,310	4,275	3,425

Thus the shortfall would be made up by production from traditional packers in Australia and New Zealand being produced by the Huttons cannery label. Specifically, Huttons requires the quota system based on import prices to ensure a market share of 5,015 (2,715 + 2,300) tonnes in Y1 building up to 6,125 tonnes in Y5.

In general, both proposals require total market control for canned meats within the categories manufactured.

4.5. Product pricing

The canned meat is an important item ofPNG's diet and the price is of great concern. It is very difficult to make a sound comparison between the price data found in Barnes and that proposed by Huttons project. In the Section 3, p. 21, Barnes considers product prices, saying that with the exception of the Highland Provinces, the wholesale price for product will be the same at any main port location within PNG, and any additional movement of products will be to the wholesalers account. The Barnes proposal of the CIF product prices - per dozen cans in Kina is the following.

Corned beef, tapered	12,12
Corned beef round	11,52
Corned beef loaf, round	6,24
Minced meat loaf, round	6,20
Luncheon meat, tapered	9,70
Braised beef/gravy, round	11,50
Braised steak/onion, round	11,20

Huttons proposal is very general in the statement that with the establishment of the Lae cannery, the cost per can of corned beef and corned meat loaf will rise by ten cents per can and this will initially reduce the demand. Such a price rise, according to Huttons, is not too inflationary (Section 2, p. 16).

The following table gives retail prices for Barnes and Huttons corned beef product marketed in PNG.

340 g Corned beef taper can	Port Moresby (21.2.1984)	Lae (29.2.1984)	Madang (24.2.1984)
Huttons, Oxley Australia	K1,26	K1,27	-
of Barnes "GLOBE", Sydney Australia	K1,17	K1,22	K1,21

From Barnes price proposal for future manufacture canned meat products, it is evident that the wholesaler's price for one taper corned beef will be K1,07. The difference of 0,16 toes is obviously too small to allow a fair return to the wholesaler and retailer for their services. Accordingly, Barnes proposal will also lead to an essential increase of canned meat retail prices.

4.6. Prospect for PNG canned meat export

Relating to the fact that both proposals emphasize the possibility of PNG's canned meat export, it is necessary to point out that the future of world meat and canned meat export is today somewhat clouded not only by the present economic recession but also by unknown inherent factors in the ever-growing demand for national self-sufficiency (protective policies, quotas, etc.). Even leaving aside the confusing actual world economic situation, PNG's prospects for canned meat export remain still minimum. However, while world meat prices are more exposed to periodic or unexpected fluctuations, it happens somewhat more rarely in marketing canned meat products. On the other hand, canned meat prices in the world market have increased proportionally more in the last ten years than those for meats or other meat products this trend is likely to continue. Speaking very broadly if the projected cannery were able to reach a sufficient production level, the export possibility could not be excluded.

However, it is well known that the potential to export, apart from the product quality and price, depends also on the manufacturer's ability to meet the sanitary regulations of importing countries. It suggests that an important antecedent condition for the canned meat export is the compliance with the international standard with regard to building, processing conditions and quality of final products. Atlhough the regulations of individual importing countries vary widely, usually canned meats are exported only by producers holding a current meat exporting licence. This means that the plant engaged in meat processing for export should be registered by the meat inspection authority concerned, whose veterinary staff exercise control of operations from the time of ante-mortem inspection of the live animal through slaugthering and transportation up to the point of the meat products being prepared for shipment.

With respect to canned meats, they can be prepared to a buyer's specification provided they conform with local health regulations and of those in the importing coutries. Usual points requiring specification are the processing time, product composition, type and weight of can, packaging and labelling.

Although the chances for PNG canned meat export are at present small, the fulfillment of all international sanitary requirements concerning the cannery's building and meat canning practice is of importance for a successful start and future operation of the factory. Thus, the PNG meat canning plant should be built, conducted and maintained accoring to international regulations.

