Development and Financing of
Fishery-Related Infrastructure

by

Walter Miklius, Ph.D.
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In its inaugural meeting in Pago Pago in 1981, the Pacific Islands Development Program was directed by the Standing Committee of the Pacific Islands Conference to evaluate the potential beneficial role of multinational corporations in the Pacific islands region. In 1984 the Standing Committee again addressed the question of multinational corporations and approved that this study be undertaken on a sectoral basis, with the tuna industry being the first sector to be examined.

The tuna industry was selected as the first sector for investigation by the Standing Committee because the tuna fishery and industry in the Pacific islands region affects all countries and territories. The broad objectives of the tuna sectoral study are (1) to analyze the current and future role of multinational corporations in the tuna industry in the Pacific islands region, and (2) to evaluate the potential contribution these corporations could make to industry development in the region. This is the first time that a comprehensive study of the tuna industry in the Pacific islands region will focus on regional and international issues affecting the industry from the perspective of all island countries.

A proposal outlining the tuna sectoral study was drawn up in 1984. This was done in consultation with the Forum Fisheries Agency, and research commenced in January 1985. The study will produce a range of technical reports that will address issues critical to the development, management, and expansion of tuna industries in the Pacific islands region.

This report, prepared by Dr. Walter Miklius, analyzes options for Pacific island governments for the development and financing for shore-bases for tuna fleets operating in the region. Options discussed range from government owned facilities to privately owned bases.

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ABSTRACT

Pacific Islands Governments have expressed an interest in establishing tuna operating bases in order to induce homeporting of the distant-water fishing fleets operating in their respective exclusive economic zones. The purpose of this report is to evaluate the options available to island governments for development and financing of these facilities.

Purse seine vessels are the most likely potential users of base facilities and the bases are most likely to be primarily transshipment facilities. Cold storage is the most expensive component of these facilities and the investment required would depend on the frequency of calls by the reefer vessels and the number of fishing vessels being serviced by the base. The investment in other types of port facilities is relatively small and some of it could be avoided if the base is established in an existing port. The total investment in infrastructure facilities for a small base (for example, servicing ten fishing vessels) would fall in the range of US$1—2 million.

There are a number of options for ownership and management of the base. At one extreme, a Pacific island government could own and operate the base. At the other, the base facilities could be privately constructed and operated. A wide variety of arrangements is possible between these extremes, that is, the government could own the base facilities but lease them to a private company with or without the purchase option or it could contract management of the base to a private firm. The decision on ownership and management will affect financing options. In some situations construction of base facilities by government is preferred because the terms of loans provided by the World Bank or regional development banks are usually more attractive than those available to private companies. Contract terms and setting of the user fees will depend, in part, on the method used to select the private company.

While this report discusses major factors to be considered in development and financing of the tuna operating bases, the selection of the most appropriate ownership and management arrangements depends on site specific parameters, that is, they can be determined only when a specific base site is identified. This is the major function of the project's feasibility study.
The purpose of this study is to conceptually outline options that might be used by governments in the Pacific islands region with respect to the provision of social and physical infrastructure required to support commercial tuna ventures. These ventures could be wholly government owned ventures, joint-ventures or private undertakings. Where applicable, the consultant should draw on published literature relating to infrastructure in developing countries and his/her background and experience to provide appropriate illustrations.

1. Review of Types of Infrastructure. This section shall provide a general overview of infrastructure. It shall cover the following issues, among others:

   (a) definition of different types of infrastructure (social and physical);

   (b) under what conditions should infrastructure be provided by government or by industry.

2. Financial Aspects for Infrastructure. This section shall consider financial consequences for government and for the project if new or existing infrastructure is:

   (a) paid for by government at zero cost to industry;

   (b) paid for entirely by the project developers;

   (c) paid for by government and (1) leased to the project developers, (2) subject to a user-charge arrangement, or (3) sold back to developers on a lease to own plan.

   The relative advantages of each financial scheme should be examined relatively and from the point of view of government (principally in terms of cost) and from the point of view of the long term success of the project. This will include an assessment of the merits and disadvantages of each option.

   With respect to the leasing/user-charge approach, the consultant will:

   (a) line methods for determining lease/user-charge arrangements;

   (b) propose guidelines for determining the duration of leases.
INTRODUCTION

Large and commercially proven tuna resources exist within the Pacific islands region, with many of the established fishing grounds falling within the exclusive economic zones (EEZs) of various countries (Clark 1985:1). In 1984 an estimated 650,000 tonnes of tuna of all species were harvested in the region, of which 90 percent was taken by distant-water fishing fleets (Doulman 1986:1).

