Potency of Transferring Fish Processing Technology as a Tool of Livelihood Improvement
—In the Case of a Technical Cooperation Project in Indonesia—

Kikuko SAKAI
Department of Industrial Policy and Culture, Graduate School of Applied Marine Environmental Studies,
Tokyo University of Marine Science and Technology
E-mail : KikukoSAKAIfish@gmail.com

ABSTRACT

Livelihood improvement strategies play a fundamental role for sustainable coastal fisheries development in many regions throughout the world. Community based livelihood improvement may ensure ongoing sustainability as local communities in Indonesia are engaged in small scale fishing, fish processing and traditional trading activities. Under a three-year technical cooperation project for promotion of coastal fisheries, artisanal fish processing improvement was introduced through community based approaches without changing existing infrastructure and local distribution system. From results of the field study as well as profit simulation, extending preservability may improve the revenue and may contribute to establish a strategy for coastal fisheries promotion with institutional capacity development as well as the multilayered approach to local administration and community.

1. Introduction

Community based coastal fisheries promotion is fundamental to revitalize coastal communities, to manage fisheries resources and to improve fishers’ livelihoods. Fish handling, processing and distribution are considered to be one of keys to contribute the resource management as well as the livelihood improvement. Since a declaration of the Millennium Development Goals by the United Nations, fish processing technique has been transferred for the purpose of sustainable development of rural communities, poverty reduction and female participation as a part of development strategies and also in a frame of international programs and projects.

The Japan International Cooperation Agency (hereinafter referred to as “JICA”) has contributed to capacity development through the deployment of various programs, projects and training activities since 1954. In accordance with the United Nations Millennium Development Goals, rural development strategies to reduce poverty and hunger have been a significant priority for JICA (JICA, WEB1). With regards to fisheries development, JICA has established three principal objectives as follows; 1) promotion for vital and dynamic fisheries villages, 2) stable food security (effective utilization of fisheries resources), and 3) sustainable fisheries resource management (JICA, WEB2).

According to Allison et al., the sustainable livelihood approach is prominent in recent development programs that aim to reduce poverty and vulnerability in communities engaged in small scale fishing, fish processing and trading (Allison et al. 2006). Namely, fish processing should be introduced as one of the measures of livelihood improvement as well as poverty reduction especially for rural community development. However it is required to put questions to select appropriate planning and technique for community based coastal fisheries promotion: can the transferred techniques be adapted to local communities? Do those techniques contribute to fisheries management and livelihood improvement? Who can take a responsible role to monitor and revitalize communities after
the technical transfer?

This manuscript is intended to answer those questions based on the experience of technical transfer as well as its analysis on a technological cooperation project, “The Project for Promotion of Sustainable Fisheries Development in the Republic of Indonesia” (hereinafter referred to as “the Project”). The author’s hypothesis states that a strategy for fish processing improvement can be proposed to ameliorate fishers’ livelihoods. Then the technical applicability and the necessary conditions to introduce the strategy are discussed from the results of field studies as well as profit simulation.

2. Outline of Livelihood Improvement Model

The Project was implemented to develop the capacity of local government to establish the livelihood improvement model. It can be considered that the local governments are favorable for community development as they retain the same languages, cultures and customs with local people. Then local governments understand each process of development and take possible action by planning and implementing regional policies and strategies. Satria et al. state that fisheries community management systems, involving traditional rules or local wisdom, contain valuable norms of how to wisely treat natural marine resources. In addition, those systems are self-monitored by local fishers, and enforced by local moral and political authority (Satria et al. 2004). In the case of Thailand, Chenkitkosol et al. comment that coastal resource management by local government is preferred as the central government cannot afford to allocate sufficient manpower and budget for surveillance and control (Chenkitkosol et al. 2006). It is considered reasonable and proper that the institutional capacity development mainly targeted to local government as a project for sustainable coastal fisheries development.