5. LOCATION AND PLANNING OF PNG MEAT CANNING PLANT

5.1. Location of meat canning plant

Barnes project envisages that the cannery will be located at the main port location of Madang. Huttons proposal has selected Lae for possible location. In both cases the location was selected for similar basic reasons, livestock industry area, access to Highlands in line with long term Government planning, adequate port facilities, etc.

5.1.1. General considerations and comments

There are many factors which determine the suitability of any location for a meat cannery. The more important are: availability of an ample supply of raw material of the desired quality at prices which are satisfactory for livestock producers (of course, if locally produced meat is intended to be processed), an adequate electricity supply, the availability of adequate labour and regular transport connections at reasonable rates between the cannery and the primary markets, adequate facilities that comply with regulations for the disposal of plant waste, etc. On the other hand, the structure of production and the commercial strategy will determine to some extent, the location of a meat cannery.

Although the order of importance of these factors will not be the same in the case of the Madang cannery and that proposed to be located in Lae, they seem to be in the same manner dependent upon the labour required, the nature of the raw materials as to perishability and the amount of waste. In the case of canning meat with vegetable, more mannual work will be necessary for deboning, cutting and trimming operations than for imported boneless frozen meat blocks.

Choosing a location for a meat cannery with reference to labour should go further than merely getting near or in a city or large town, but the plant should be in a vicinity that will attract the better class of abattoir and butchering workers. The physical equipment may be purchased or built but labour can be made efficient and satisfactory only through training.

There is a clear advantage in locating a meat processing plant near the raw material, i.e. in a livestock producing area. Modern meat canning has developed beyond the point where a cannery can be successfully operated without having impact on the other meat processing activities, especially on the diversification and better utilization of special carcass cuts, and types of slaughter animals. And last but certainly not least, the meat

cannery cannot be successful if it depends only upon the use of either culls or occasional surplus as sources of raw material.

The site of the cannery should be one easily accessible for the receipt and shipment of raw and finished materials and for labour. It should have ample space and be in a clean locality. Both proposals, in principle, are satisfactory in this regard.

Doutblessly there are also some advantages in locating a cannery near a can manufacturing plant. However, the extent of these advantages could be evaluated with the information given.

5.2. Cannery building

5.2.1 Construction Barnes meat canning plant - Madang

5.2.1.1. General consideration

Barnes report proposal is sufficiently elaborated to obtain clear insight of the proposed solution, but here only some basic things will be considered.

No set rule can be laid down for sizes of different areas because of the wide variations in space required for different types and sizes of operations. Barnes proposal, however, has applied specific and suitable rules to develop space areas. For instance, room space is enough to store the amount of raw product which might be expected in the PNG situation. Warehouse storage space seems also to be quite sufficient, after allowing for aisles to store the anticipated capacities of the plant. The preparation and processing area is obviously planned to allow for the length of the longest lines of equipment, etc. There will be also enough room to permit lift-trucks to maneuver in transporting raw or finished products and also in placing or removing the equipment which may need to be moved from time to time. The processing, cooling, ware-housing and packaging areas seem to be well separated.

From the attached drawings of Barnes' project proposal, it can be quickly concluded that a logical flow of receiving, raw material storing, tempering, trimming, cooking, closing, heat processing and other operations will be possible, leaving still enough room for diversibility and necessary flexibility of the processing lines.

The problems of waste disposal, offices, laboratory facilities, etc. are also adequately treated. Special attention is devoted to the cannery effluent treatment. The initial idea is that the goal in treating waste flow is to render it suitable for discharge without causing a public nuisance. In the interest of simplicity of design and economy, the character of effluents has been analysed and selections for treatment and disposal procedures are proposed, taking into account the possibility of cannery expansion. Without entering into technical details, it can be fully accepted that the proposal system of effluent treatment, if duly executed, will be in maximum accordance with international regulations governing the disposal of industrial wastes.

In a quite general way it can be concluded that Barnes planning meat canning plant is in principle technologically and hygienically well projected and presents a solid basis for further elaboration of technical and other details.