Most distant-water fishing vessels operate in the Pacific islands region under access agreements and pay a negotiated license fee to the Pacific islands governments. According to Doulman (1985a:4) these governments attempt to secure a financial return equal to at least five percent of the free-on-board market value of the fish harvested. Aside from these licensing payments, under present conditions, the distant-water fishing fleet generates few indirect benefits for Pacific island economies. This is because vessels operate from and return to their home ports where they purchase all provisions before the start of each fishing trip and usually land their catch upon their return. As a general rule, distant-water fishing vessels utilize ports within the Pacific islands region only in cases of emergency.

The Pacific islands governments believe that the indirect benefits generated by the fishing fleets could be substantial if these fleets transshipped part or all of their catches in the region. Island governments, therefore, have expressed an interest in establishing tuna transshipment bases. The establishment of these bases, in turn, would require construction of infrastructure facilities. The purpose of this report is to evaluate options available to Pacific island countries for the development and financing of these facilities.

The type as well as the size of these facilities will vary depending, in part, on the type, size and number of vessels to be serviced and, in part, on the degree of processing to be done at the base. The types and size of these facilities will, in turn, determine the required investment and operating costs. The second section of the report attempts to determine the likelihood of processing and to identify the potential users of these bases. The third section is devoted to determination of the infrastructure facility requirements, and section four to evaluation of the financing options. The final section provides a brief summary of conclusions.
LIKELIHOOD OF PROCESSING AND THE POTENTIAL USERS

A tuna base designed for canning all or most of the landings would require more extensive infrastructure facilities than one designed primarily for transshipment. The probability that a new tuna operating base would include a large scale processing facility, however, is rather small. There are two large canneries in the region located in American Samoa with a combined processing capacity of about 155,000 tonnes per year. The American Samoa canned tuna has an advantage because it can enter the U.S. market free of tariffs.

Other canneries in the region are small. The processing capacity of the Fiji cannery is at maximum 15,000 tonnes and the capacity of the Solomon Islands cannery is only 5,000 tonnes per year. Given the existence of these canneries, limited availability of labor and other factors of production, small local markets for canned tuna, and the known, significant economies of scale in food processing, it is unlikely that a new tuna base with a large scale cannery would be established in the Pacific region. It is more likely, therefore, that new tuna bases would focus on transshipment of landings to canneries in Japan, Puerto Rico, Thailand, Philippines or to existing facilities in the Pacific region.

According to Doulman (1985a:15) the region's only shore-based transshipment facilities with the capacity to service the industrial tuna fishery are in Palau and Vanuatu. However, the facility in Palau has not been utilized since 1982 (although efforts are underway to bring it back into service). The facility in Vanuatu is underutilized. It has a capacity to handle 10,000 tonnes of tuna annually, but in 1984 only 4,500 tonnes of tuna were transshipped through the facility.

The use of transshipment facilities in certain circumstances can improve operational efficiency of the fishing fleet by reducing nonproductive time (i.e., travel time between fishing grounds and the port, and the time in port). The underutilization of existing transshipment facilities as well as the lack of development of new ones until recently was due, in part, to the Japanese government's policy of requiring all Japanese flag vessels to return to Japan to discharge their catches at the end of each fishing trip. This policy has recently been modified and as a result, overseas transshipments for the Japanese purse seine fleet have increased. Doulman (1985b:8) estimates that in 1984 about 80,000 tonnes of tuna were transshipped through Guam, Tinian (Northern Marianas) and Rabaul (Papua New Guinea). Doulman, however, feels that these operations are temporary because they do not involve the use of shore-based facilities.

Apparently, the change in Japanese policy has also encouraged construction and planning of new transshipment facilities. Doulman (1985a:17) reports that in Majuro, Marshall Islands, a US$2 million wharf and cold storage facility is being built, and is financed by the Japanese government under its fisheries aid program. It will service some 400 tuna vessels mainly of Japanese flag, fishing Marshall Islands waters and will later be expanded to make Majuro a prominent regional tuna transshipment base. Other transshipment facilities are being planned elsewhere.
Since the infrastructure requirements of an operating base depend on type, size and number of vessels it is designed to service, it is necessary to identify the potential users of a transshipment facility. According to Doulman (1986:18) there were 1,456 distant-water fishing vessels registered on the Forum Fisheries Agency's Regional Register. Of these, 1,128 or 77.5 percent were longline vessels, 112 or 7.7 percent were pole-and-line, 146 or 10.2 percent were single purse seine, 11 or 0.8 percent were group purse seine, and 59 or 4.1 percent were other types of vessel.

In spite of their numbers, however, the longline vessels are not likely to be the primary users of tuna transshipment facilities. About one-half of these are Japanese vessels which generally prefer to offload at Japanese ports. Similarly, Korean and Taiwanese longline fleets, which in the past focused on catching albacore for the U.S. canning market, more recently have redirected their efforts towards producing fish for Japan's more lucrative sashimi market (Doulman, 1986:3).

