Rebuilding of Tsunami Affected Areas in the Southern and the Eastern Provinces of Sri Lanka

WORKSHOP PROCEEDINGS

Editors

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COST BENEFIT ANALYSIS OF NOVEL FISH DRYING EQUIPMENT IN GANDARA CENTRAL, MATARA

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Abstract

Sri Lanka is an island which is mainly having an agriculture based economy. Agriculture, forestry and fishing, is one of major sources of income for GDP. Among those fishing industry is very important and contributing to GDP by 2.3% in 2004, 1.3% in 2005, and 1.8% in 2006. Southern Province is one of the important areas contribute to this achievement. Further, Gandara, Dikwella, Dondra, Mirissa, Thotamuna are the major fishing harbors in Matara District. Gandara cenral was mainly selected by CIDA Restore Project because that area was highly damaged by Tsunami and the incumbents and their livelihood was mainly based on fish related industries. In early times, the people in the area produced dried fish and maldive fish using very traditional methods and technologies. Mainly, women are the key members among the producers of maldive fish and dried fish while the men are engaging with fishing. The livelihood group of the CIDA Restore Project identified the fish and maldive fish industry as viable livelihood industry, specially for women in this area, and found the problems of the industry. As a solution, the livelihood development group got the assistance from an expert of the Faculty of Agriculture, University of Ruhuna, who invented a solar-power drier. This drier helps to minimize various costs and maximize benefits of the fish drying process. Hence, 10 Tsunami affected women who are willing, and as well as, previously engaged with this industry in small scale were identified to start a new business. This paper aims to analyze the costs and benefits of the venture as well as feasibility of the solar drier as a fish and maldive fish drying equipment. The costs were analyzed in terms of monetary, time, energy, and psychic costs and benefits were analyzed in terms of product, service, personnel and image. Finally, it was disclosed that the benefits are considerably higher than the cost incurred of the production of both maldive fish and dried fish.

Keywords: *benefits, costs, fish drier, livelihood*

Introduction

The Tsunami that hit Sri Lanka in December 2004 has brought a great loss of life, livelihood and infrastructure. Fisheries sector was the most damaged sector from the Tsunami disaster, resulting in the loss of lot of lives, and properties. Between

90,000 to 100,000 active fishermen lost their livelihoods in Sri Lanka due to the tsunami (Amarasinghe, 2005). About 103,000 people in fisheries based community were displaced and 16,500 fisher houses where destroyed whereas 13,300 houses were damaged. Coastal communities dependent on the fishery industry to provide livelihoods were seriously affected by the tsunami. Damages to the fishing industry in Sri Lanka was immense with 76 percent of the fishing fleet affected, i.e. 53 percent destroyed and 23 percent was damaged (10 of the 12 existing fishery harbours, 37 fishing anchorages and 200 fish landing centers were damaged (nara.ac.lk). Accordingly, the fisheries community in the Southern Province faced a severe problem in restoring their livelihoods.

In fisheries, men and women often have distinct roles. For example in marine fisheries, usually only men go out to fish, but women are often involved in trading and processing They were very active in the revenue generation. Most of them were housewives both before and after the tsunami. However most of those who generated income before the tsunami were unable to conduct these activities in the aftermath in the absence of a place. Even though a large number of NGOs made attempts to restore the lives of the Tsunami victims, most of these NGO focused on supplying consumables and very less attention was paid on the restoration of the livelihood. Sometimes, what were supplied were not what people needed. On the other hand, that affected persons have not been duly consulted in the process.

Women actively participate in the small-scale fishery industry in Sri Lanka. A fishery sector is contributes 4 percent to GNP. 88 percent of this contribution is coming from small-scale fishing community. Women are claimed for 52 percent of this contribution. They are engage in fish processing and fishery business. (http://sudeesa.org/social-development/index.html).

On the southern coast, women are the main managers of income. They have a crucial role in fish sorting, cutting, processing and dragging the boats ashore (www.fao.org) However women in fishing communities have low levels of education, a lack of access to and control over productive assets as well as a lack of investment and working capital. Women also lack access to markets and rural infrastructure, credit and microfinance services. Therefore, women can be considered as an important human resource which can be effectively geared up to facilitate the restoration of the livelihood of Tsunami affected community.

