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Establishment of Rural Enterprises Using Multi-Commodity Solar Tunnel Dryer through the Application of Social Laboratory Concept as a Sustainable Technology Transfer Strategy in the Philippines

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Abstract - The social laboratory concept as a sustainable technology transfer strategy was developed and applied in the establishment of rural enterprises using the multi-commodity solar tunnel dryer (MCSTD. This is in order to improve productivity and income of micro-enterprises engaged in processing and drying of agricultural and fishery products. First, the roles of stakeholders and resources needed to hasten the adoption of MCSTD were established. Coaching and mentoring of new MCSTD adopters followed to strengthen their technical capability on proper drying of agricultural products, the operation of the solar dryer, and on managing their businesses. Finally, the enterprises were monitored in terms of technical, socio-economic, financial viability, and their contribution to the community. Results showed that the social laboratory concept was an effective technology transfer strategy. It played major role in the establishment of new MCSTD-based enterprises in the different regions in the Philippines. A total of 15 new enterprises were established and 3 of the enterprises were found to be technically, economically and financially viable. The use of MCSTD generated income for the enterprises, facilitated the creation of new enterprise, introduced unique products in the market, and increased demand of raw materials. Moreover, the solar drying technology was found very technically efficient, cost efficient, environmentally sound generating employment for people in the community.

***Keywords* – solar drying, social laboratory, technology transfer, rural enterprise.**

INTRODUCTION

The Philippine Center for Postharvest Development and Mechanization (PHilMech) developed a dryer which originated from University Hohenheim, Germany. The dryer is called the Multi-Commodity Solar Tunnel Dryer (MCSTD) used as an alternative to sun drying practice and use of mechanical dryers. In 2007, PHilMech established a technology demonstration site on MCSTD with the Kababaihang Masigla ng Nueva Ecija (KMNE), as the project's cooperator. The KMNE is an association of women engaged in the processing of dried fruits, vegetables and fish. Results of the study conducted by PHilMech in 2008 showed that the MCSTD was beneficial to KMNE because it generated income for the enterprise, improved the quality of dried products, boosted confidence to expand market, and generated employment opportunities for the community (Martinez, 2008). Since then, KMNE became a popular destination of PHilMech visitors which resulted in increase of interest and requests for visits and training by prospective investors. This prompted PHilMech to convert the demonstration site into a "social laboratory". The social laboratory concept is an example of a technology transfer strategy towards the development of postharvest enterprises. This was conceived out of the need to sustain client's interest on the technology. The social laboratory on MCSTD showcases a profitable and sustainable business model of processing quality dried agriculture and fishery products (Martinez, 2012). To establish the role of the social laboratory in accelerating the establishment of new MCSTD rural-based enterprises, PHilMech partners with the KMNE providing the following services: 1) venue for technology demonstration/information dissemination 2) venue for technological and entrepreneurial skills training, and 3) marketing and display center of quality dried products.

As a model in the adoption of MCSTD, the social laboratory also assist PHilMech in training and coaching new MCSTD adopters not only on proper processing and drying of quality agriculture and fishery products but also in proper management of the business. The target clients of the social laboratory were the rural women, farmers and processors belonging to micro, small and medium enterprises (SMEs), non-government organizations, foundations and other development workers in government and other MCSTD investors.

MATERIALS AND METHODS

The MCSTD is the technology used in drying of commodities at the social laboratory. In 2006, PHilMech lend one unit of MCSTD to the KMNE to be used as a demonstration unit.

The MCSTD has three major components, namely; 1) heat collector, 2) drying chamber and 3) blower (fan). The heat collector (7.2 m) and the drying chamber (9.8 m) are made of a long span ribbed type G.I. sheet, with insulation. Five pieces of 120 mm diameter impedance type axial fans forces air into the heat collector increasing the drying air temperature from 45 to 60 °C. The dryer is covered with 0.15 to 0.20 mm UV-stabilized polyethylene plastic sheets, mounted in inverted 'V" panelized metal frames. The trays containing the products to be dried are placed in the drying chamber. Metal stands of about 0.90 m serves as dryer stand (Martinez, R.C. et. al., 2010). At present, two units of MCSTD are being used by KMNE at the social laboratory.

Figure 1 shows the conceptual framework of the project**.** The process of establishing new MCSTD -based enterprises emanates from the influence of the MCSTD social laboratory. The *Inputs* are the resources given by KMNE, PHilMech and other government agencies .The *Process* describes the action undertaken by the MCSTD adopters before it finally adopts the MCSTD. The *Output* is the number of MCSTD units adopted, type of enterprises established and assisted. Finally, project *Outcome* is a viable MCSTD-based enterprise.

