Solar Powered Aeration Technology Transfer for Fish Farmer : A Student Perspective

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Abstract— This paper presents a student perspective on the Indonesian Government's technology dissemination program. This program located in the aquaculture center in Sleman, Yogyakarta, Indonesia. The government, i.e. Ministry of Research and Technology, conducts a solar powered aeration technology dissemination to help aeration in fish breeding and also for future research projects in renewable energy application. It needs an intense communications to avoid miscommunication and to accelerate the execution of the project. The problem is how to transfer the technology and who accompany the process. The approach for the solution is to assist the community through local student where projects implemented. The student role is to assist the public in scientific and sociological aspect. The method is to design the students participation because the student have a more flexible movement in bridging communication. Students can communicate with various parties, academic, private and public. Establishing public awareness to move itself more sustain than a top-down approach. The student responsible for monitoring the community and provide another point of view. Community drives itself to find out the answer for their problem. The result is when the government conduct a technology transfer to the smallholder fish farmers, it required students involvement for effective project communication in dissemination process. Without the presence of students as a catalyst to fish farmer, the government project will lose a bridge of communication to the public. Sustainable relationship among the stakeholders will be an advantage in the future.

Keywords—technology transfer, student, communication

I. Introduction

One of the economic keys in Indonesia is agriculture. Agriculture contributes to drive economic growth and employment in Indonesia. Agriculture play role in Indonesia's food security status, alleviate poverty and unemployment in rural areas. In order to improving food security, livelihoods and increasing agricultural production there are several program and activities. The program and activities include technology adaptation for smallholder farmer. In the developing countries, technology transfer remains a social and economic issue.

On the issues of contribution to the development, Sleman Regency is known as a center for fisheries producers in Yogyakarta city. The center of fish farming is situated in Sleman, exactly in Parakan Wetan, Sendangsari Village. Parakan Wetan is also an area directly adjacent to Progo River. The total population of Parakan Wetan and Parakan Kulon Sendangsari Village, Minggir is 876 people. Therefore, it is necessary to maximize existing resources and reduce the vulnerability of society.

To reduce the amount of existing unemployment, local people formed a joint venture group of productive fisheries. There are a lot of group of fish farmers that exist due to the characteristics of the soil, water, and climate in Sendangsari Village which is suitable for aquaculture both prawn and carp.

Fish farmers in Sendangsari village are running their business in private and groups. Total production of prawn in 2010 reached 166 tonnes out of the 215 tonnes in Sleman. But in 2011 production decreased due to 30% of 23 hectare ponds did not operate or changed to other commodities such as prawn and carp [1].

Sembada Mina Mandiri is one of the aquaculture group (prawn and carp) located in Parakan Wetan RT 01/RW 21, Sendangsari, Minggir, Sleman, Yogyakarta. This business is a joint venture owned by 15 members of the community, founded in December 3, 2005. Majority, education level of the community member were the high school/equivalent. The group targeted to manage 5 hectare of fish pond and have produced 18.5 tonnes in 2009. The basic system of fish farming is conducted by intercropping between prawns and carp.

One of the problems of fish growing in ponds is the dissolved oxygen (DO) concentration in the water. The level of DO under 2 ppm is dangerous to the life of the fish because at this level of DO the probability of mortality among the fish is high [2]. In the fish farming business, the ability to maintain water quality is the key of improving fishery production capacity. The common used in maintaining water quality is the implementation of the aeration.

In an effort to develop fishery products, the government is supporting the community to increase fisheries production.

The Government through the Ministry of Research and Technology has conducted specific technology dissemination program (SPEKLOK) [3]. This program brings to infrastructure fulfilment, such as the construction of photovoltaic system to provide the energy demand for fishpond aerator and lighting. With the power from solar energy, the community can utilize it for aeration system and light at night for fish farming security. Aeration used to maintain the quality of fish seed quality because it will determine the final outcome of production. The solar powered aeration system is a new technology to the community. The community needs guidance on solar powered aeration system, operate and maintain the system. It is important so that the community can keep the sustainability of the utilization of the supporting technology for fish farming activities.

II. Technology Transfer Barrier

Adaptation of supporting technology is needed to stimulate fisheries production capabilities. The adaptation of solar powered aeration have indirect role on improving the production of fisheries. Solar energy technology introduced because it is environmentally friendly and in order to expand the utilization of renewable technology for productive activity. On the other hand, currently the renewable technology such as solar energy remains expensive technology and lack penetration to the market.