Fish drying is one of the main ways of fish processing in the Southern coast of Sri Lanka. Sun drying has been used for this purpose from the early days. However, this traditional drying method has many disadvantages such as loss of nutritional value, germination, colour, and quality. Further, rain, insects and enzymatic reaction may cause problems.

Based on these grounds, the Tsunami Restore Project of the CIDA focused on developing a community based model of women entrepreneurs which uses local innovations and performs on the basis of business principles. Accordingly, a Solar

Drier was introduced to a selected group of potential women entrepreneurs in Gandara, Matara, Sri Lanka. The group was guided by a team of specialists from the CIDA Restore Project, University of Ruhuna, Sri Lanka to facilitate their livelihood development. This paper explains the project implementation and highlights the costs and benefits of the novel fish drying equipment located in Gandara Central, Matara. The paper analyses the data qualitatively and highlights the important dimensions of this livelihood development attempt.

Review of literature

Fish is a major source of protein and its harvesting, handling, processing and distribution provide livelihoods for millions of people as well as providing foreign exchange earning to many countries (Al- Jufaili and Opara, 2006). Appropriate processing of fish enables maximal use of raw material and production of value-added products which is obviously the basis of processing profitability.

The fisheries sector in Sri Lanka has an important role in terms of employment opportunities, income generation, foreign exchange earnings, and the provision of animal protein for the population. The sector provides direct and indirect employment to approximately 250,000 people, with a dependant population of 1,000,000. The contribution of the fisheries sector to GDP was around 2.7 per cent in 2000. An estimated 65 per cent of the animal protein consumed in Sri Lanka in 1991 was derived from fish. The fisheries sector is also considered as one of the major fields with potential for economic expansion. A predominant obstacle is the deficiency of credit to the coastal fishers (Sydnes and Normann, 2003). The Sri Lankan fishery sector serves both the domestic and export markets, with the domestic component attracting 75 percent of the marine fish production. In 2006, total marine fish production was 215,980MT, and the export market and dried fish production accounted for 9 percent and 15 percent, respectively (Analysis of Fisheries sector in Sri lanka, 2008).

There is a growing demand for fishery products by both local and export markets, and world demand for all types of fish products is increasing. the country has still not been able to fully capture these opportunities and supply remains far below the potential capacity and existing demand. The competitiveness of fish depends on price, quality and the stability of supply. The importance of these factors varies depending on the end market; price is the major factor determining competitiveness in the local market, while quality and regularity of supply play a major role in export market competitiveness. In spite of these important signs of progress, their impact remains limited and recently, Sri Lanka's fisheries sector has performed less than satisfactorily with domestic supply unable to provide the quantities of fish products required at affordable prices to meet the nutritional needs of the country's population (www.ips.lk).

In Matara The fishery industry is the central economic sector of the 4 divisions, especially Devinuwara and Dickwella, and is recognized as a key source of employment and income generation. Every social and economic activity of villagers depends on the climatic conditions in the area. During the Season the fishermen earn a relatively high and constant income, during Off-season the fishermen earn a low and irregular income. The coastal fishing income is high during the Season (September- March), while is low from April till August.
(www.sudeesa.org/dp%20matara/01/coir.htm).

Fish drying

Even though technological leaps have enhanced the fish production, due to the perishable nature of fish, an estimated 21% of the harvest is lost due to lack of post harvest processing (IREDA NEWS, 2006). This results in fishermen losing a considerable portion of their profit apart from the loss of considerable nutritional food to the common man. Fish is a highly perishable food product and can be stored only by refrigeration or drying. But the problem affecting the quality of the dried fish is the unhygienic way in which fish is prepared and dried. The open beach drying, results in insects laying eggs inside the fish, that renders the product non-consumable. Therefore, appropriate technology needs to be introduced for fish drying. According to Dennis (1997) drying is an excellent way to preserve food and solar food dryers are an appropriate food preservation technology for a sustainable world.

According to the Häuser and Ankila (2000), that traditional sun drying methods often yield poor quality, since the produce is not protected against dust, rain and wind, or even against insects, birds, rodents and domestic animals while drying. soiling, contamination with microorganisms, formation of mycotoxins, and infection with disease-causing germs are the result. They assert that the drying equipment used in industrialized countries overcomes all of these problems, but unfortunately is not very well suited for use in developing countries because it requires substantial investments and a well-developed infrastructure.

