Cost-Benefit Analysis of Tuna Value Chain & eCDTS in Bitung, Sulawesi, of Indonesia

Summary Report

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ABSTRACT

This study comprises cost-benefit analysis (CBA) of tuna value chain in Bitung (Indonesia) and evaluation of USAID assistance for development of eCDT technologies. It includes estimates of financial and economic returns at different stages of tuna value chain: fishers, fresh and frozen tuna processors and packed tuna processors, establishing their contribution to economic growth and tax collection. In addition, the study conducts cost benefit analysis of USAID assistance for development of different types of eCDT technologies and examines their financial and economic viability and net economic contribution due to efficient utilization of inputs and tuna resources. The results show that the tuna value chain makes significant contribution to the local economy and the development of eCDT technologies has contributed towards better management of tuna resources. The CBA models are built based on Harberger-Jenkins methodology.

ACRONYMS & ABBREVIAITONS

BC Ratio	Benefit Cost Ratio
CBA	Cost Benefit Analysis
CIT	Corporate Income Tax
eCDTS	Electronic Catch Documentation Traceability System
eCDT	Electronic Catch Documentation Traceability
EIRR	Economic Internal Rate of Return
FIRR	Financial Internal Rate of Return
FAF	Fresh and Frozen
GWT	Gross Weight Tonnage
IDR	Indonesian Rupiah
MT	Metric Ton
tpd	Tons per day
VMS	Vessel Monitoring System
VAT	Value Added Tax

INTRODUCITON

The analysis is based on literature research and a weeklong fieldwork in Bitung and Manado areas of Sulawesi Province in Indonesia from 9-17 January 2020. USAID Ocean provided the necessary support: Frengky Sihombing and Nina Dwisasanti organized the fieldtrips; John Parks and Farid Maruf provided the long-distance support.

The tuna value chain in Bitung area comprise fishers, fresh and frozen (FAF) tuna processors and canned tuna processors. The processing companies in the area have their own cold storages and generally deal directly with the fishers. Some of the bigger processing companies have their own fishing fleets, tuna collection centers and ducking facilities. However, government owned Oceanic Fishing Port Authority operates in Bitung area since 2003, which manages a harbor of 45000 MT cargo handling capacity.

Bitung is one of the important tuna fishing areas in Indonesia. In 2018, Bitung harvested some 55000 metric ton comprising tuna (45%), skipjack (48%) and Deho (7%). The fishing technologies used were Hand Line (22%), Longline (38%), Pole and Line (11%) and Purse Siene (29%). Some 23275 fishers were involved, operating 385 vessel of 5-10 GWT, 336 vessels of 11-30 GWT, and 184 vessels of +30 GWT capacity.

Indonesia commands about 17% of the global tuna market. It exports 70% of the total production, which may be higher for the Bitung area. Approximately 60% of the export is canned tuna and 40% is fresh and frozen tuna. USA is the major export market. Other export destinations are European Union, Japan, Vietnam and the Middle Eastern countries. Indonesia's tuna catch value is about 5 billion USD. The sector employs some 3.3 million people.

The cost benefit analysis (CBA) of tuna value chain and USAID Oceans intervention are conducted by using Harberger-Jenkins methodology. In total six CBA models are built: one each for 5-10 GWT, 11-30 GWT and +30 GWT fishing entrepreneurs, fresh and frozen tuna processor, canned tuna processor, and one each for eCDT technologies, which comprise of e-Logbook, Pointrek, and TraceTale.

Field data are used for the estimates of costs and benefits; market data are used for estimating the cost of financing; and World Bank's data (for Indonesia) are adopted for computation of foreign exchange premium. Economic conversion factors are computed by incorporating the foreign exchange premium and market distortions in the Indonesian economy. The economic and financial discount rates (real) are assumed at 10% and 12%, respectively.

Each CBA model has nine sub-headings. The sub-headings comprise the table of parameters, preparatory tables, financial analysis, economic analysis, sensitivity analysis, net economic value addition, and scenario analysis. Tax contributions are also estimated wherever relevant. The models are presented in excel sheets: namely, 5-10 GWT, 11-30 GWT, +30 GWT, FAF Industry, Canned-Industry, eCDT, Data-Bitung, Economic-CF and Inflation. A tab is also created for the summery report. The details of assumptions and calculation are provided in each excel sheets.