A. Determine the roles of stakeholders and resources needed to hasten technology adoption

In 2010, PHilMech and KMNE forged an agreement to strengthen its partnership in the social laboratory. Implementing guidelines were formulated and required manpower , technical, material and financial support were determined through a consultation workshop attended by KMNE members, representative from PHilMech and participating government agencies. Two regular staff from PHilMech served as resource speakers during the conduct of technical orientation as well as monitor and report the progress of the project. Two KMNE members do the actual demonstration on proper drying of commodities using the MCSTD. Other government agencies like the Department of Science and Technology (DOST), Department of Trade and Industry (DTI), Department of Labor and Employment, (DOLE) and the Local Government Units (LGU) also provided additional equipment and financial support to sustain the operation of the social laboratory. PHilMech also allotted a total amount of Php 696,749.11 to support project activities including coaching and mentoring of the newly established MCSTD-based enterprises for a period of three years. KMNE cost shared with PHilMech by sharing their time, processing facilities and expertise in the social laboratory.

B. Coaching and Mentoring of New MCSTD adopters to strengthen their technical capability and managing their businesses

Series of technical orientation, technology demonstration and hands-on -skills training on the proper operation and maintenance of the MCSTD as well as exchange of information on best practices of managing the enterprise were conducted in the social laboratory. PHilMech prepared specific training modules tailor-fitted to the needs of the clients. Interested clients were encouraged to first do actual visit/exposure to the social laboratory to observe the dryer's performance, and then clients are encouraged to undergo hands-on skills training on processing and drying of commodities to gain more knowledge and skills on proper drying of commodities. Finally, a follow through on the job one-one coaching and mentoring was done to guide new MCSTD adopters in the proper use of the technology as well planning and managing the newly built MCSTD-based enterprise. Depending on the level of operation of the enterprise the following coaching and mentoring services were conducted: a) linkage to PHilMech accredited manufacturer for purchase of the dryer, b) on-site installation, c) skills training on the operation & maintenance of the dryer, d) assessment of adopter's needs, e) business planning and business plan preparation, f) entrepreneurial skills training linkaging and networking with other agencies.

C. Determine the effect of adoption in terms of technical, socio-economic, financial viability and its contribution to the community

Effect of adoption was done by describing and tracking the sequences, processes related to the establishment of the new MCSTD-based enterprises. Likewise, the status and progress of newly established MCSTD-based enterprises were analyzed and assessed in terms of technical feasibility, socio-economic viability, financial viability and networking with other agencies to ensure sustainability. All enterprises were subjected to an c) Investment analysis – to measure the worthiness of the enterprises showing the following financial indicators 1) Payback period (PBP), 2) Internal Rate of Return (IRR), 3) Net present value (NPV) and 4) Benefit Cost Ratio (BCR).

RESULTS AND DISCUSSIONS

A. *Roles and Function of the Social Laboratory*

The social laboratory serves as venue for technical briefing and technology demonstration on MCSTD. For a period of three years (2010–2012), a total of 65 technology briefing and demonstration were conducted participated by a total of 903 participants. It also served as venue for the conduct of skills training on proper operation and maintenance of the dryer to improve the technical capability of new MCSTD adopters**.** For the year 2012, a total of 11 skills training and business planning were conducted and attended by 67 participants. The type of trainings conducted at the social laboratory include: a) processing of dried fruits, vegetables and dried tilapia "tilangit" b) skills training on proper operation and maintenance of the MCSTD, c) product development and improvement, and business plan preparation. The social laboratory also benefited both PHilMech and KMNE. PHilMech utilized the social laboratory as demonstration site and exchange of best practices among MCSTD adopters. While KMNE gained more income from the sales

of it processed products. KMNE recorded a total sales of P 355, 070 in 2010, P490,095 in 2011 and P 816,554 in 2012.

B. Establishment of New MCSTD-Based Enterprises in the Different Regions of the Country

By the end of 2012, a total of 15 enterprises were established in the different regions of the country (Figure 2). Out of the 15 enterprises, three were found to be viable. These include 1) Keño Foods Inc. of Bustos, Bulacan; 2) Chef Duque of Marinduque State College of Boac, Marinduque, and 3) Remzon Organic Products & Deli of Floridablanca, Pampanga (Figure 2). The social laboratory played a major role in accelerating the establishment of new MCSTD-based enterprises. At present, PHilMech continues to provide technical assistance and other business development services (BDS) to guide the new MCSTD adopters in running their businesses.

Keño Foods Inc. is the first company in the country to engage in the commercial processing of dried young tilapia located in Bustos, Bulacan. The company is owned and managed by a farmer-businessman. The idea of processing tilapia into dried fish started when Keño visited PHilMech and KMNE in 2006. Keño was impressed of the performance of the dryer and requested assistance for skills training on drying of tilapia at the social laboratory. He started his market research on processing of dried young tilapia using the old MCSTD which he repaired with the assistance of PHilMech. In 2008, Keño applied for applied a loan from Agriculture Competitiveness Enhancement Fund (ACEF) of the Department of Agriculture to finance the project. The loan was approved in 2010, enabling the company to construct a processing plant and other equipment and started the enterprise. Keño's "tilapia crunch" is highly demanded in the market. Every pack of tilapia crunch contains 100 g dried fish sold at P 100.00/pack. The company has established 33 market outlets in Manila and retail shops in Bulacan. The company is currently using three units of MCSTD for its drying requirements. Keño is also supported by the Bureau of Fishery & Aquatic Resources, (BFAR) and DOST.