The distant-water pole-and-line vessels are even less likely to be the potential users of tuna transshipment facilities in the islands region. This fleet is all Japanese, operating primarily in the exclusive economic zones of Micronesia countries from ports in Japan. In recent years the fleet of pole-and-line vessels has declined steadily and is expected to continue to shrink further (Doulman, 1986:5).

This leaves purse seine vessels as the most likely users of tuna transshipment facilities. The purse seine fleet operating in the region expanded rapidly in the early 1980s and peaked in 1984 when the number of single seiners exceeded 115 (Doulman, 1985b:3). Since that time the number of single seiners has declined largely because of the redeployment of U.S. vessels to the eastern Pacific and a reduction in the number of vessels in the U.S. fleet. Doulman (1986:5) does not expect the number of seiners operating in the future to exceed the number of seiners that fished in 1984.

In short, the above discussion suggests that a new tuna operating base in the Pacific islands is likely to be primarily a transshipment facility which would service the purse seine fleet.
INFRASTRUCTURE REQUIREMENTS

The most obvious infrastructure requirement for any tuna operating base is an adequately sheltered bay or harbor with a turning basin sufficient to accommodate the largest vessel expected. The need for a deep water wharf (or wharves) with sufficient wharf area and for the cold storage facility depends on the methods of transportation to be used from the transshipment base to the overseas cannery. That is, frozen tuna can be transshipped in bulk by reefer carrier vessels or in refrigerated containers.

Transshipment by reefer vessel does not necessarily require any wharfs or any other shore-based facilities. As discussed above, in Guam, Tinian and Rabaul the frozen tuna is transferred directly over the rail from tuna seiners to reefer vessels. The efficiency of this system depends heavily on (1) the ability to closely coordinate the arrivals of seiners with the arrivals of reefer vessels; (2) the difference in costs between the over-the-rail transfer and the transfer using shore-based facilities; and (3) the reefer vessel's and seiner's daily costs in port.

Transshipments using reefer vessels combined with shore-based facilities require a deep water wharf (or wharves) with adequate wharf area and a cold storage facility. The optimum size of the wharf and the size of the cold storage facility can only be estimated for a specific tuna base because the results depend on the site-specific parameters. However, estimates of approximate magnitudes involved can be obtained using a number of plausible operating assumptions for a hypothetical base. The set of such assumptions is shown in Table 1.

Table 1. Operating assumptions: a hypothetical tuna transshipment facility

<table>
<thead>
<tr>
<th>Fishing vessels characteristics:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel size</td>
<td>1,200 GRT</td>
</tr>
<tr>
<td>Fish holding capacity</td>
<td>1,000 tonnes</td>
</tr>
<tr>
<td>Vessel length</td>
<td>61 meters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fishing vessel operating characteristics:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily catch rate</td>
<td>32 tonnes</td>
</tr>
<tr>
<td>Traveling time between the port and the</td>
<td>7 days</td>
</tr>
<tr>
<td>fishing grounds/trip</td>
<td></td>
</tr>
<tr>
<td>Time spent fishing/trip</td>
<td>31.5 days</td>
</tr>
<tr>
<td>Time spent in port/trip</td>
<td>11.5 days</td>
</tr>
<tr>
<td>Total time/trip</td>
<td>50 days</td>
</tr>
<tr>
<td>Number of trips/year</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reefer vessel characteristics:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of calls at the base</td>
<td>Once every 30 or 40 days</td>
</tr>
</tbody>
</table>
Given these assumptions it is possible to estimate the required length of the unloading pier as a function of the number of fishing vessels to be serviced at the base. The results show that pier length necessary for one vessel at a time will be sufficient unless the base is designed to service a very large number of fishing vessels. There are two reasons for this result. First, the probability that two or more vessels will be in port at the same time is relatively small until the total number of fishing vessels serviced by the base increases above 50. Second, the crew of the fishing vessel requires 3—4 days of rest and recreation per trip while the vessel is in port. Thus, the crew can be on rest and recreation while the vessel is waiting in a queue to unload the catch and, therefore, the 3—4 day waiting time does not represent an increment in cost.

MacDonald and Mapes (1985:8) estimate that the length of pier twice the length of the vessels is needed to service one vessel. However, a pier only slightly longer than the length of the vessel is needed if another area for mending of the nets is available. Thus, the cost of constructing a 7.62 x 17.20 meter pier is estimated at US$625,000. However, since the reefer vessel is likely to be larger than the fishing vessels the length of the pier as well as the size of the turning basin will be determined by size of the reefer vessel.

Pier construction costs would be incurred only if the tuna base facility was to be started from "scratch". However, Mattson (1984) reports that pier facilities adequate for transshipments are already in place in all Western Pacific ports he has surveyed. It is assumed, therefore, that a new transshipment base would be established in a port with the existing pier facilities.