5.2.1.2. Barnes cannery buildings

The main building of Barnes cannery encompasses the following three departments: frozen meat storage, production area and warehouse for storage of finished goods; a future expansion by 33 per cent is envisaged for all departments. Secondary buildings are including: offices, staff amenities, workshop, and boiler compressors room (Section 5, p. 28). The design will be confirmed by the Australian Department of Primary Industry (in the absence of specific PNG regulations).

The frozen meat storage department contains also a tempering room. Walls, ceiling, doors, etc. will be from polystyrene foam panels finished with high quality metal finish, etc.

The production area, spaced to provide high plant efficiency, will have the walls, ceiling, etc. as above mentioned.

The warehouse to store four weeks stock of finished goods will be of material to be decided in the future.

Cost estimates for main and ancillary buildings are:

Main building	K 1,040,000
Ancillary buildings	K 276,000
Other	K 194,000
Total:	K 1,510,000

5.2.2. Planning Huttons', meat canning plant Lae

Huttons project proposal does not contain data on planning the meat cannery. In the Section 7, p. 30 it is stated that the plant will be designed for versatility covering the other meat and vegetable products and that it will be semi-automatic capable of producing 8,160,000 cans (340 g) per annum for 2,775 tonnes. It is also said that the plant will be based on Huttons Australian experience and knowledge. In Section 7, p. 31, the warehouse and process room are only mentioned. The global cost estimates are:

Site works	566,500
Buildings	235,000
Other	30,500
Total:	$ 832,000

5.2.2.1. The possibility of the conversion of the JANUBADA dairy plant facilities in the Huttons's cannery

In building a modern cannery many factors will play an important role in its operation and will be seriously felt if by chance they are overlooked. Especially it might be true in the case of remodelling or conversion of a factory into another one.

Therefore, the adequacy of the conversion of the existing JANUBADA dairy product plant facilities into a meat cannery may be questioned. However, in order to make any decision, it would be indispensable to elaborate a technical and technological proposal including the necessary designs and other data and explanations. The expert had the opportunity to pay a very short visit to the JANUBADA plant and his impression has been that there is a possibility for adapting this plant into a cannery. However, only after studying the adequacy of the water supply, land sufficiency and its load-holding capacity, building strength, height, ventilation, frozen storage facilities, warehouse capacity, system of effluents, etc. would it be possible to make the final decision.

6. EVALUATION OF THE EQUIPEMNT PROPOSED

6.1. Equipment

6.1.1. Barnes proposal of equipment

6.1.1.1. Production equipment

Barnes proposal of equipment, itemized on the special summary sheet, encompasses 97 major items. Anticipated purchase of 34 items of equipment in Australia are A$ 854,800 (K 666,745); anticipated purchase of new equipment in PNG 947 items) are A$ 308,250 (K 240,435) and total cost estimate, including some items of second-hand equipment, etc. is A$ 1,510,250 or K 1,178,000.

6.1.1.2. Production ancillary equipment

J. Barnes (Section 5, p.36) cost estimates for vacuum system compressed air system and hot water system are K 62,400.

6.1.1.3. Services equipment

With regard to the steam/hot water system, Barnes proposal envisages: (1) four mobile high pressure units with an insulated 12,0001b hot water storage tank, satisfying an estimated requirement of 80,000 1b steam per shift and (2) 230 HP boilers having an output of 2 x 800 1b/h which should adequately cope with the maximum demand load projected at 17,750 1b/h. A cost estimate of the total system including chemical treatment of water etc. is K 173,940.

The refirgeration system proposal seems also to be suitable for the purpose.

6.1.2. Huttons' proposal of equipment

Huttons' proposal includes only a summary list of 24 items of production equipment with estimated costs of $549,000; the types and sizes of selected machines or producer's data are not included. The list or cost estimates of ancillary and service equipment are also not included.

6.1.3. General consideration and comments

The type, quality and quantity of canned meat products manufactured by a factory are strongly dependent on the quality and quantity of the equipment used.

Correct, well selected meat processing and canning equipment contribute to better production economy and gives assurance of the reliability of the enterprise. Therefore, a project of a meat canning plant can be successfully evaluated only if it contains firsthand information on the equipment to be used.