Experience from several projects shows there are barriers for technology adaptation to the developing countries. Murai (2000) explain some obstacles in the process of technology transfer are as follow:

1) Hit and away approach
   A very short term project where usually a developed country rashes to bring high technology or equipment into developing countries, acquired all necessary data and left in a few years after submitting a report of analysis with respect to a certain topics without real participation by developing countries.
2) Push button approach
   Most of technical transfer includes how to use a technology in the application in developing countries. The developing countries are trained how to "push button" of existing computer software without knowing the real meaning. Such black box type training will not strengthen the capability of developing countries.
3) Money approach
   Only donating money or equipment can not reach a solution.

Besides, in the process of technology transfer there is a communication between the government and farmers. Communication processes play a role in the process of technology transfer. Communication is the medium to deliver technology and policy. Good communication will accelerate the technology transfer proces in achieving the target. Otherwise ineffective communication will disrupt the process of technology transfer. In the conventional approach in the process of technology transfer, there is a distance between farmers and the government.

The distance between the farmers and the government in the technology transfer create the rigid communication between them. This rigid communication is formed by the government because they using the formal communication to the smallholder farmer, hierarchical organisational structures, authoritarian, and topdown decision.

Indeed, the government should know and understand the condition of its own society and culture. The rigid communication prevents clear and honest communication. Also, it is prevent both parties to be more open and receptive to different perspective and solution. It is difficult to deliver the aspiration when the government sitting in high places that never came down directly on a regular basis to see the real condition.

The higher level of technology requires more intense communication to the farmers. It should be noted that the adopted technology could not make the difference immediately. Farmers prefer to adapt traditional technologies because socially accepted practices, proven, cost-effective and easy to understand.

III. Approach & Solution

The technology transfer involving the synergy between some stakeholders. There are four stakeholders; academic, business, community and government. Each stakeholder has their contribution for successfull technology transfer. Government creates supporting policy for farmer, business stakeholder makes improvement in equipment and service. The community is a subject to the sustainable development.

In the academic stakeholder, there are university student as agent of change in the technology transfer to community. The goal is not to generate revenue for the university, but rather to foster sustainable development and change behaviour through the transfer, or teaching of that intellectual property [4].

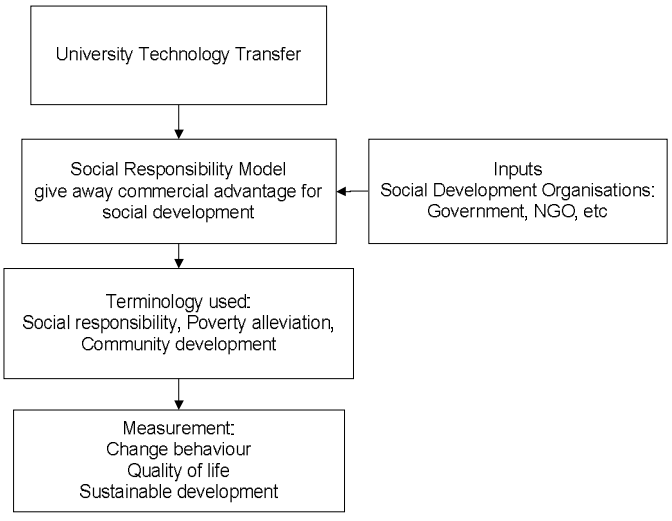

Fig. 1. Modes of technology transfer in a developing country [3]

Kloppers et al (2006) propose the model of technology transfer in developing countries by university and make a distinction between commercial technology transfer and social

technology transfer. Fig. 1. shows how social technology transfer exist in the developing countries. Technology transfer facilitated by academic staff in social mode of technology transfer and the outcome is change behaviour in the society. The vast majority of technology transfer happens through lecturers teaching student in highly structured process.

Fig. 2 shows the mechanism of communication in technology transfer for smallholder farmer. Whatever the kind of technology transfer, they have the same pattern in technology transfer process. In order to fill the communication gap between government and smallholder farmer, there should be "good friend or great supporter" to bridge the communication. In technology transfer project needs an intense communications to avoid miscommunication and to accelerate the execution of the project. The problem is how to transfer the technology and who accompany the process. The approach for the solution is to assist the community through local university student where projects implemented. The student role is to assist the public in scientific and sociological aspect. The method is to design the students participation because the student have a more flexible movement in bridging communication. Students can communicate with various parties, academic, private and public.