Salayo et al. mention that community based coastal fisheries is one of the key issues for sustainable fisheries development. This is especially true for the large populations living in Southeast Asia, where small-scale fisheries play a crucial role in the provision of livelihoods, food security and income (Salayo et al. 2008). They also declare that one of the important policy directions is building institutional capacity for an integrated approach at all levels of governance from local up to international. This is needed to develop coordination and partnerships among the various stakeholders (Salayo et al. 2008). Therefore, it is fundamental for coastal fisheries development to establish institutional capacity as well as to enhance governance by facilitating local empowerment.

Considering the Project activities from the donor side, Pomeroy et al. explain that external agents assist the community in defining the problem; provide independent advice, ideas, and expertise; provide training and technical assistance; guide joint problem solving and decision making; and assist developing management plans in terms of co-management in Asia (Pomeroy et al. 2001). They also mention that the external agents fill a special role to draw out insight with a participatory style of facilitation, to process the insight and to guide the community in reaching its goals (Pomeroy et al. 2001). They comment that the external agent should have a temporary relationship with the co-management advice, serving their particular function and then phasing out (Pomeroy et al. 2001).

Jentoft indicates that managers would be careful not to damage the social structure and culture of fisheries communities by fisheries management or other measures. Because they would avoid management designs that threaten the social fabric of fisheries communities and would adopt designs that restore and reinforce the solidarity and cultural qualities of fishing communities (Jentoft 2000). As they say, experts from donor agents may assist a community to comprehend existing problems and needs then to plan development programs and to implement technical supports during the project period. One of the difficulties might be that new techniques as well as development strategies should be accordance with local structure and culture and should not threaten the social structure of fisheries communities.

Moreover Alcala mentions that partner organizations which initiate community-based coastal resource management (CBCRM) projects are prepared to support these projects financially for only 2 or 3 years generally,
whereas 4 to 5 years are required for a community to establish viable organizations that are capable of formulating and implementing development plans (Alcala 1998). In general, the allowable period for technical transfer is limited. Therefore, external agents as well as individual experts should propose improvement measures in the period of technical transfer through workshops, meetings and future roadmaps.

Following those studies, the author reviews Project activities and its results in the field of fish processing. It is also intended to consider technical adaptation of fish processing for the purpose of livelihood improvement, fisheries management and capacity development of local government.

3. Outline of the Project

3.1 Project design

A technical cooperation project, "The Project for Promotion of Sustainable Fisheries Development in the Republic of Indonesia" (hereinafter referred to as "the Project"), was implemented from August 2006 to August 2009 for the purpose that "promotion model(s) for improvement of fishers’ livelihoods is formulated by the Project and recognized by the State Governments of West Nusa Tenggara Province (hereinafter referred to as "NTB") and East Nusa Tenggara Province (hereinafter referred to as "NTT") (JICA 2006). Three objectives, resource management, livelihood improvement and effective utilization of fisheries resources, were set to achieve the Project purpose (JICA 2006). In the middle of the Project, JICA sent a project consultation team to monitor and evaluate progress of the Project.

Concerning the livelihood improvement, the Project team implemented a baseline survey with a short term expert and an Indonesian consulting agency. Then the team has conducted workshops to research on household economies in villages surrounding the Waorada Bay. Then the expert introduced fishers’ household management by keeping them to recording household account books in Rompo (Fig. 1). Reflecting the result of the baseline survey and the household economy research, a long term expert continued to monitor the household economies and conducted the Mini Project to increase the revenue of fishers (Iwamoto, unpubl. report, Aug. 2008, in Japanese). Fish handling using cooler boxes as well as artisanal fish processing, such as steamed fish, were included in the Mini Project (Fig. 1). Therefore the consultation team evaluated those project activities and recommended modifying the third approach, development of fishing techniques, for fish processing, expecting clear results for livelihood improvement through effective utilization of fisheries resources (the Minutes of Meeting between Japanese Consultation Team and the Authorities Concerned of the Republic of Indonesia on Japanese Technical Cooperation for the Project, signed Nov. 2007). As recommended by the consultation team, a short term expert for fish processing was dispatched from November 2008 to January 2009 as well as from April to June 2009.