FISHING OPERATION

The fishing operation is categorized into small, medium and large-scale fishers. In this analysis, entrepreneurs with vessel capacity of 5 to 10 GWT are categorized as small-scale fishers; with vessel capacity of 11 to 30 GWT as medium-scale fishers; and with vessel capacity +30 GWT as large-scale fishers.

Small-scale fishers work under informal setting with single or a few fishing vessels. However, the medium and large-scale fishers are organized as business entities. They own a fleet of vessels including dedicated carrier vessels. Small-scale fishers pay VAT. Large-scale and medium scale fishers pay VAT and corporate income tax (CIT). The VAT and CIT in Indonesia are 10% and 25%, respectively. About 70% of the production goes as input to processing industries, hence it is not subjected to VAT. The VAT collection at the fishing enterprises is only from 30% of the total production.

Each vessel user makes two trips in a month. The fishing crew size varies from nine to twenty-one members. Fuel and food supplies constitute the major chunks of the operating cost.

The prime fishing period lasts for nine months, starting from the beginning of June to end February. The harvest decreases to a half during the lean period, namely March, April and May. Annually, on the average, small-scale fishers harvest 10.5 MT; medium scale fishers, 26.1 MT; and large-scale fishers harvest 93 MT.

The fish harvest is categorized into A, B and C. The category A and B constitute 70% of the harvest. These categories fetch IDR 66000 per kilogram of tuna, occasionally commanding higher prices on bigger tunas if exported directly from the port. The category C constitutes 30% of the harvest, and it fetches IDR 40000 to 45000 per kilogram. The pricing remains similar even for vertically integrated fishing enterprises.

Normally, a mix of equity and bank loan finances the fishing operation. The share of loan varied from 50% to 70%, and it carries an annual nominal interest rate of 10%, payable over a period of three to eight years. The capital investment is for the purchase of vessel, and there is a need for borrowing operating expenses in the case of medium and large scale fishing operation.

The fishers are engaged on profit sharing basis. The profit is derived by subtracting operating expenses from the revenue. The share of fishers varied from 30% to 40% of catch value. The details of estimating the operating costs and sales revenues are given in sheet:5-10GWT, sheet:11-30 GWT and sheet:+30 GWT. The summary results of CBA are given in Table:1 below.

In real term, the average financial internal rate of return (FIRR) to fishing entrepreneur is 18%. However, the economic internal rate of return (EIRR) is more than three folds. The EIRR is highest for +30 GWT fishing vessels. The EIRR is estimated by removing economic-wide distortions in capital expenditures and operating costs, including adjustment for foreign exchange premium

Table 1: Results of CBA, Fishing Operation

FISHING OPERATION	EIRR %	FIRR %	Net Benefit US$/Kg	Tax US$/Kg	% Share
Small-Scale Fishers (5-10 GWT)	52.88%	14.65%	0.59	0.12	18.98%
Medium-Scale Fishers (11-30 GWT)	53.46%	20.92%	0.55	0.32	27.45%
Large-Scale Fishers (+30 GWT)	70.32%	17.76%	0.66	0.52	53.57%
Weighted Average	**62.4%**	**18.0%**	**0.62**	**0.39**	**100.00%**

The average net economic value addition in the local economy is estimated 0.62 US dollar for each kilogram of raw tuna. Bitung area harvests some 55000 metric ton of tuna annually. This makes annual net economic contribution of 34 million USD in the local economy due to tuna harvest.

In addition, there is value added tax (VAT) and corporate income tax (CIT) especially on medium scale and large scale fishing entities. On the average, the tax contribution is 0.39 US dollar for each kilogram of fish harvest. That amounts to annual tax contribution of 21.27 million USD.

The key risk variables for fishing operation are tuna catch and tuna prices. The scenario analysis establishes that the financial IRR could fall below the benchmark of 12% with a 5% decrease in tuna catch and tuna prices. Detailed movements are given in the tables of sensitivity analysis and scenario analysis.