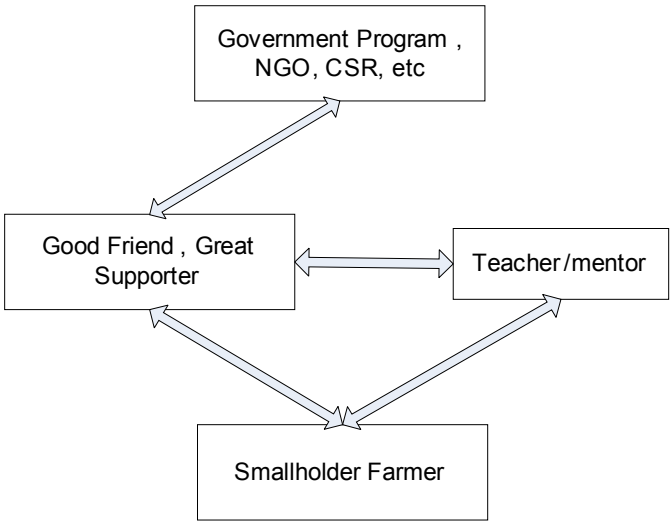

Fig. 2. Communication scheme of technology transfer for smallholder farmer

Murray (2000) explains that technology transfer needs cosmopolitans who understand people, culture and infrastructure in developing countries. In Asia, keeping face or pride is one the most important factors for Asian colives each other. Someone can not make a good friends if do not understand people and culture in developing countries. It will take a long time for foreigners to become friend with people in developing country. Any business will not be succesfull unless we become friends in developing country. Commonly local student in Indonesia can make a good friends to the people in grassroot level or smallholder farmer. Local student know how to communicate with the local language and adjust the local wisdom. Good friend means they are exchange personal views, understand real culture and people's life.

University student have a flexibility movement in communicate with the government and the smallholder farmer. Universitas Gadjah Mada serve the local community every period year to year through field work service or Kuliah Kerja Nyata (KKN). This activity involving the student to assist the community to increasing the community quality of life. There are technology transfer to the community in many cluster; science and technology cluster, agricultural cluster, social-humanities cluster and health cluster (medical, nursery, etc).

The student as a goodfriend to smallholder farmer and the University lecturer as great supporter who can evaluate real capability of a person in a charge of technology transfer. The student responsible for monitoring the community and provide another point of view. Establish community awareness to move itself more sustain than a top-down approach. The community or smallholder farmer push to solve their problem by themselves. Motivate the farmer and accompany while they are learn from another parties called the teacher or mentor. The teacher/mentor here means a role model or the success farmer in their business or the expert practitioner. Let the smallholder farmer learn from the best.

IV. Project Experience

In order to improve the distribution of national development, Indonesian Government try to disseminate the utilization of science and technology research and development based on the local resources with the technological support. Fig. 3. shows one of the technology dissemination program; solar powered aeration to support fish farming. This program conducted by department of applied science and technology for community, The Ministry of Research and Technology, Indonesia.

Fig. 3. Solar powered aeration technology

The purpose of this program are to create and strengthen the network between technology producer and technology user, give the solution for local problem with the appropriate technology by using local resources and improving the integration between research-development institution and local small-medium enterprises [5]. Also, solar power aeration system promoted as a pilot project for future renewable energy research.

The objective of the SPEKLOK program are; technological packages (proven technology) can be used in the fish farmer, create the relations between academician, expertise practitioner with local governments, communities and businesses. Develop the community to adopting the supporting technology of fish farming for improving fisheries production [5].

Fig. 4. Fish farmer and the student

Fig. 4. shows the technologies adoption process involving the local student. Adaptation technologies should not be limited to the narrow definition of hardware and equipment but should also include social and institutional practices that increase the resilience of the smallholder farmer [6]. Community participation are needed for capacity building. Students assist the community from the beginning of the project until the end of the project. The students accompany and assist the smallholder farmer when the government conduct forum discussion with the stakeholder, when the fish farmer learn from expert practitioner and when the community needs.

Fig. 5. Knowledge sharing

Fig. 4. shows the process of knowledge sharing by the student. Knowledge sharing about the concept of solar powered aeration system to the four people responsible for the system. Discuss the types of tools used in the solar powered aeration system, how to operate the instruments, reading monitoring systems, the installation process, system description, system components, maintenance and security operations. All technologies or practices to be transferred are not necessarily high technology. Adaptable techniques that are useful at the current of the targeted smallholder farmer are sufficient enough [7]. The capable researcher (the student lecturer) give the support from behind.

Fig. 6. Aeration system maintenance

Fig. 6 shows the fish farmer repairing the aeration piping systems. This aeration system used to maintain dissolved oxygen (DO) concentration in the water above 2 ppm. By maintain DO concentration in the water, at least maintain a constant harvest between 2.000-4.000 fish seed. It is reduce mortality of fish seed until 60 percent that previously without aeration system .

Fig. 7. Learn from expert practitioner

Fig. 6 shows the fish farmer learn from the expert practitioner. The practical training to improve technical skills in adaptation of technology. The community or smallholder farmer push to solve their problem by themselves. The community participation is needed for capacity building.