This is not the case with cold storage facilities although they are in place at the existing transshipment facilities in Palau and Vanuatu. The required capacity of cold storage facility depends on the frequency of reefer vessel calls and the number of fishing boats to be serviced by the base.

Approximately four cubic meters of capacity is required to store one tonne of frozen tuna. Assuming a cold storage building height of 4.572 meters, 0.886 square meters of floor space per tonne would be required. It is difficult to obtain more than a very crude estimate of the construction costs but US$100 per 0.093 square meter appears to be reasonable. To this must be added US$150,000 for cost of the refrigeration plant and its own building.

Table 2 provides estimated investment costs in cold storage facilities for the various scenarios discussed above. These cost estimates are subject to a wide margin of error. Nevertheless, it is possible that the cold storage facilities would represent the most expensive component of the tuna base infrastructure. It is also obvious that the capacity of the required cold storage facility is very sensitive to the frequency of calls by the reefer vessel. The service frequency, however, is a decision variable if the reefer vessel is chartered and dedicated to service the tuna base. Thus, it may appear that the frequency of service could be easily increased to reduce the size of cold storage facility and the required investment.
Table 2: Investment costs for cold storage facilities under different assumptions

<table>
<thead>
<tr>
<th>Number of fishing vessels</th>
<th>Frequency of reefer calls</th>
<th>Required storage capacity</th>
<th>Investment in cold storage facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>30 days</td>
<td>500 tonnes</td>
<td>US$ 630,000</td>
</tr>
<tr>
<td>25</td>
<td>30 days</td>
<td>2,500 tonnes</td>
<td>US$ 2,500,000</td>
</tr>
<tr>
<td>5</td>
<td>40 days</td>
<td>667 tonnes</td>
<td>US$ 785,000</td>
</tr>
<tr>
<td>25</td>
<td>40 days</td>
<td>3,334 tonnes</td>
<td>US$ 3,330,000</td>
</tr>
</tbody>
</table>

An increase in the frequency of reefer calls at the facility may not be a solution. Given the number of fishing vessels to be serviced by the base the increase in frequency of calls by the reefer vessel would reduce the required size of a reefer. However, there are significant economies associated with the vessel size, that is, the larger the size of the reefer vessel the lower the costs per tonne of cargo transported. These cost savings are reflected in charter rates. Because of this trade-off as well as other considerations (such as the distance from the base to the cannery, loading and unloading rates, and the vessel speed) the optimum number and size of reefer vessels as well as the optimum capacity of the cold storage facility can only be obtained by modelling the tuna operating base as a system.

Investment in a cold storage facility, however, can be avoided if frozen tuna is transshipped in refrigerated containers. Of course, investment in refrigerated containers would be required and this investment is sizeable. According to Mattson (1984:32) forty-six 40-foot (12 meter) containers are required to handle a 900 tonne shipment of frozen tuna. He also estimates that at least three containers will be needed to support the monthly shipment of one container due to the one-way haul of frozen tuna and return of empty containers. At approximately US$30,000 per container this represents an investment of over US$4 million.

While the ownership of containers is usually the responsibility of the shipping companies, these costs would ultimately be passed on in the form of higher freight rates on shipments of tuna from the transshipment base to the overseas cannery. On the other hand, this method of transshipment reduces the required port infrastructure to the provision of the site for container storage, and the installation and maintenance of electrical outlets. The equipment for handling containerized cargo is currently available in almost every port.

Lower handling costs are another possible advantage of containerized shipments. However, because of the known shortage of refrigerated containers in the region and the large required investment it is less likely that this method of transshipment would be adopted.

In addition to wharves and a cold storage facility, Sperling (1984) lists the following as "basic" infrastructure requirements for a tuna base:
(1) Icemaking facilities sufficient to supply base internal requirements as well as those of the fishing fleet, particularly pole-and-line boats with no refrigeration capability;

(2) Machine shop with lathes, shaper, milling machine and similar metal working equipment, welding/brazing capability for mild and stainless steel, aluminum, bronze and a furnace for preheating cast iron prior to welding, drill and hydraulic presses, and a complete line of hand and portable electric tools;

(3) A "clean" room or shop for servicing diesel fuel injectors and pumps, and for hydraulic motors, pumps and control valves, and the appropriate equipment to perform such servicing;

(4) An electric/electronic repair shop with the equipment to test for faults and circuit continuity, and an oven for baking out motor and generator windings, coil rewinding capability, etc.;

(5) Shore power connections for fishing vessels;

(6) Refrigeration shop for servicing both the base and vessel equipment such as compressors, condensers, expansion valves, etc.;

(7) A service slip or wharf area for resupplying vessels and unloading heavy machinery components for repair;

(8) A slipway large enough to accommodate the largest vessel in the fleet; and in this age of the superseiner such a facility must be quite large. Regardless of scale, the slipway should be equipped to handle all aspects of vessel underwater hull maintenance and repair, and at reasonable cost. The machine and other specialized shops should be a part of the slipway complex, but located so as to have easy access from either the slipway or wharf area;

(9) A separate wharf, safely removed from the main wharf area, should be provided for bunkering the fleet. Both the main and bunkering wharves should have potable water outlets as well.