FRESH AND FROZEN TUNA PROCESSOR

Fresh and frozen (FAF) processing is done primarily for export. Indonesia is one of the key international suppliers of tuna commanding as much as one-sixth of the world's trade.

The region exports some 70% of production as fresh and frozen or canned tuna. Of the total export, the fresh and frozen tuna constitutes 40%.

In Bitung area, there are a number of entrepreneurs involved in fresh and frozen tuna processing business. The size of plants vary from entrepreneur to entrepreneur. Some of the bigger entrepreneurs are vertically integrated companies, from fishing to processing, to assure themselves a sustain supply of tuna.

The capital cost of processing plant is estimated at US 0.5 per kilogram of final output evaluated over the life of the project. The investment is required on land, cold storages, freezers, and vacuuming machines. Normally, the capital requirement is financed through banks with loans at 10% nominal interest rate, payable in equal installments spread over the period of eight years. Generally, the gearing ratio is high to save in corporate income tax payment.

The bulk of processed output is tuna loin. The unprocessed tuna loin is purchased at 66000 IDR per kilogram, same as the selling price of grade A and B tuna. There is a processing loss of 200 kg for every 6000 kg of raw tuna input.

In addition, there is operating cost, which is estimated at IDR 29000 per kilogram of processed output. The share of operating costs are manpower (50%), operating expenses (30%), electricity (5%), water (2%) and miscellaneous expenses (13%).

About 80% of the output is exported. The importing countries are USA, Japan, European Union, Vietnam and Middle Eastern countries. The price per kilogram varies from seven to ten US dollar for export and 65000 IDR for domestic sale.

The details of CBA are given in Excel Sheet: FAF-Industry. Table: 2 below depicts the key results of the analysis.

Table 2: Results of CBA, FAF-Processing Industry

FAF Tuna Industry			EIRR	FIRR	Net Benefit
			%	%	US$/Kg
FAF Processing			28.94%	26.14%	0.67
Corporate Tax	0.022	US$/Kg			
Net Tax Collection	0.025	US$/Kg			

The industry generates financial internal rate of return of 26% and economic internal rate of return of 29%. These returns provide adequate cushion for risk adjustment when examined from the perspective of the hurdle rates. The hurdle rates are 12% and 10% for financial and economic analysis, respectively.

The net economic value addition per kilogram of processed tuna is US$ 0.67. If 40% of the total export were the share of FAF tuna industry, some 15400 ton of fresh and frozen tuna were processed in 2018. That would result in net economic value addition of US$ 10.27 million annually.

The FAF industry pays corporate income tax (CIT) and also collects VAT from its domestic sale. There is also VAT refunds for other inputs, for example, water, electricity and repair and maintenance cost. The CIT collection is 0.022 US$ for each kilogram of processed tuna. To it when added adjusted VAT (netted out VAT), the net tax contribution from FAF increases to US$ 0.025. This makes total tax contribution of US$0.38 million.

The FAF industry is subjected to risk for the changes in input and output prices. As seen in the sensitivity analysis a simultaneous increase of 5% in raw tuna cost and equal percentage decrease in output prices would make the industry unviable financially and economically.

CANNED TUNA PROCESSOR

The canning industry handles 60% of tuna export. It secures raw material from domestic and foreign suppliers. It is a capital-intensive industry requiring investment on land, cold storage facilities, processing plant and logistic infrastructures. The capital cost per kilogram of tuna processing varies upward from 10 cents per kilogram of processed product when accounted for the operation period of 20 years.

The operating cost comprise the cost of raw tuna, labor, water, electricity and repair and maintenance. Each kilogram of raw tuna costs around 45000 IDR, and it comprise almost 76% of the total operating cost. The other costs are estimated as percentage of raw tuna cost; of which, labor is 14% and electricity and water is 4%.

The outputs are cooked flesh tuna and fishmeal. The conversion ratio is 0.45, of which 70% will be tuna flesh and 30% will be fishmeal. The fishmeal is sold in the local market as chicken feed, which fetches IDR 840 per kilogram.