Actually, solar food drying is one of the oldest agricultural techniques related to food preservation, but every year, millions of dollars worth of gross national product are lost through spoilage. Reasons include, ignorance about preservation of produce, inadequate transportation systems during the harvest season (mostly climate related), and the low price the rural farmer receives for products during the harvest season (Whitfield, 2000).

An Indian study done on Solar Dryers by Balakrishnan and Banerjee (2006) pointed out that Solar dryer technology can be used in small-scale food processing industries to produce hygienic, good quality food products. Furthermore, they mentioned that solar technology is ideally suited for women since they can place a load in the dryer and then get on with their other numerous tasks.

The project: how does this initiative address the development problem?

A livelihood has been defined in many different ways but this study takes Ellis' (2000) definition of a livelihood as comprising "the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household". However, introduction of technology to the fisheries community to facilitate livelihood development happens rarely. Thetransfer of technology service by the R&D Institutions seldom reach the large sections of women in fisheries. The major drawback is lack of funds coupled with resistance of planners and administrators to deviate from existing development strategy (Cecily, 1999).

Methodology

After the tsunami, the University of Ruhuna started a 3-year collaborative project on "Environmental and Livelihood Restoration and Development in Tsunami-affected Coastal Areas of Sri Lanka" with the University of Guelph, University of Manitoba, University of Waterloo and Queens University of Canada with financial assistance from the CIDA. The purpose of the project was to implement a multi-sectoral approach to environmental restoration, sustainable livelihoods and community development, with full community input and participation in specific tsunami-affected districts of Matara/Hambantota, Ampara, and Batticaloa in Sri Lanka. Under that project, the Faculty of Management and Finance, University of Ruhuna worked for sub projects aiming at livelihoods development. Based on the pilot survey, the livelihood development project team selected a fishing village called "Gandara" in Matara district to conduct activities encouraging small enterprises on Fish Processing. The project team visited the village and had discussions with the participation of all stakeholders, including government organisations at the local levels, for example: Assistant Government Agent, Grama Niladhari and discussions with the leaders in women Associations. The group conducted several meetings with villages to identify the problems and did feasibility study to introduce appropriate technology for fish drying using SWOT analysis. It was found that "poor quality" as a one main problem for not having good market price for dried fish and Maldive fish they produced. Addressing these issues, with the participation of all stakeholders, including government organisations at the local levels, the project team initiated a Fish drying project on 09.03.2008 using solar driers at Gandara Central Matara, Sri Lanka.

Discussion

Venture members

Traditionally, women of fishing communities in many Asian countries have been playing important roles in marketing fresh fish, and processing surplus catch for sale at a later date. However, with modernization of the sector, the growth of the industrial fleet and the expansion of domestic and export markets, the situation has changed fast (Sharma, 2004). However, in Sri Lankan fisheries sector, particularly in the Southern Province, women play a leading role in the fish drying process. Therefore, the CIDA Restore Project focused on the development of women based model to facilitate the livelihood development. Four initial meetings were conducted with the help of "Grama Niladari", Gandara Central, to provide awareness of the project. At the same meetings, the members were informed about the solar drier and the costs and benefits of the drier were explained to the participants. After those meetings, the members were invited for the interviews. Specially, the women who are engaged with producing fish related products. Those interviews specially focused to understand the factors such as capability of producing fish related products, willingness to work as the team members, number of hours can be dedicated for the business, participation in other social activities and networking, education, family size, family background and the possible contribution to venture. Figure 4.16 shows some of the pictures of the interviewing process and initial guidance to the selected members.

Figure 4.16: Establishment of a model business

Finally, 10 members were selected as venture members to start the project. The initial workshop was conducted to give training on society formation and society leaders were appointed in the following meeting. These activities was conducted under the guidance of CIDA project group of Faculty of Management and Finance. The 10 member venture was registered as a partnership (under the Reg. No: MA.2-7 at Mahawaththa, Jayabodiya Mawatha, Gandara, Matara) and with the participation of selected members, local authorities, villages and CIDA project team, the

business was inaugurated. Figure 4.17 shows some pictures of launching the venture.

Figure 4.17: Launching the venture

After launching the venture, the selected members continued their business under the registered name "Gandara Karavala (Gandara Dried Fish) and Gandara Umbalakada (Gandara Maldive Fish).