Sperling (1984:3) also lists specialized infrastructure requirements. These include facilities needed to supply inputs to fishing vessels or for the preservation of fish, provision of electrical service of appropriate voltage, a suitable gear loft—essentially a fairly large open air shed for shelter from the sun and rain—for the repair, modification and/or maintenance of fishing gear. He also mentions a gear supply store with an inventory of replacement fishing gear and for longliners an adequate supply of frozen bait.

Among the social infrastructure requirements Sperling (1984) lists good hostel to accommodate fishing vessel crews with some entertainment and recreation facilities and a well-regulated whorehouse.

Not all of the listed facilities need to be provided in a base
designed to service distant-water purse seine vessels. Furthermore, it will be economically feasible to supply a complete complement of these facilities only in a base designed to service a large number of fishing vessels. This is particularly true of the various repair facilities which require a highly qualified staff of experts with skills scarce in the region. The decision as to which of these facilities to include in a base will depend on proximity of similar facilities available elsewhere in the region and the number of fishing vessels to be serviced. Moreover, which of the listed facilities would be provided by the Pacific island government and which by the private parties depends on the type of operation adopted. These decisions as well as the estimation of costs should be a part of the feasibility study once the site for the base is identified.
There are a number of ways the construction and development of base infrastructure facilities could be financed. The financing options depend, in part, on the role of the island government in management and operation of the base.

Ownership of facilities by government may be a preferred option if aid funds are available for the construction of the base or if loans can be secured for this purpose from international lending institutions (for example, World Bank or regional development bank). Nevitt (1983:35) lists the following advantages of the World Bank or regional development bank loans:

(1) The loans tend to be for longer terms than might otherwise be available;

(2) The interest rates tend to be lower than would otherwise be available;

(3) Participation by the World Bank or regional development bank endorses the credit for other potential lenders;

(4) A co-financing arrangement or a complementary financing arrangement may be possible, whereby commercial bank loans are linked with the World Bank or regional development bank loans.

The government could operate the fishing base in a similar manner as it operates other ports. This manner of operation, however, has two major disadvantages. First, few ports are being operated profitably, that is, most of them are heavily subsidized. The second disadvantage pertains to the functions to be performed.

Mattson (1984:21) concludes that the major problem to be overcome in creating a viable transshipment endeavor is the lack of a "coordinator," the role previously played by the major U.S. tuna packers, Japanese trading companies and European buyers. The disappearance of these coordinators has created a "vacuum" which has an impact on the potential feasibility of tuna transshipments. Mattson contends that tuna transshipment must be managed as a system in order to provide the necessary coordination. This system would include all facets of fishing, maritime transportation and even marketing.

Given these requirements a private firm with extensive knowledge of markets as well as experience in business logistics would probably do a better job of managing the facility than would a government agency. Such a firm is likely to be foreign-owned although joint venture arrangements with or without government and domestic and/or foreign firms are feasible.

A variety of contractual arrangements are possible between a government and a company selected to manage a base. At one extreme is a pure service contract according to which the company manages the base for
the government for a fee and government receives all gross proceeds from base operation. The service fee, in turn, may be a fixed fee or be based on the percentage of gross or net revenue generated by the base. The latter type of arrangement provides an incentive for the company to operate the base efficiently. Another option is a fixed fee plus a percentage of either gross or net revenue.

The method of payment (that is, the fee) specified in a contract determines the allocation of market risk between the government and the managing company. In a fixed fee contract the government bears all the market risk. In a service contract based on gross or net revenues part of the market risk is shifted to the managing company.

A "concession" type of contract is an alternative to the service contract. In this type of contract the management company pays a negotiated fee to the government for use of the base facilities. The "true" lease is one example of this type of contract. The lease terms, in turn, could be a fixed dollar amount per year or could vary as a percentage of gross or net revenue or be a combination of the minimum fixed amount and the percentage of gross or net revenue above some specified level. Again, the terms of lease payments determine the degree of risk borne by the government. With a fixed lease payment the risk is borne by the management company and with lease payments tied to gross or net revenues the government shares in the market risk but also benefits from the increased revenues and/or profits.