The packed tuna is sold mostly in the international market, which fetches around three US dollar for one kilogram of canned product. The export destination are Europe, Japan and the Middle Eastern countries. The domestic market is tiny, and the market price is around 21000 IDR for 125 gm of packed package.

This industry requires substantial amount in working capital because it requires holding inventory both in raw material and in finished products. Normally, bank financing is resorted to secure working capital, which is normally in US dollar. The interest rate is 7% in nominal terms and loans are available on annual basis or for tenured period.

The details of CBA are given in Excel Sheet:Canned-Tuna. For financial and economic analysis, a plant of 150-tpd capacity is adopted for estimating the internal rate of returns and net value addition in the local economy. The summary results of CBA are given below in Table 3.

Table 2: Results of CBA, FAF-Processing Industry

Canned Tuna Industry			EIRR %	FIRR %	Net Benefit US$/Kg
Canned Processing			27.73%	12.20%	0.23
Corporate Tax	0.070	US$/Kg			
Net Tax Collection	0.068	US$/Kg			

The financial rate of return is 12.2%, which is lower than in the case of FAF industry. However, the economic internal rate of return is 28%, which is almost the same as in the case of FAF industry.

However, the net economic value addition is only one-third of FAF industry on per kilogram basis. This is primarily because of the capital intensive nature of the industry and distortions in input markets, especially water, electricity, and labor. At US$0.23 net economic value addition for each kilogram of packed tuna, the annual contribution to the local economy amounts to US$5.42 million.

The net tax collection is higher as compared to the case of FAF industry. The corporate income tax collection is estimated at US$0.070 per kilogram of processed tuna. This when adjusted for VAT returns it would decrease to US$0.068 per kilogram. This makes annual net tax contribution of US$0.66 million.

The industry is very sensitive to input cost of raw tuna since it comprise almost two thirds of the production cost.

CONCLUSION

The CBA of tuna value chain establishes that it is an important economic resource of Bitung area in Sulawesi province.

At every stage of the tuna value chain there is addition of economic benefit. Annually, net economic addition to the local economy is US$50 million, of which the fishing operation contributes 68%.

The value chain also contributes in tax revenue through corporate income tax (CIT) and value added tax (VAT). The annual net tax contribution amounts to US$22.31 million.

CBA OF eCDTS

To shift away from paper-based catch documentation and traceability (CDT) the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) has been working with USAID Oceans in the development and implementation of electronic documentation and traceability system (eCDTS). In the process, e-logbook, pointrek and tracetale technologies are developed.

e-Logbook

In e-logbook system, the fishers use an electronic tablet in which they enter fishing records while in the sea. Once the vessels arrive at the port, the information is transferred through internet service into electronic information system, which will be available at the click of the bottom. The cost of the electronic tablet is US$ 178, requires replacement in the interval of

every three years, and it has monthly net subscription fee of US10. The government owns the e-logbook, and it is mandatory for vessels over 30 GWT.

Benefits of this technology are timesaving as compared to the paper-based logbook. Savings in time accrue to vessel users, fishing regulatory authority and exporters. Vessels save time in recording fishing information, regulatory authority saves time in documentation and compilation of records, and the exporters save time in obtaining catch origin certificate and avoid loss of income from delay of revenue inflow. For example, in average, paper process could take about 1-2 days back and forth for the staff to the port each of the visit, to finalize the paper.

Table 4 below shows that e-logbook technology is not viable financially for vessel users. Its benefit cost ratio is 0.31. However, it generates economic internal rate of return of 181% and contributes in net economic benefit 0.03 USD for every kilogram of tuna harvest.

A subsidy of about 70% on the purchase of electronic tablet would make the use of e-logbook financially viable for vessel users. More details about its CBA are given in Excel/Sheet/E-CDT under tables 3.01 and 4.01.