From the points of sustainability, the fish processing improvement was designed to conform to the existing way rather than to alternate infrastructure. The improvement approach was also intended to increase local incentives. For these reasons, the approach included three steps: field survey to analyze the existing situation of fish processing and distribution (Field survey I and II, Fig. 1), a participatory workshop to discuss problems in fish processing (Workshop I, Fig. 1) and then practical workshops to propose improvement (Workshop II, Fig. 1). These steps and number of participants of workshops were shown on the Fig. 1. The field survey was mainly conducted with counterparts of DKP Bima as a majority of people in fisheries villages spoke in a local dialect, Bima language. Then a counterpart from Ministry of Marine Affairs and Fisheries participated in the later phase, from April 2009. It was purposed that both local and national governments participated in those improvement activities to establish future strategies for coastal fisheries promotion respecting local initiatives.
Livelihood improvement
From Dec 2006 to Nov 2007

- Fishers’ household management
  - Mini Project
    - Selling fresh fish using cooler box
    - Steamed fish

Fish Processing
From Nov 2008 to Jan 2009

Project review
Field survey I
  - Fisheries infrastructure
  - Fishers’ activities (daily, monthly)
  - Local fisheries products

Fish processing improvement
Object: Quantitative management
Method: Preservability improvement
Product: Smoked salepe
Target village: Rompo
Target group: Palele

Fish Processing
From Apr 2009 to Jun 2009

Field survey II
  - Fish processing
  - Distribution

Preparing manuals
  - Workshop I
    - Participatory workshop: 38 participants
  - Workshop II
    - Demonstration of smoked salepe processing: 12 participants
    - Practical workshop: 7 participants, 12 participants

Fig. 1 Overview of fish processing improvement
Source: Prepared by the author

3.2 Project site

According to the Project implementation study, the target area for technical transfer was defined as villages surrounding the Waorada Bay in Bima regency as rural fisheries villages were dotted in the area and fishers have disadvantages in the access to their markets as well as lack of water during the drying season (JICA 2006). As shown on Fig. 2 and Fig. 3, NTB consists of Lombok Island and Sumbawa Island. Bima regency is located in the eastern region of Sumbawa Island. The field studies were implemented in villages in Bima regency, such as Rompo, Karampi and Kangaa, for the study of fishers’ livelihood in terms of fish processing, and then Sape,
Tente and Bima (city), for the study of market and distribution (Fig. 3).

From the results of the baseline survey by the Project and PT. PLARNECO, the population of Langgudu, a district which is composed of coastal villages of the Waorada Bay, is approximately 25,000 people and a majority of these individuals earn a living directly from the fisheries which includes activities such as fishing, product distribution and fish processing. Furthermore this population also relies heavily on agriculture for family consumption which includes rice and/or vegetable production. Bima regency in NTB covers an area of 4,394 km² and its population is approximately 420 thousands in 2009 (Badan Pusat Statistik Kabupaten Bima). Its land mass consists of forest (70.5%), paddy fields (6.1%), crop and garden areas (6.7%), grass fields (3.5%), buildings and yards (0.8%), while the rest of the area consists of hatcheries, ponds, gardens etc. (the Project and PT.