It should be pointed out here that there is no such thing as standardized meat canning plant construction or equipment. The machines are not balanced as to size and capacity so that each step bears a relation to that which preceded or is to follow. Usually it is a matter of taking the best that is offered and timing the different units to work as alike as possible. For a number of reasons, the producer of meat canning equipment recommends expensive large scale meat canning equipment, leaving aside the more complex problem of medium - or small - sized machines.

With respect to the above, Barnes and Huttons equipment proposals differ obviously not only in the size and amount of equipment but also in the precision of descriptions of selected items. While Barnes proposal allows a sufficiently clear insight into the equipment and the main reasons for its selection, it is lacking a detailed identification of machines. The scarcity of

data in Huttons' proposal does not enable a technical evaluation of the equipment selected. In a general way the suitability of the equipment proposed by Barnes can be estimated as adequate for an economically justified canned meat production, maintenance or hygienic conditions and optimum use of labour. Nevertheless more specific data is required to evaluate precisely the equipment cost estimates. In particular, an appropriate description of second hand equipment is indispensable.

6.2. Utilities

6.2.1. Projected water usage

The water demand of a cannery depends largely upon its production volume and the water requirements of the individual products being packed. However, water requirements are influenced greatly by methods of handling and types of equipment used and so are found to vary widely for the same product in different plants. Hard water (high content of Ca and Mg), is objectionable for the boiler supply for the brine and for all canning purposes. Another aspect of water quality is the bacterial count and the most practical means presently available for insuring low total bacterial content of cannery water is chlorination, envisaged by both cannery proposals. However, the projected water usage of the cannery is estimated only by Barnes: the proposed facility has a maximum of 450 KL per shift, the majority of which is expended over a ten hour period. This requirements, 3.7 per cent of the present Madongtown water requirement, will be drawn from two underground bores. The site cost estimates for the total water supply system are K 223,400. Huttons report does not evaluate the cannery's total water supply.

6.2.2. Effluent handling and treatment

The effluent discharged from the operation includes retort cooling water and a floor drainag system. Retort cooling water, which can be considered as "clean", should be retained

within a separate drainage system. This is the solution accepted by Barnes proposal. It is also accepted that floor drainage effluent will be conducted into a concrete pit and then, utilizing level control equipment, the effluent will be skimmed from the surface, fat separated from the settled solids and treated through a 48 mesh vibrating screen and finally, conducted into a laggo system. The system provided is in excess of the requirement. Sedimentation (1,300 m^3), sludge (1,300 m^3) and aerobic (2,600 m^3), able to hold 12 days effluent if retort water has to be included. A cost estimate for preliminary and tertiary effluent system is K. 50,400 and K 148,200 respectively or totally K 198,600.

Huttons project proposal does not include the method of effluent handling and treatment.

6.2.3. Others

The fire protection, office equipment, amenities, laundry equipment, incubators and housing for key personnel are duly indicated only by Barnes and their costs estimates.

6.3. General conclusions

Barnes proposal of equipment and utilities can be, in principle, accepted as completely adequate for economical canned meat production, maintenance of high hygienic conditions and optimum use of labour.

7. EVALUATION OF THE PROPOSALS IN TERMS OF TECHNOLOGY AND OPERATION

7.1. Process operations

Barnes proposal gives a brief outline of the process and flow charts of the packs proposed which is in full accordance with machines, buildings, structure of production and other details found in the report. Huttons proposal does not include such or analogue data.

A special attempt will be made here to give a brief description of the general process as it can be understood from Barnes project proposal, paying attention to some specific operations of crucial importance for the evaluation of the technology to be applied. The properly tempered frozen meat is cut to the desired sizes or otherwise treated depending upon the product. The quick-cure method of curing meat is normally used. The parboiling of meat is done by plunging it into boiling water or broth. The broth resulting from this parboiling may be used several times for subsequent changes (but it should not be used for periods in excess of three hours), the surplus of water in which meat is boiled may be utilized for other canned products. After curing and inspection for gristle, excess fat, etc. meat is conveyed to the filling equipment. As far as possible meat is packed in cans while hot, without exhausting. Corned beef may be canned with or without "added jelly". The stuffing machines are equipped with hoppers in which the meat is placed. All cans are marked by letter, numerals, etc., so that the product, its grade, place and date of packaging may be known. The code is embossed in the lid by the can closing machine. All operations are carried out as far as possible as a continuous operation so as to minimize the time elapsing between the taking of meat from storage and the completion of the heat processing.