The introduction of appropriate technology: The "Saviru Solar Drier"

The solar drier (Saviru Solar Drier) was introduced by one of the lecturers (Mr. Kapila Weerathungaarachchi) attached to the Department of Agricultural Engineering, Faculty of Agriculture, University of Ruhuna. Initially, this drier was designed to produce high quality spices. The Saviru Solar drier is made partly of fibre-glass and typically measures 24ft long by 3ft wide. To achieve the required temperature, two small fans blow air through the tunnel. This drier was used at neighboring village for drying spices. Though this is for drying spices, the livelihood group requested to modify the dryer for fish processing. Thus new dryer with more thick mesh was introduced to the venture team for processing their fish. Drier fixing place was selected considering the group's willingness and amount of sunlight receiving for the place.

With the installation of the drier, a series of workshops conducted to provide required training to carry out the venture. The CIDA project group of Faculty of Management and Finance conducted workshops on Entrepreneurship Development, Marketing and Leadership while staff of Faculty of Fisheries and Marine Sciences & Technology conducted workshops on dried fish production and post harvest technology. During the initial stage, project team had frequent visit to monitor the project. Figure 4.18 shows some pictures of the drier.

Figure 4.18: Solar drier

Cost benefit analysis

The cost benefit analysis of this venture is discussed under four main headings: monetary, time, energy and psychic costs.

Monetary costs

Monetary costs are discussed under fixed costs and variable costs. Fixed costs were comprised of the cost of the drier, installation cost, cost of the scale, storage containers, boiling barrels, and sealer. Variable costs incurred were fish, salt,

goraka, fire wood, packeting materials, transportation, labels and other costs incurred in marketing and sales commissions.

This cost is around Rs.750 per 1Kg of maldive fish and Rs. 375 per 1Kg of dried fish. However, this will change according to the prices of fish, post harvesting activities and the type of the fish. The prices ranged from Rs. 750 to 800 for maldive fish and from Rs. 375 to 450 for dried fish.

Comparatively the above costs are less than the imported dried fish and maldive fish products. However, researchers found that the entrepreneurs of this venture individually contributed in the production process. Hence the transport cost of the materials and other elements were very high. However, they marketed their products according to the cluster marketing under the same brand. It is advisable for them to minimize the production cost through bulk purchase, collective transportation, *etc*.

Further, it was found that the cost component, especially the variable cost component, varied according to the seasonal variances of fishing. Researchers observed that the entrepreneurs initially purchased raw fish at retail prices without considering the high availability of cheaper types of fish depending on the season. As a result the cost for raw fish has been high and it has been the main reason for the increase in the total cost. Therefore it is recommended that they have to purchase raw fish which are highly available during the seasons at considerably lower prices. Table 4.12 provides a comparison of monetary cost under traditional method and the new method.

Table 4.12: Monetary cost comparison

Monitory cost	**Using the Solar Dryer**	**Traditional method**
Fixed cost	Rs	Rs
Cost of the dryer	60000	
Scale	3000	3000
containers	1500	1500
Boiling barrels	500	500
Sealer	1900	1900
Variable cost to produce 1kg of dried fish		
Raw fish	600	600
Salt	20	20
Goraka	20	20
Firewood	20	20
packeting materials, labels etc.,	10	10
Fish Transportation	20	20
Marketing, sales	10	10

Machine depreciation	8	
Other depreciation	2	2
Total cost	710	700

Time costs

Time cost for the venture is the time sacrificed for the processing raw fish. With the drier, the man-time needed for cleaning and boiling fish is two man-hours if work is done by one person. Further, it will take six hours to clean the boiled fish and feeding them into the drier.

On the other hand, three hours will be needed for the inspection of the drying process and one hour for packeting and finished goods preparation. Therefore, altogether the total time cost to produce 20Kg of maldive fish out of 120Kg raw fish is equal to 12 hours. If one man-hour is rated at Rs.60 the time cost equals to Rs720/person for producing 20Kg maldve fish. If it is compared with the traditional method, the cleaning, boiling and packeting time will be the same. But inspection time is very high in and it equals to 18 hours. There the cost is very high and it amounts to approximately Rs 2340 for producing 20Kg of maldive fish. This calculation is more or less equal for the dried fish also. Hence, the overall cost will increase. Furthermore, women engaged with this venture can allocate her time for some other work while engaging with fish drying.