Source: http://www.ezmapfinder.com/jp/map-64219.html (May 16, 2011), highlighted two provinces by the author

Source: http://commons.wikimedia.org/wiki/File:Lokasi_NTB_Kabupaten_Bima.svg (May 16, 2011). The geographical names were added by the author

Fig. 2 Location of NTB and NTT in Indonesia

Fig. 3 Location of Bima Regency
The Indonesian government identified two provinces, being NTT and NTB, as the preferred project sites. The population of those provinces were 4,620 thousand people in NTT (Badan Pusat Statistik Provinsi Nusa Tenggara Timur) and 4,434 thousand people in NTB (Badan Pusat Statistik Provinsi Nusa Tenggara Barat) in 2009. According to the report of “The Study on Fisheries Infrastructural Support and Coastal Communities Development Plan in East Indonesia”, the gross domestic product (GDP) of these provinces was ranked as 25 and 27 respectively out of 27 Indonesian provinces (JICA 2006). The preliminary study team of the Project identified the Bima Fisheries Office (hereinafter referred to as “DKP Bima”) in NTB as the counterpart organization of JICA (JICA 2006).

3.3 Regional characteristics in fisheries

From DKP Bima statistical data, the total fishery production in Bima regency was 20,845 tons in 2006, 21,183 tons in 2007 and 22,420 tons in 2008 (DKP Bima, annual fisheries statistical data from 2006 to 2008). From the statistic, Langgudu occupied the second largest share of the total catch at around 10 to 20% of total production within the Bima regency. In the statistics, 484 fish gears are recorded in Langgudu, such as hand lines (19%), floating lift net (18%), long lines (17%), bottom line (11%), floating long line (9%), purse seines (8%), bottom long line (7%), Drift gillnet (5%), fish traps (4%) and others (2%) (Kabupaten Bima 2007/2008).

The seasonal catch fluctuations by species are represented in Fig. 4. The original data are based on catch monitoring, from April 2007 to May 2008, at Rompo (the Project, unpubl. data, from 2007 to 2008). According to Iwamoto, JICA expert, the catch data were recorded by individual fishermen in terms of gear types such as mobile lift net, purse seine and gillnet (Iwamoto Aug, unpubl. report 2008, in Japanese). Two remarkable peaks in

![Fig. 4 Seasonal Catch Fluctuations by Species in Rompo](image)

Source: Prepared by the author from the Project data (the Project, unpubl. data from 2007 to 2008)
the catch were seen from April to May 2007 and from October 2007 to January 2008 (Fig. 4). The major catch from purse seine fishery (Fig. 4) was tongkol, considered to be an inclusive name of bullet tuna, frigate tuna or eastern little tuna (Auxis spp. or Euthynnus affinis). Its catch rose from April 2007 to June 2007. The peak catches of Ciro, spotted sardinella (Amblygaster spp.), were seen from October to January (Fig. 4). Ciro or other small pelagic fish such as Teri, anchovies (Stolephorus spp.), was mostly caught by mobile lift net fishing (Fig. 4).

The correlation between the catch and the corresponding unit price of tongkol and Ciro at Rompo was shown in Fig. 5. The catch and its value were referred from the landing data recorded by the Project (the Project, unpubl. data, from 2007 to 2008). Tongkol represented the largest catch by purse seine while Ciro showed the largest catch by mobile lift net fishing during the monitoring period. The unit price in Fig. 5 was calculated from total monthly value divided by total volume. In spite of the obvious seasonal catch fluctuations, there was a poor correlation between the catch and the unit price. The unit price of tongkol was around 3,000 rupiah (Rp)/kg and that of Ciro ranged from 1,000 to 1,500 Rp/kg as was presented in Fig. 5. In Rompo, caught fish is sold immediately by catu, fish transporters on the sea, or palele, fish brokers. Under a local distribution system between fishing vessel owners and catu or palele, there is not remarkable change in the prices of fish. From Rompo, the fish is transported and sold at the local markets of Tente and Bima which are located about 30 and 45 minutes respectively from Rompo by vehicles. Fish are handled without using any chilling medium such as ice and sold as individual pieces without measuring weight in these markets.

The livelihood improvement activities in the Project were mainly implemented in Rompo which is a base of the purse seine fisheries. Therefore, fish processing activities were also targeted in Rompo, applying the utilization of purse seine products.