It is stated in Barnes report that the "heat treatment" schedules, i.e. the venting and process time and temperature, which will be applied in the PNG cannery are those established by the C.S.I.R.O. and that they have a wide Fo-value safety margin. According to this, the canned meat products will have a shelf-life suitable for a tropical country.

After heat processing the cans are cooled in water to an average internal temperature likely between 35° and 43°C and stored at an incubation temperature for a determined period of time.

Post processing can handling and methods of warehousing canned meats, including the maintenance of warehouse environmental conditions, are also sufficiently and adequately treated in Barnes project proposal.

Although this picture may be oversimplified, the fact remains that Barnes proposal ensures modern and efficient methods of meat processing and canning. The obtained products will be in maximum accordance with the requirements for products marketed in tropical countries.

7.2 Packaging finished products prior to distribution

Although the standard pack for PNG market is 48 x 340 g cans per carton, Barnes is in favour of packs of 24 cans per carton for all products. In oposition Huttons proposal has selected the standard PNG packs to be used, because they are often preferred in the retail market.

7.3. In-plant quality control

In plant quality control in the meat canning industry is generally assumed to have the following basic aims: (a) to control the cans, meat and other ingredients and raw materials, (b) to reduce the hazards of spoilage, (c) to control sanitary practice, (d) to ensure compliance with inspection regulations and (e) to control finished products.

A wide range of attitudes toward the need for and type of organization of in-plant quality control exists in the meat canning industry. As a matter of fact it is extremely difficult to estimate the value of a quality control programme until an avoidable loss has been encountered due to a lack of such control. On the other hand, it is practically impossible to estimate the gains that might be realized by a slight improvement in quality which would increase product value and saleability. In any case the fact that in Huttons proposal no effort is spent on an in-plant quality control programme. should be considered as a defficiency. On the contrary, Barnes proposal includes a full programme of in-plant quality control based on a laboratory with elementary equipment.

8. SUMMARY OF CONCLUSIONS AND SUGGESTIONS

I. Meat Industry

1. Livestock and meat marketing

The meat industry in PNG is relatively undeveloped. The cattle population has reached nearly 150,000 heads in recent years. Many thousand pigs are locally slaughtered and their meat is not marketed, however, the extensive piggeries in the vicinities of big cities are prosperous and increasing in number.

Nearly fifty per cent of the national cattle herd is concentrated in Morobe with the market nearly saturated, the same is basically true to the pork and poultry industry.

2. Abattoirs

Local small-scale abattoirs in Lae, Madang and neighbouring cities are basically well equipped and hygienic in design and character, with adequate refrigerating facilities. Their capacities are presently under-utilized.

3. Meat processing

Small goods manufacturing local plants of a limited size are emerging in many cities throughout the country.

II. The Proposed PNG Meat Canning Plant

PNG is critically dependent on imports of canned meats (K 16,000,000 annually).

The PNG market for canned meats of 8 - 10,000 tonnes per annum is able to make a meat canning plant economically and technologically viable.

The establishment of a meat canning plant may have a growing influence on the country's meat industry development and by reducing canned meat imports, contribute to foreign exchange saving. The extent of this effect will greatly depend upon the volume and range of products manufactured.

Canning plant meat procurement

Canning plant meat procurement is of primary importance for potential net saving in foreign exchange and particularly for local meat industry development; therefore, the proportion of imported meat for canning purposes should be as low as possible and proportionally decrease with time.

The range of selected products and their formulations should be in maximum accordance with the present and future PNG meat industry development; special attention should be given to the utilization of low priced beef cuts as well as pork and poultry meat.