So far, it was assumed that the government would construct and retain ownership of the infrastructure facilities. At the other extreme, the government under contractual arrangements, could require a foreign firm to construct all infrastructure facilities for its own use and the use of other operators as well. Requirements such as these have been included in some concession agreements. Smith and Well (1975:106), for example, cite the long access roads to iron ore mines in Liberia which were opened to other users. This led to the development of small rubber farms and other cash cropping that did not extend to the interior before the roads were built. Similarly, the building of the first section of the Trans-Gabon Railway in Gabon, which was intended to take iron ore from eastern Gabon, was expected to benefit the timber industry. In some development projects, particularly in remote areas, the concession-holders are asked to provide community services beyond what is normally required for the concession's community. These services include schools and hospitals.

Concession agreements which include these types of requirements pertain to large projects with high expected rates of return. In the case of a tuna operating base the government could require the developer to construct larger port and power generating facilities than those needed for its own operation as well as require provision of some social infrastructure. These requirements, however, may be self-defeating, that is, given the small size of the project, they may make the project financially unviable.

Still another option is for government to construct the base facilities but to offer a lease with a purchase option. The lease payments
could be so structured that the title passes unconditionally to the lessee upon the final rent payment under the lease or it could include the negotiated purchase price at the termination of the lease. These types of leases are very popular in Japan and the so-called Shogun leases are available to foreign lessees. According to Nevitt (1983:80) a Shogun lease is a lease offered by a Japanese leasing company to a foreign lessee in fixed rate yen which is funded domestically in Japan. Shogun leases are generally available in the range of US$10—100 million for up to 15 years term with low effective interest rates. However, the lessee must assume the foreign exchange risk.

In short, there are a variety of financing options available for the development of tuna base infrastructure facilities and for its management. However, there are no general rules for choosing the best option. The preferred choice can be determined only for a specific case since it would depend, among others, on the availability and terms of loans available to a government from the World Bank or regional development banks vs. the availability and terms of loans available to the foreign companies, assessment of various risks involved, the risk preferences of the government and the foreign company, legal considerations and tax policies not only in the island country but also in the home country of the foreign company, etc. Furthermore, the ownership, management and other contractual arrangements are not independent of service fees, lease rents and user charges discussed below.
OPTIONS FOR DETERMINING SERVICE FEES, LEASE RENTS AND USER CHARGES

Suppose that initially we assume a scenario in which the government contracts with a private foreign company to operate a fishing base. The company either owns fishing boats or contracts with private boat owners and performs all functions including marketing of the catch. The base infrastructure is owned by the government and the contract with the company is either service contract or a lease. In this scenario the determination of the actual level of service fees or the lease rent will depend on the method used to select the management company or the lessee.

Auction

If the government selects a managing agent by auction (either sealed bid or oral) the level of service fees or the lease rent is determined automatically through the bidding process.

This automatic determination of the service fees or lease rents is not the only advantage of using an auction. If a large number of bidders is expected, the service fee may be lower or the lease rent may be higher than those resulting from negotiations with individual companies since the auction participants will be bidding against each other. Furthermore, in auctions there is less opportunity for corruption.

There are also some disadvantages. The auction may not be desirable if only one prospective bidder is expected and if only few bidders are expected there is a possibility that they may collude among themselves in order to reduce the winning bid price. As a partial remedy the solicitation of bids should specify the maximum service fee or the minimum (upset) rent acceptable to the government and reserve the right to reject all bids and to negotiate a contract instead.

Negotiation

If the selection of a management company or a lessee is made by negotiation, the actual service fee or the lease rent will be the outcome of those negotiations and as is the case with all two party negotiations, the outcome is a priori indeterminate. It is possible, however, to estimate the highest lease rent the firm will pay rather than forego leasing the base or the lowest lease rent that the government would accept (or vice versa for the service fee).

The maximum lease rent a company would be willing to pay for use of the fishing base is equal to the CIF market value of the catch less the sum of all operating expenses, normal profit on investment and the premium for risk. Thus, for example, the expected trend in tuna prices will directly affect the maximum amount of lease rent a company would be willing to pay. Similarly, any other contract terms, which indirectly affect either the costs or the risk would also affect the maximum amount.
One of these contract terms is the length of the lease or the length of the service contract. A long-term, fixed rent lease will be preferred by a company if tuna prices are expected to increase and vice versa. However, length of the lease is usually associated with increased risk and, thus, a higher risk premium. Furthermore, the longer the lease term the more detailed the terms of the lease have to be in order to anticipate any long run contingencies that may arise. For both of these reasons even a long term lease or a contract usually specifies periodic renegotiations every five to seven years. This requirement probably benefits both parties.