The second successful adopter is the Chef Duque of Marinduque State College (MSC) an academe-lead MCSTD-Based Enterprise located in Boac, Marinduque. The project began in February 2009, when President Romulo H. Malvar of MSC visited PHilMech in search of appropriate postharvest technologies. He was able to observe the actual operation of the MCSTD at the social laboratory. Convinced with the potential of the MCSTD, President Malvar commissioned three of his faculty to learn the basic operation of the MCSTD and proper drying of commodities. A year after MSC and PHilMech entered into an agreement to implement an MCSTD-Based Enterprise at MSC. The project team at MSC processed breadfruit "rimas" into flour and baked products. Beginning in January 2011, rimas baked products are sold at MSC Convenient Stores and canteen. The **"**Chef Duque" is the official brand name of MSCs processed rimas products. For 2012, MSC recorded total sales of P 139,250.00 of baked rimas products.

The third adopter is Remzon's Organic Products and Deli Shop a family enterprise, located in Floridablanca, Pampanga. Remzon started in 2009 selling dried herbs, tomatoes and other processed products. However, sun drying is inefficient because it renders poor quality dried leaves. In most instances customers complained of the presence of molds in Remzon's processed products. In 2010, Remzon became a recipient of the DOST – SETUP program a government agency enabling entrepreneurs to upgrade and/or acquire additional processing equipment and facilities to promote productivity. The DOST referred Remzon to PHilMech and visited the social laboratory on MCSTD in 2010. During the visit, Remzon learned not only the actual use of the MCSTD but also the proper use of the dryer. Impressed by the performance of the MCSTD, Remzon purchased 1 unit of MCSTD from PHilMech's accredited manufacturer. Remzon processed basil tea, dried basil leaves, chili sauce and dried tomatoes. The products can be bought in grocery stores, canteen and restaurants in Pampanga and selected market outlets in Manila.

C. Technical, Financial and Socio-Economic Benefits of the MCSTD-Based Enterprise

The MCSTD perfectly fits the drying requirements of Keño Foods Inc. A total of 200 kilograms fresh ready to dry tilapia is distributed in three dryers/batch of drying. Drying is completed in 1.0–1.5 days. The shorter drying time enables Keño Foods to achieve the desired quality and volume of tilapia crunch to meet their market demand. Chef Duque of MSC processed breadfruit "rimas' into flour and baked products. Drying of rimas chips using the MCSTD is completed in 6.6 hours shorter compared to sun drying which takes 1 or more days depending on the intensity of the sun. Likewise, Remzon was also satisfied with the performance of the MCSTD because of shorter drying time, production of better quality dried products and increased volume of production. Customers no longer complain of presence of molds in the processed products. Moreover, the use of MCSTD increases the demand of raw materials in the area providing alternative market of farmers produce. It is also easy to operate even by women. This confirms previous studies conducted by PHilMech on the excellent performance of MCSTD. (Martinez, 2008) Table 1 shows the commodities dried using the MCSTD.

Table 2 shows the summary of financial analyses of Keño Foods Inc., Chef Duque of MSC Remzon for the year 2012. Results showed that the three MCSTD rural-based enterprises were financially viable. For Keño Foods Inc., the initial capital investments can be recovered in 5.9 years, the Internal Rate of Return is favorable at 16.90%, it has positive Net Present Value (NPV) and the Benefit Cost Ratio (BCR) was more than 1.0 For Chef Duque of MSC, payback period is 3.49 years, NPV is positive, IRR of 27.29% and BCR of more than 1.For Remzon payback period is less than three years and has a positive NPV of P 842,306.32,and IRR of 35.96% and the BCR of 2.19.

The adoption of MCSTD opened opportunities to build new enterprise like Keño Foods Inc. in Bustos, Bulacan and introduced a unique product "tilapia crunch" highly demanded in niche market. The company now employs two regular staff and 20 on-call laborers working

in the processing plant. The MSCs adoption of the MCSTD added economic value to breadfruit which used to be neglected by the people of Marinduque. The income generated from the project contributed to the over-all income generating activities of the College. Remzon provides employment opportunities specially the rural women and out of school youth in the community. Five rural women and 2 farm laborers works in the processing plant. Moreover, the flexibility of the MCSTD to dry multiple commodities simultaneously encouraged Remzon to expand its production area planted for its raw material requirements.

CONCLUSIONS

The social laboratory is an effective techno-transfer strategy because it played a major role in accelerating the establishment of new rural-based enterprises. About 15 new MCSTD-rural based enterprises are established in the different regions in the country. Three enterprises namely: Keno Foods Inc., Chef Duque of MSC and Remzon Organic Products were profitable and established market of their products. All three enterprises are satisfied with the technical performance of the MCSTD. The use of the technology generated income for the three enterprises, developed new products in the market, increases demand for raw materials, environment and gender friendly and generated employment opportunities for the people in the rural community. PHilMech must continue to establish partnerships with either government or non-government agencies/organizations to sustain technology adoption. All three enterprises are supported by other government agencies providing additional technological, material and financial support.

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