![Graph showing the correlation between Tongkol and Ciro catch and unit price in Rompo.](image)
3.4 Product distribution and processing in purse seine fishery

Purse seine owners in Rompo employ a traditional distribution system, direct dealings with palele. It means that each purse seine owner has an arrangement with the palele. According to the Rompo office of DKP Bima, there were 44 palele who had contracts with purse seine owners in Rompo village in the year of this study (2008). Under the arrangement, palele have the exclusive right to receive all catch from those owners who are financed (on cash or in kind) by them. Namely, the owners tend to borrow cash otherwise they might receive necessaries from palele for their fishing activities. Therefore, the owners provide all catch to palele as refund.

Purse seine vessels usually return to Rompo in the evening, however the Tente and the Bima markets open in the morning. Because of existing infrastructure in Rompo, the palele cannot preserve the catch by chilling or freezing till the next morning, hence they broil fish, mainly tongkol, as a local product salepe. Then the salepe is sold at the markets in Tente and Bima. After the product sale, the palele receive their earnings and then return certain amount of payment or provide the necessaries for fishing to the owners. Therefore, both the palele and the owners will lose benefit if the products are not sold at an adequate price.

Processing salepe only requires locally available materials such as betel palm leaves, bamboo sticks, salt, fire wood and two iron poles for broiling and does not need any electricity. Its procedure is as follows; firstly, fish and dried betel palm leaves are rinsed with sea water, and then salt is scattered over the surface. Secondly the fish is wrapped by the leaves and the wrapped fish is broiled for a few hours. Depending on the fish size, approximately 50 units are broiled during one batch. When there is an abundant catch, each batch is processed repeatedly, all night long. They are then transported to, and traded at, the markets of Tente or Bima the following morning.

A notable difficulty in purse seine fishery was noted by the fact that it was not possible to realize quantitative control at each phase of catch, processing and distribution. The fishers of purse seine tend to catch as much as possible and that might lead to excessive production, especially in the high season. In these instances, palele cannot preserve the fish as raw material stock because of lack of infrastructure for chilling or freezing. Consequently, salepe is processed using all the volume of fish that they accept from the purse seine owners to avoid its deterioration. However it is said that salepe itself has to be consumed within 5 days to a week. If a large volume of products is distributed to the markets at once, they might fail to sell all of it. This existing situation tends to cause oversupply and cuts profit.

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3.5 Livelihood improvement activities in the Project

According to Iwamoto, livelihood improvement involved activities such as 1) data collection of landing by type of fishing gear (or with respect to fishing gear—lift net, purse seine and gillnet fishing), 2) household income and expenditure survey and 3) the Mini Project. The Mini Project aimed to achieve livelihood improvement through training activities: such as 1) culturing commercial fish, 2) rearing goats, 3) baking cakes, 4) fish steaming, 5) ice making, 6) selling fresh fish using cooler boxes and 7) seaweed culture (Iwamoto, unpubl. report, Aug. 2008, in Japanese). The total 53 fishers participated in the training activities. With regards to the training on 6) selling fresh fish using cooler boxes, 5 palele participated as the result of household income and expenditure survey and its workshop (Iwamoto, unpubl. report, Aug. 2008, in Japanese).

Table 1 shows the monthly profits of those members who participated in selling fresh fish using cooler boxes. All the members of this activity were basically engaged in fish processing and/or distribution as palele, then 4 peoples over 5 starters continued those activities and their earnings were monitored (Iwamoto, unpubl. data, 2007). The livelihood of palele could not be represented or generalized by those 4 palele, however, it could be one of grounds to understand how palele make their living through fish processing and distribution in Rompo. The data on the Table 1 were extracted from the record of household account of the members. There was a wide
range among the days that palele engaged in processing salepe (Table 1). The number of days that they engaged in its processing might depend on the frequency of the purse seine operation. Palele also have supplemental activities for income generation. For example, palele A runs a small retail shop and palele B participates in seaweed culture as a supplemental activity of fish processing and distribution. Palele C is mostly engaged in fish processing and distribution, and palele D is mainly work on fresh fish distribution.