The forecast drying time for maldive fish is three days and for dried fish the duration is four days. However, during the second week of March it was rained continuously for five days. As a result the drying process delayed and members were unable to put their portion of raw fish into the drier on time. Due to this reason some members had to keep their portions of raw fish in refrigerators until the drier becomes available to feed up. Therefore, it is advisable to have a contingency plan during the rainy seasons as rain and other weather factors such as humidity is critical in fish drying business.

Energy costs

The energy cost included fire wood, manpower, and electricity. In relation with the drier the energy need for the maldive fish and dried fish production process is very low, especially man power. After feeding raw fish into the drier no manpower needed for other activities. With the traditional method the women had to sacrifice additional energy to bring them into the home when the rain comes, and bring them again to the sunlight. Moreover, when there is sunlight they lay the fish daily in the sunlight. It needs additional energy when compare with the drier as it only needs to lay the fish once in a three or four days. Therefore the energy cost is very low with

the drier. Table 4.13 proves a comparison of time and energy cost of these two methods.

Table 4.13: Time and energy costs

Time and Energy cost	Using solar dryer	Traditional method
Number of Man hours needed for Processing raw fish, cleaning, boiling	2	2
Number of Man hours needed for Putting / laying fish into the dryer or open space	6	18
Number of Man hours needed for Inspection	3	18 (6hrsx3days)
Number of Man hours needed for Packeting & finishing	1	1
Total Man hours taken to produce 20 kg	12	39
If Rs. 60 given per man-hour total cost	Rs. 720	Rs. 2340
Time and Energy Cost to produce 1kg maldive fish	36	117

Psychic costs

The psychic cost includes the stress due to the bad weather conditions, unexpected delays in the drying process, wastage of fish in processing stage, and cleanliness of the house environment. With the machine the all the psychological efforts are very minimal. With the traditional method, this is very high and they should concentrate on fungal effects, protect from animals, etc. Table 4.14 highlights the psychic costs of these two methods.

Table 4.14: Psychic costs

Stress Factors	Using the solar dryer	Traditional method
Bad weather conditions	Very minimal	higher
unexpected delays in the drying process,	Very minimal	higher
wastage of fish in processing stage	Very minimal about 2%	Higher about 10%
cleanliness of the house environment, smell, pest damage	No	Higher, about 10% increasing the cost

Additional benefits

All these years, fish farmers have traditionally dried their produce in the open. Fish are dried virtually anywhere; on roads, on cement floors where dogs sleeps and chickens scratch for food. Such open drying gives incomplete results to the dried fish that are of inferior and inconsistent quality, often contaminated with germs, due

to mould infections. Table 4.15 provides further details of the benefits of the solar drier.

Table 4.15: Additional benefits of the drier

	Using the solar dryer		**Traditional method**	
Product				
Quality & Price per kg	High & higher price	1000	Low and low price	1000
Features & price	High & higher price		low	
Quantity & return	High & no return		Higher Possibility to getting pest attacks at processing	(200)
Performance	High & very good taste		low	
Service				
Guarantees	Gurantee possible		Limited gurantees	
Personnel				
Can engage with other work	Very high		Not possible	
House cleanliness	Very high		Highly affected (unclean)	
Image				
Consumer perception and attitudes	Once purchased, will buy again		questionable	

Conclusions

The traditional fish drying has been facing a number of disadvantages to the Sri Lankan fishing community and this resulted in the requirement of innovative practices to be introduced to the fisheries community. The Tsunami disaster made the problems faced by fishing community severe and provided the space for the governmental, non-governmental and other organizations to act on the development of livelihood of the fisheries community in the Southern Province, Sri Lanka. The solar drier introduced to a selected group of women in Gadara Central, Matara, Sri Lanka provided numerous benefits to the selected group. This study highlighted the costs and benefits of this solar drier. First, it was revealed that the benefits of the solar drier are mainly “non-monetary” and the monetary benefits of the solar drier are minimal. Accordingly, it can be concluded that the time, energy and the psychic costs of the new solar drier are considerably much less than the traditional method. Furthermore, the quality of the harvest also shows a considerable improvement due to the adaptation of this appropriate technology. Therefore, the solar drier mainly provides an example of an appropriate technology which can be incorporated into

the fisheries industry in the province to facilitate the sustainable development of the livelihood.

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