Economic impact

Relative to the lease rent the government should consider any aggregate benefits the tuna base is expected to generate in the domestic economy. These benefits are not equal to the payments by the company to the government but are rather benefits that accrue to any individual in the domestic economy. For example, suppose that the only direct effect of the transshipment base on the local economy is through wages paid for loading and unloading of tuna. Let us further assume that the loading and unloading rate is 110 tonnes per 24 hours, that this requires 960 worker hours and that the wage rate is US$1 per hour. Given these assumptions, a transshipment base that handles 5,000 tonnes per year would generate a total wage bill of US$87,300 per year. Suppose that the regional income multiplier is 1.8. Then the total aggregate benefits of the base to the local economy would equal US$157,140. Therefore, given the choice, the government would be better off with the transshipment base and a subsidy less than US$157,140 rather than have no base at all. This is obviously the worst case scenario and is used to emphasize the point that the aggregate benefits to the economy generated by a base rather than payments by a company to the government in any form is the relevant criteria for decision-making. Actually, the negotiated lease rent is likely to fall in the range between the maximum amount the firm is willing to pay and the minimum amount that the government is prepared to accept (vice versa for a service fee). It is the purpose of the preliminary feasibility study to determine the maximum amount a company would be willing to pay in order to guide the country's negotiating posture.

Government operation and pricing

So far it was assumed that the government would contract a foreign company to operate the base and to perform all functions associated with the integrated fishery operation. An alternative scenario calls for the government to operate the base and to provide the usual port services to individually-owned or company operated fishing vessels. The boat owners, individually or jointly, or the company could undertake marketing of the catch as well as coordination of the logistics of transshipments. In this scenario the government would set user fees.

Unfortunately, the current practice of pricing for use of port facilities provides little guidance as to what these charges should be. Heggie (1974) compared the principal dues levied in nine major ports in Pacific Islands Development Program - 16
various countries of the world. His comparison shows that dues vary substantially between the nine ports indicating the lack of agreement on any universal pricing principles. He further found that the financial objectives of public port authorities are rarely made explicit, that individual port tariffs lack an obvious rational basis, and that the implicit objectives often contradict other national policies.

To an economist the role of the pricing system is to encourage the efficient use of existing facilities and to provide guidance on investment or disinvestment in them. According to Heggie (1974) pricing does this in three main ways:

(1) It measures the aggregate demand for each service and hence determines its (social) profitability in relation to other competing infrastructure facilities;

(2) In the short run it leads to the most efficient use of existing facilities by rationing scarce facilities and by encouraging the use of any excess capacity; and

(3) in the longer run it not only determines whether effective demand warrants the continuation of existing services but also determines the demand for new or improved facilities (that is, it guides innovation and investment policies).

In order to achieve these objectives prices need to be related to social opportunity costs. That is, they need to be based on the marginal opportunity cost of the resources used to provide each service. If users are prepared to meet this cost by the actual prices they are prepared to pay, it is then reasonable to suppose that they prefer to purchase this service rather than the alternative goods and services (opportunities) they have implicitly foregone. Economists, therefore, recommend that prices for port services be set on the basis of the marginal cost of providing the particular service.

The introduction of marginal cost pricing, however, involves some conceptual as well as practical difficulties. The main problem is that, where there are economies of scale, the application of marginal cost pricing will give rise to losses and the need to subsidize port authorities. To avoid subsidies Heggie (1974) recommends the traditional demand-based pricing (that is, charge what the "traffic will bear"). An alternative to demand-based price discrimination is the two-part tariff suggested by Walters (1976), in which a fixed charge is levied (say annually) to recover unassignable costs, combined with a low variable usage rate.

Marginal cost pricing will generate losses, however, only if port facilities are not congested. For congested facilities the marginal cost pricing principle requires that charges be levied high enough to eliminate uneconomic waiting in a queue or congestion at other facilities. Thus, for congested facilities the general rule is to charge prices considerably above the average cost. The main problem is to estimate the appropriate level of charges which is by no means a simple task.
The best strategy is probably for a government (port authority) to assess charges closely linked to identified costs of different services provided by the port. Port services are conveniently divided into two kinds:

(1) Services rendered to the vessel, such as provision of navigation aids, a dredged channel, tugs and berth space.

(2) Services which are provided for cargo such as wharf space, transit sheds, handling and transshipment services.

Traditionally, the port will charge the ship owner for ship services and the cargo owner for the services of the wharf and its facilities. Thus, the port authority could develop costs of providing these various services plus assess a fixed annual fee to defray common and joint costs of the tuna base operation.