Table 1 indicated that the monthly profits of those palele were not stable. That is to say, fish processing is a

<table>
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<tr>
<th></th>
<th>May-07</th>
<th>Jun-07</th>
<th>Jul-07</th>
<th>Aug-07</th>
<th>Sep-07</th>
<th>Oct-07</th>
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<td>A</td>
<td></td>
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<td></td>
<td></td>
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<td>575,500</td>
<td>4,099,000</td>
<td>15,129,500</td>
<td>6,743,000</td>
<td>50,277,900</td>
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<td>Profit (Rp)</td>
<td>458,000</td>
<td>963,000</td>
<td>841,500</td>
<td>160,500</td>
<td>998,500</td>
<td>3,317,500</td>
<td>1,837,000</td>
<td>8,576,000</td>
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<tr>
<td>Volume of fish bought (piece)</td>
<td>1,577</td>
<td>6,500</td>
<td>2,494</td>
<td>140</td>
<td>295</td>
<td>14,585</td>
<td>5,590</td>
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<td>9</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>22</td>
<td>12</td>
<td>62</td>
</tr>
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<td>B</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td>25,269,450</td>
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<td>412,500</td>
<td>3,501,250</td>
<td>1,233,750</td>
<td>3,158,250</td>
<td>7,205,500</td>
<td>5,986,200</td>
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<td>7,397,000</td>
<td>2,984,500</td>
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<td>6,431,750</td>
<td>5,064,500</td>
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<td>1,019,500</td>
<td>706,000</td>
<td>516,750</td>
<td>38,500</td>
<td>702,000</td>
<td>773,750</td>
<td>921,700</td>
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<td>Volume of fish bought (piece)</td>
<td>2,216</td>
<td>4,235</td>
<td>1,870</td>
<td>156</td>
<td>1,186</td>
<td>22,832</td>
<td>19,705</td>
<td>52,200</td>
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<td>6</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>7</td>
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<td></td>
<td></td>
<td></td>
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<td>1,315,000</td>
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<td>Profit (Rp)</td>
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<td>617,500</td>
<td>1,235,000</td>
<td>108,000</td>
<td>0</td>
<td>-109,000</td>
<td>-85,000</td>
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<td>Volume of fish bought (piece)</td>
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<td>1,300</td>
<td>100</td>
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<td>6,800</td>
<td>220</td>
<td>10,993</td>
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<td>1</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>11</td>
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<td>D</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9,879,000</td>
</tr>
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<td>435,000</td>
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<td>155,000</td>
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<td>3,128,800</td>
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<td>Profit (Rp)</td>
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<td>0</td>
<td>0</td>
<td>1</td>
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<td>1</td>
</tr>
</tbody>
</table>

Source: Prepared by the author from the Mini Project Results (the Project, unpubl. data from May to November 2007)
livelihood for *palele* but it also depends on purse seine catch, thereby their engagement is variable and discontinuous. Considering their livelihood, one member (C) on Table 1 showed negative profits in October and November. Their product dealings were based on credit. Their profit depended on the sales at the markets, thus, oversupply might reduce or eliminate their profits. Though the debt could be cleaned away through annual activities, the losses of profits affected probability of their livelihood improvement.

4. **Applicability of Fish Processing Improvement**

4.1 Profit simulation for fish processing improvement

Under the above mentioned situation, it was supposed that oversupply to the markets and profit loss might be reduced by processing management thorough improvement of preservability. Thus, profit of *salepe* sales was simulated based on the household economy record of the Mini Project.