III. EVALUATION OF PROJECT PROPOSALS AND RECOMMENDATIONS OF FUTURE ACTIONS TO BE TAKEN

1. Location

Although the order of importance of different factors determining the location of the projected meat canning plant either in Madang or in Lae is not quite the same, both locations in the proposals seem to be in a similar way dependent upon the availability of raw material, water supply and electricity supply, the availability of regular transport connections at reasonable prices, the availability of adequate labour, possibilities for waste disposal, etc.

There are some advantages in locating a cannery near a can manufacturing plant but the extent of these advantages cannot be evaluated with the information given.

2. Evaluation of project proposals

(a) From two project proposals studied that of J. Barnes Pty. Ltd. is doubtlessly superior with regard to:

- volume and range of products selected
- buildings projected and production and other equipment proposed;
- methods of meat technology applied, allowing a smooth and economical flow of receiving, processing, canning and warehousing operations with enough diversability and flexibility;
- maintenance of a high level of hygienic conditions;

- programme of in-plant quality control of operations and control of raw and finished products:
- water usage estimate and effluent handling and treating methods;
- export possibilities.

In order to strengthen the impact of this project on the country's livestock development, it is suggested to:

- re-examine the possibility of increasing the percentage and enlarge the number of products in each category of non-corned beef packs, aiming at greater production of cheaper canned meat types;
- re-investigate the possibility of more rapid gradual replacement of tapered cans with round ones for corned beef and luncheon meat packs;
- elaborate more precisely and complete the list of equipment with regard to types, capacities and exact costs including the second-hand items;
- make an additional effort in analysing the possibility of final products price reduction; and
- after the completion of the above said, make adequate corrections of the project as a whole.

(b) The scarcity of data in Hutton's meat canning plant proposal has not allowed evaluations of the proposed technology; 7 ranges of productions, selection, production, ancillary and other equipment; water usage estimate; sanitation; effluent handling and treatment; stream and electricity supply; etc.

The adequacy of the possibility of remodelling and conversion of Las JANUBADA DAIRY PLANT facilities into a meat canning plant should be questioned because of the total lack of adequate supporting designs and other data normally accompanying such an operation.

3. Export

If the projected meat canning plant is able to reach a sufficiently high production level, export possibilities might arise.

4. Help of an international expert

Due to time constraints and lack of specific details, the consultant was not able to investigate all the techno-economic aspects of the project propcsals. The financial appraisal was not in his terms of reference and it is not his usual field of activity. Therefore, taking into account the volume of the work still to be accomplished, it is proposed that an expert experienced in marketing, food production economy and financial appraisal should be engaged for a period of not less than two months.

ANNEX I - VISITS AND PERSONS MET

1. Port Moresby (14 February - 22 February and 23 February to 3 March 1984)

Mr. Nemmara S. Subbaraman, Resident Representative, UNDP

Mr. N. Kulkarni, UNDP

Mr. Ivan I. Contreras, Senior Industrial Development Field Adviser, UNDP/UNIDO

Mr. Wep Kanawi, Secretary, Department of Ind. Development, P.O. Wards Strip, Waigani

Mr. David Culverhouse, Assistant Secretary, Department of Ind. Development, Central Government

Mr. Neil M. Mohanty, Assistant Secretary, Policy and Planning Division, Department of Ind. Development

- Saphires Smallgoods Plant
- Abattoir of Port Moresby
- A number of supermarkets and shops
- Local food market

2. Lae (23 February 1984)

- Hutton's Smallgoods Factory
- Crown Cork and Seal (PNG) Pty. Ltd.
- Several food shops
- JANUBADA Dairy Product Pty., Ltd. Factory

3. Madang (24 February 1984)

Mr. Galen Lang, Deputy Premier and Minister for Finance, Madang Provincial Government

Mr. John Gosiba, Minister of Commerce, Madang Provincial Government

Mr. Glyn G. Denison, Willings and Partners, Consulting Engineer

Mr. Peter Coulton, Madang Development Corp. Pty. Ltd.

Mr. Chris Young, Rabtrad Madang Pty. Ltd.