Top-down approaches have limited success. They designed and initiated by higher levels of government agencies and then implemented in the local communities without community participation. Bottom-up approaches are more successful because they tend to deal with many problems which the community concerned may be facing. The model of local and academic cooperation in the development, installation and management of adaptation technology provides an example of a successful strategy for the implementation of adaptation technology locally [8]. Student involvement as a catalyst in the adaptation technology for smallholder farmer and improve the process of communication among the stakeholder.

V. RECOMMENDATION

The improved processes to enhance adoption of technologies by smallholder farmers are as follow :

1). Appropriate technology

Traditional and local technology practices always socially accepted, proven and cost-effective. New high technology adoption less effective rather than appropriate technology in the fields while there is gap between accessibility and availability of the technology equipment and knowledge with the infrastructure development and parallel development of local market services. There should be compromising between improving the local technology practices and promoting new higher technology. We need to look into the details of current development stage. Cho (2011) explain that adopting the advanced technology could not instantly solve the problem. Technology that can be added into the developmental stage should be socially adaptable. Providing appropriate and socially adaptable technology must be realize.

2). Strengthen existing indigenous capacity and knowledge

The smallholder farmer run their activity using accumulated indigenous knowledge and practices. Local farmer understand the need to cope their productivity. In the technology adoption process, give the smallholder farmer a say in whole process; planning, designing and implementing practical adaptation. Participation gives local farmer self-resilience and independence for addressing their problem. To strengthen the existing indigenous capacity and knowledge, it needs the synergy between indigenous and scientific knowledge and optimizing functionality of farmer organization (orgware). University student and the lecturer can assist this development stage. Vincent et al (2011) stated the development of orgware is essential to ensure sustainability. Orgware should be optimize in order to receive and manage any technology and/or supporting finance.

3). Good and effective communication

What we need to accelerate technology adoption process for smallholder farmer is good and effective communication. We need "good friends" or "great supporter" who understand people, culture and local infrastructure for smallholder farmer. A personal and informal approach to the people always a good way in making business deal in developing countries. So does the technology transfer process. The university technology transfer model should involving the student as a good friend to smallholder farmer and the University lecturer as great supporter who can face the unique problem in grassroots level and evaluate real capability of a person in a charge of technology transfer. Smallholder farmer require strong assistance of agricultural technologies and expert consultations from the expert practitioner for capacity building. Strong assistance should be providing by the stakeholder.

VI. CONCLUSION

The adoption of technology to smallholder farmer needs an intense communications among stakeholder to avoid miscommunication and to accelerate the execution of the project. There should be "good friend or great supporter" to the smallholder farmer. The community needs to assist by local student where projects implemented. The student role is to assist the public in scientific and sociological aspect. Student involvement in the adaptation technology for smallholder farmer improve the process of communication among the stakeholder. Good and effective communication among stakeholder provides an example of a successful technology transfer.

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BIOGRAPHY

Agus Setiawan, S.T. assisted the fish farmer community in the Specific Technology Dissemination (SPEKLOK) conducted by Assistant Deputy of Public Science and Technology-Deputy of Administrative Sciences Ministry of Research and Technology Indonesia. He has actively contributing in the several renewable energy project for rural community in Indonesia since in his bachelor degree until now. He is granted the research aid from Directorate of Research and Community Services, Directorate General for Higher Education (DIKTI), Ministry of National Education 2012 and managed the community development in utilizing solar energy for fish farmer. He obtained BEng in Engineering Physics from Universitas Gadjah Mada. He is also interest in humanities, philosophy, economic and strategic management.

Dr. Ahmad Agus Setiawan has research passion on Renewable Energy Systems and Applications for Sustainable Development. Realizing Indonesia is an archipelagoes country with more than 13,000 islands which many of small & remote islands are lacking of electricity supply, he undertook study focusing on utilizing renewable energy resources to generate electricity. He obtained PhD in Renewable Energy Systems from Curtin University, Australia, MSc in Sustainable Energy Engineering from KTH, Sweden and BEng in Electrical Engineering from UGM, where he is currently teaching. He is actively involved in the Working Group on Energy Self Sufficient Program for Indonesia within the Institute of Research and Community Services of UGM. Previously, winning a UNESCO & Daimler sponsored Mondialogo Engineering Award 2007, Dr. Setiawan and his students successfully implemented a Solar Water Pumping System for a rural area in Yogyakarta. This work draws some other awards: PII Engineering Award 2010 from The Institution of Engineers Indonesia, Australian Alumni Award 2011 for Sustainable Economic and Social Development from Australian Embassy in Indonesia; and recently Energy Globe Award 2012 from an Austrian Foundation.