Table 2 presents examples of *salepe* production from the record of household account monitoring through the Mini Project (Iwamoto, unpubl. data, 2007). From the daily record of the Mini Project, a *palele* produces *salepe* from several dozen or a few hundreds of *tongkol*. The unit prices were calculated from the records of fish prices, production costs and the sales value as shown on the table: the unit prices of *tongkol* were 2,500 Rp/piece, 2,000 Rp/piece and 2,000 Rp/piece; the production costs of *salepe* were 3,100 Rp/piece, 2,500 Rp/piece and 2,400 Rp/piece; and sales prices were 3,500 Rp/piece, 3,000 Rp/piece and 5,500 Rp/piece respectively (Table 2). There was little difference in the unit price of raw material, however, calculated sales prices were fluctuated significantly (Table 2). It can be presumed that there were unsold products on 15 and 16 October, as the sales prices were reckoned at 3,500 and 3,000 Rp/piece. Meanwhile, it seemed that all products were sold on 17 October, as *salepe* was valued as 5,500 Rp/piece. Therefore, it was inferred that unsold products might affect the sales value because of discounting or discarding those products.

Supposing that a risk of profit loss may be reduced by improving preservability, relationship between profit and expirations days was analyzed by the following simulations. First, it was assumed that production cost was 3,000 Rp/piece and sales price was 3,500 Rp/piece based on the above mentioned records. Secondly, profit was simulated corresponding to expiration days, production and sales volumes per day. Figures 6 to 9 show the profit simulation with different expiration days and sales volumes per day. Considering its distribution and consumption,

| Table 2  Daily *salepe* Production in Rompo |
|-----------------|-----------------|-----------------|-----------------|
| Fish (piece)   | 400             | 300             | 200             |
| Fish value     | 1,000,000       | 600,000         | 400,000         |
| Production cost (Rp) | 1,241,000 | 763,000         | 486,000         |
| Sales value (Rp) | 1,400,000       | 900,000         | 1,100,000       |
| Profit (Rp)    | 159,000         | 137,000         | 614,000         |
| Unit Price     |                 |                 |                 |
| Raw material (Rp/piece) | 2,500   | 2,000           | 2,000           |
| Prime cost of product (Rp/piece) | 3,103   | 2,543           | 2,430           |

Source: Prepared by the author from the Mini Project Results (the Project, unpubl. data from October 2007)
it was assumed that salepe should be sold in 4 days. When a palele produces salepe from 200 pieces of tongkol, the palele may not lose their profit as long as the products are sold more than 50 pieces per day (Fig. 6). If a palele processes salepe from 300 or 400 pieces of tongkol, those products should be sold more than 75 and 100 pieces respectively to gain their profit (Figs. 7 and 8). When she receives 500 pieces of tongkol and process salepe at once, she might lose profit unless products could sell more than 150 pieces of product per day (Fig. 9). However, if the expiration period was prolonged to more than 10 days, a palele could gain profit under the above condition at 50 pieces of daily sales (Figs. 6–9). To summarize the simulation, palele may gain profit within 500 pieces of tongkol as raw material, when the expiration period becomes longer than 10 days and more than 50 pieces are sold per day.
From the simulation above, it is believed that the profit loss might be minimized by improvement of preservation. Thus fish processing activities in the Project were planned to ameliorate preseavability and production management with the expectation of local incentives for livelihood improvement.

4.2 Consideration on technical adaptability

From the field surveys, it was identified that salepe was a local method to avoid postharvest losses, especially in high season. However if a large volume of products is produced and distributed to the markets at once, they
might fail to sell all of it. The simulation (4.1 Profit simulation for fish processing improvement) showed that the production management through adding preservability for quantitative control would improve livelihood for purse seine fishers.

Throughout the survey and the discussion with palele, the core problem was identified as a loss of profits by oversupply. This problem was caused by the existing infrastructure as well as the traditional trading system. The former means that both caught fish and processed products cannot be preserved using chilling methods hence the excess products can be distributed to the markets. The latter represents that palele have an exclusive right to receive the entire catch from purse seine vessels, process salepe from it then distribute the whole quantity of products at one time. Therefore, the improvement mainly focused on the preservability of salepe through encouraging palele’s awareness and initiatives.