Table 4: Results of CBA, eCDT System

Technologies	EIRR %	Net Econ benefit US$/Kg	FiRR %	Benefit/Cost Ratio	Payback Period	
e-Logbook	181%	0.03	-ve	0.31	NA	
Pointrek	268%	0.37	224%	4.32	5.12	months
Incremental benefit	279%	0.30	257%			
TraceTale (1-batch/day)	NA	0.00	11%	0.99	21	months
TraceTale (2-batches/day)	84%	0.01	121%	1.97	11	months
Note: Incremental Benefit is from switching e-Logbook to Pointrek						

Pointrek

The Pointrek has the features of both e-logbook and Vessel Monitoring Sysetem (VMS). Private Service providers manage it, and there is no cost involved from the government side. It requires both capital and operating costs, as is with the case of VMS. The capex cost including one year of airtime is US$1630; the subscription fee from the second year onward is US$540 per year. The system requires reinvestment after every five years.

In addition to the benefits listed for e-logbook, use of Pointrek can save 10% of fuel cost, 2% of supplies cost, and it improves quality of catch by 1%. In addition, there is saving of IDR 280,000 per trip from the avoided cost of radio operator.

Savings in fuel and supplies cost are based on the shorter trips due to better navigation as a result of increased oversight of captains' at sea operations. The increase in catch quality is because of better coordination among the fishing team to locate better fishing grounds.

Also, Pointrek has the potential to replace the use of VMS, which can accrue as benefit to vessel users in terms of avoided cost. However, this benefit is not taken into accounts in the model since use of VMS is mandatory by government regulation.

Other non-quantifiable benefits are fleet management, operational coordination, including information about temperature, wind and wave activities, which are critical for peace of mind for the fishers.

The results of the analysis are given in Table 4 above. The investment on Pointrek technology is financially viable. The investment has financial internal rate of return of 224%, BC ratio of 4.33 and payback period of five months. Its economic rate of return is 268% and generates US$ 0.37 in net economic benefit for every kilogram of tuna harvest.

The incremental analysis, for switching from e-logbook to Pointrek technology, generates financial rate of return of 257% and net economic value addition of US$0.30 on each kilogram of tuna harvest. This supports the shift from e-logbook to Pointrek technology for mass coverage. More details are given in Excel/Sheet/E-CDT, under tables 3.02, 3.03, 4.02 and 4.03.

TraceTales

The TraceTales technology is based on impregnated barcoding of the unprocessed tuna; and it helps improve process control, labor productivity, data system to track inventories and operation process, and it eases compliance requirements of the regulatory authority. The cost of the system vary with the size of operation, but in general, the investment cost is about US$20000 and annual licensing fee is US$15000.

The estimated quantifiable benefits of the technology include 30% labor savings associated with internal tallying/traceability processes (in which 23 employees are involved in daily basis) each day. These employees could work in one shift or two shifts, depending upon the protocol of the processing plants. Also, there is annual savings of 40 labor-days associated with customer audit.

Table 4 above depicts the summary results of CBA. If the operation is two shifts a day, it yields financial internal rate of return of 121%, benefit cost ratio of 1.97, and payback period of 11 months. For it the economic internal rate of return is 84% and makes net economic contribution of US$0.01 for every kilogram of processed tuna.

If the operation is only one shift a day, the investment is barely financially viable and its payback period increases to 21 months. More details about the analysis are given in Excel/Sheet/E-CDT under tables 3.04 and 4.04.

CONCLUSION AND RECOMMENDATION

Tuna industry is important for Indonesia from the viewpoint of economic contribution, tax collection and employment generation. Livelihood of about 3.3 million Indonesians depend upon tuna related activities.

USAID Oceans has made significant contribution to tuna resource management by introducing different electronic catch documentation and traceability technologies in a short period of time. Financial and economic analysis of all technologies have proven that the interventions are robust from the viewpoint of financial sustainability and economic viability.

In total, USAID Oceans provided grant assistance of US$ 448808 through different channels for the development of e-Logbook, TraceTales and ISD Dashboard. The number of estimated users at present are 6500. Based on the above analysis the contribution of USAID Oceans is enormous, yielding very high benefit cost ratio for the total coverage if we take the contribution over the period of next 20 years.

In addition, the benefit of this intervention goes beyond the boundary of Indonesia. Tuna is a global resource. Sustainable management of this resource is in the interest of consumers, who are primarily in USA, European Union and Japan. Those benefits should be attributable to the development of these new technologies.

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