As an alternative, the port authority could adopt average cost pricing, the main purpose of which is to assure that the port authority recovers all costs of operating the port. The application of this method is relatively easy because Applied Systems Institute, Inc., under a contract with the Maritime Administration (MarAd), U.S. Department of Transportation, has developed a method, that is, a formula, for deriving "reasonably compensatory prices" for usage of public marine terminal facilities. The focus was on the determination (based on cost) of dockage and wharfage tariff rates, rental prices for leased terminals, and rental prices for cranes and equipment. Although developed for U.S. ports, the formula can be easily adopted for any port in the world. The adoption of the formula is greatly facilitated by the step-by-step usage guide provided in Volume II of the report which includes all the forms to be used for application of the formula.
CONCLUSION

Purse seine fleets will be the most likely users of tuna transshipment facilities in the Pacific islands region. The total investment in infrastructure for these facilities will depend on the frequency of calls by reefer vessels and on the number of fishing vessels to be serviced at the base. The most expensive component of these facilities is cold storage. The investment in other port facilities is relatively small and could be avoided if the fishing base is established at an existing port. The total investment in infrastructure facilities in a relatively small base (for example, one serving ten purse seiners) should be in the range of US$1—2 million.

There are a number of ways the construction and development of the base infrastructure facilities could be financed as well as a number of options for its management. At one extreme, the government could construct, own and operate the base. At the other extreme, the base facilities could be constructed, owned and operated by a private company. A wide variety of arrangements is possible between these two extremes. The government, for example, could own the base facilities but lease them to a private company with or without the right of purchase. Alternatively, the management of the base could be contracted to a private company. In some cases the construction of base facilities by a government would be preferred because better loan terms could be obtained from the World Bank or a regional development bank than those available to private companies.

If the base is leased to a private company or if a management company is retained, the terms of the contract and, in fact, the need to develop service fees, would depend, in part, on the method used to select the private companies. If an auction, for example, is used the level of lease rent would be determined automatically. If the government, however, operates the base as a port, the user fees for each service would have to be determined. Although universally accepted port pricing principles do not exist, a port authority could develop a cost based tariff.

This report discusses the major factors to be considered in general when planning a tuna operating base. The selection of the most appropriate ownership and management arrangements involves site specific parameters the values of which can be determined only when a specific site of the base is identified. This is the main function of the full scale feasibility study.
1. Dublon Island, The Federated States of Micronesia, Manus or Rabaul, Papua New Guinea, and reactivation of the former Van Camp transshipment and freezer facility in Palau.

2. De Weille and Ray (1974:258) have shown that the mean length of the queue and the mean waiting time per ship can be calculated if the following assumptions are made: (see De Weille and Ray (1974) for formulas)

(i) The time between successive arrivals is a random variable and has a negative exponential distribution. As a consequence of this assumption, we have the probability that any number of arrivals occur within an interval of time given by a Poisson distribution.

(ii) The service time per ship is a random variable and has a negative exponential distribution, with the mean service rate, as the parameter. The service rate is the inverse of the service time.

(iii) All berths have the same mean service rate.

(iv) There is no limit to the length of the queue.

(v) The order of servicing is on a "first come, first served" basis.

Given these assumptions, it is possible to determine, in a steady state, the mean length of the queue as well as the mean waiting time.

3. The probability of at least one fishing vessel being in port at the same time as the reefer vessel is not considered since it is assumed that in such a case the transfer can be made directly from the fishing vessel to the reefer vessel and that this can be done while the reefer vessel is being loaded from the cold storage facility.

4. The slipping of medium to large purse seiners in the islands region is realistically unlikely to take place. This is because these services are readily available in Asian or Australian/New Zealand ports at reasonable cost and larger sized seiners can easily make the trip to these ports for this service.

5. Vertical integration of the industry has many advantages but some industry observers maintain that from the point of view of Pacific island countries, this role should not be played by foreign canning or trading interests.

6. In a "true" lease the lessor does not intend to transfer the ownership to the lessee at the expiration of the lease.

7. One successful example of such an operation is Zee Enterprises currently transshipping from Tinian and using Guam as an operational base (Mattson, 1984).
8. Heggie (1974) provides an example of a cost-based tariff in the appendix to his paper.

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Pacific Islands Development Program - 23
The purpose of the Pacific Islands Development Program (PIDP) is to help meet the special development needs of the Pacific Islands region through cooperative research, education, and training. PIDP also serves as the Secretariat for the 1980 Pacific Islands Conference, a heads of government meeting involving leaders from throughout the Pacific region, and for the Pacific Islands Conference Standing Committee, which was established to ensure follow-up on development problems discussed at the Conference.

PIDP's research, education, and training activities are developed as a direct response to requests from the Standing Committee. PIDP's projects are planned in close cooperation with the Committee to ensure that the focus and the organization of each project address the needs identified by the heads of government on the Committee, a process which is unique within the East-West Center and in other research and educational organizations serving the Pacific.

A major objective of the program has been to provide quality in-depth analytical studies on specific priority issues as identified by the Pacific Island leaders and people. The aim is to provide leaders with detailed information and alternative strategies on policy issues. Each Island country will make its own decision based on national goals and objectives. Since 1980, PIDP has been given the task of research in six project areas: energy, disaster preparedness, aquaculture, government and administrative systems, roles of multinational corporations, and business ventures development and management.
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