Under the existing infrastructure as well as distribution system, improved products should be preserved longer than salepe but still they might be handled and distributed without chilling or freezing system. During the implementation of the Mini Project, steamed fish was introduced as a trial fish processing activity. The steamed fish was easily adopted by palele, however, it should be consumed in a few days. Considering the volume of products that palele process, improved fish processing should be technically simple and more preservable to minimize post harvest loss and discard of unsold products. Though DKP Bima has already introduced some fish processing methods, such as fish crackers and fish balls, through workshops, the processing methods are more complicated than that of salepe. It was also considered that it would be more efficient for palele if they could process salepe as collaborative work from the process of raw material acceptance to the product distribution. However the collaborative fish processing as a group might not be adapted to palele as they have own arrangement with purse seine owners. Thus, smoked salepe was proposed in the participatory workshop as one of examples of fish processing improvement. Trial processing at DKP Bima also noted that approximately 20% of water (in weight) of the original salepe was evaporated during the process of smoking. There was not a significant difference in the production cost between the original and the smoked salepe. Therefore, the smoked salepe is considered to be an effective solution against the profit loss and then to be able to stabilize palele’s income.

There might be another possibility for palele to control product sales through processing both salepe and smoked salepe. Namely, palele process salepe from all the tongkol which is supplied by purse seine owners. Then they distribute some part of the salepe which meets the markets’ demand. In parallel, they produce smoked salepe from the rest of the salepe which has not been distributed to the markets. It means that palele can provide the smoked salepe after all the salepe has been sold at the markets. That is a way for palele to control product sales in accordance with markets’ demand in order to minimize their profit loss under the existing infrastructure. Smoked products were generally seen at local markets as well as supermarkets in other regions such as Makassar and Manado in North and South Sulawesi provinces, accordingly there is a potential that the smoked salepe will be accepted by consumers in Bima. Hence the sales promotion and marketing will be the next approach for fish processing improvement.

In prospective view, catch controls may be possible when palele and purse seine owners reach agreement through discussions about suitable catch quantities which reflect local markets’ demand. The purse seine vessels tend to catch as much fish as possible and palele accept all the catch landed. With improvement of preservability by processing smoked salepe, palele might aware the importance of production management. Furthermore, it is recommended for palele and purse seine owners to have discussions about controlling the catch to meet the demand for sustainable fisheries. Supposing that they establish own regulations, it will be an example of sustainable livelihood approach through fish processing improvement as well as fisheries management.

The processing improvement in the Project, adding preservability, was considered to be technically applicable for palele as it reflected local processing and distribution system under existing infrastructure and even daily work. For its sustainability, it was required for palele to be aware of present situation, to take initiative for fish processing improvement and to see what has been changed. In the case of Japan, fisheries cooperative associa-
tions, which have been developed from local communities over decades, take incentive actions for coastal fisheries development. In the case of Bima, traditional customs have been deployed in artisanal fisheries from catch to distribution. External experts can define technical problems however they also need to consider locally adapted technics, methods and rules. Therefore, the fish processing approach provided know-how for quantitative management of production through improvement of preservability to increase fisher’s livelihood. The approach may also provide awareness of existing situation and any possible consideration of improvement to local stakeholders.

For the next step, it is expected for local stakeholders, from fisheries community to national governments, to apply the practical experiences for future development strategies. Moreover, as domestic institutional linkage will be required to realize those strategies with aspects of technology, policy and budgetary requirement. The fish processing improvement approach was intended to develop capacity of DKP Bima and the fisheries community in Rompo to realize a bottom up approach under decentralization policy. However, with a comprehensive aspect, the national government was also included to understand local needs, to monitor the improvement approach and to establish future development strategy and roadmaps. The author believes that the trials and lessons learned from this project can be applied to future policies, projects and collaborative efforts to aid in livelihood improvement of artisanal fisheries in the developing world.

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