

# Education of Smart Fish Feeder Technology based on internet of things (IoT) for Catfish Farming Groups in Dham Pulo Village, Aceh Besar

Dedi Fazriansyah Putra<sup>1\*</sup>, Ramzi Adriman<sup>2</sup>, Nazaruddin Abubakar<sup>3</sup>

<sup>1</sup>Department of Aquaculture, Faculty of Marine and Fisheries, University of Syiah Kuala Banda Aceh, Indonesia

<sup>2</sup>Department of Electrical Engineering, Faculty of Engineering, University of Syiah Kuala Banda Aceh, Indonesia

<sup>3</sup>Department of Ship Machinery, Aceh Politechnic of Marine and Fisheries, Aceh, Indonesia

Submitted: September 08<sup>th</sup> 2021; Revised: April 08<sup>th</sup> 2022; Accepted: May 20<sup>th</sup> 2022

## Keywords:

Automatic feeder  
Internet of things  
Dham Pulo Village  
Community service

## Abstract

This community service program aimed to implement the smart fish feeder technology based in internet of things (IoT) to increase aquaculture productivity in Dham Pulo Village, Aceh Besar. The community service program consisted of three stages, namely: (1) Dissemination and training, (2) Practice and installation of smartphone/ Internet of Things-based automatic feeder to fishpond plots and (3) Evaluation in the form of focus group discussion (FGD). Implementation of this program managed to enhance the aquaculture productivity of fish farmer in Dham Pulo Village, Ingin Jaya Regency, Aceh Besar. This technology was successfully transferred to the farmers and supported less contact economy and database-based technology.

## 1. INTRODUCTION

Feeding catfish is the most expensive cultivation process among catfish farmers (Novaria et al., 2019). It is because the catfish farmers uses commercial feed which result in high operational costs. Therefore, the farmers will gain less profit compared with the operational costs (Nurhidayat & Raha, 2018). In addition, catfish farmers need catfish feed with high protein at affordable prices in that catfish farmers allocate 1 kg of feed for 1 kg of catfish. The price of feed ranges from IDR 9,500 to IDR 14,500 per kilogram, and such feed only has moderate quality. The price of the good quality feed containing high protein reaches IDR 20,000 per kilogram, and this is fed to 1 kg of catfish. The cost of procuring commercial feed is much higher than other operational costs (Pahae et al., 2020).

Labor wages are also one of the biggest expenses fish culture industry (Wibowo et al., 2019). In catfish farming, especially in the lower middle class, requires human resources who act as technicians in feeding two to three times a day, weighing feed, transporting feed from the warehouse to the pond, and various other tasks that require a lot of energy and time.

Dham Pulo Village, Ingin Jaya Regency, Aceh Besar is one of the traditional catfish cultivation centers managed

by two groups, namely the Lhok Krueng fish farming group and Gampong Lele group. The village, is located about 15 km from the city of Banda Aceh, it has approximately 20 catfish ponds made of either clay or concrete walls (Figure 1). The catfish cultivation business in this village has been managed since 2008. This fish farming was initiated by Mr. Baihaqi, the initiator, who have developed the farming up until today. Currently, the catfish cultivation business was more coordinated with the formation of two farming groups that have been registered in a public notary. The production of catfish from this cultivation in Dham Pulo Village can reach 75 to 100 kg per cycle, and required three sacks of feed at a total price of IDR 855,000. When the wages of workers and technicians were added, it was certain that catfish farmers would find it very difficult to get optimal profits. Therefore, when viewed in terms of production and business management, the catfish cultivation by Lhok Krueng and Gampong Lele groups in Dham Pulo Village was not optimal because it still managed by conventional method. There were some problems in their cultivation management: the amount of feed fed to the fish, the number of seeds stocked, and the amount of production harvested that was not recorded properly. As a result, every time

ISSN 2460-9447 (print), ISSN 2541-5883 (online)

\*Corresponding author : Dedi Fazriansyah Putra

Department of Aquaculture, Faculty of Marine and Fisheries, University of Syiah Kuala, Jl. T. Nyak Arief No. 441, Banda Aceh 23111, Indonesia

Email: [dfputra@unsyiah.ac.id](mailto:dfputra@unsyiah.ac.id)

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the fish farmers in these two groups started a new catfish farming cycle, they had to start over as if they started it from the beginning.

In addition, the problem or obstacle that was often encountered by these catfish farmers in this village was the lack of human resources needed to feed the catfish in approximately 50 ponds. The feeding method they carried out was in still the conventional method, namely the hand-feeding technique, which makes the fish feeding inefficient. When these farmers handfed their catfish, the feed was always spread directly into the pond in large quantities. More specifically, a worker would spread a bucket full of feed directly into a pond. In this case, when the feed submerged in the water, some nutrients could be lost up to 98 percent within an hour. The submerged feed was still eaten by the fish, but unfortunately this no longer contained the nutrients. In addition, the recording or documentation of the expenditure/feeding of the feed was often not carried out by the fish farmers. As a result, the data in the forms of the number of feed types, the amount of feed fed to the catfish, the feeding frequency, the feeding schedule, and the doses of feed were not well recorded. This information would otherwise be very useful as a database traceability, transparency, effective and efficient cultivation management strategy in the future for both farmer groups.

Based on the above problems, the best solution recommended for the catfish farmers in Dham Pulo Village introducing them an automatic feeder based on the current information technology (IoT). Along with the massive use of smartphones among fish cultivators, the use of Internet-based smartphones (IoT) is a necessity. This could be implemented using Internet of Things (IoT) based feeder technology using a smart phone, so that the fish farmers could easily create a feeding schedule with certain doses of feed that suited their needs. Each feed package fed to the fish could be recorded automatically, so that the farmers could continue to monitor their feed expenditure every day without having to record manually. The purpose of this product-based community service activity was to implement the latest technology for automatic feeder based on the Internet of Things (IoT) for catfish farmers in Dham Pulo Village, so that the productivity of their catfish culture could be increased to support the government's food security program.

## 2. METHOD

This community service activity was carried out from March to September 2021 in Dham Pulo Village, Ingin Jaya Regency, Aceh Besar. The target communities of this activity were two catfish farming groups, namely Gampong Lele and Lhok Krueng. This community service activity consisted of 3 (three) stages, namely: (1) Socialization and training, (2) practice and installation of smartphone/Internet of Things-based automatic feeder to fish pond plots, and (3) an evaluation that took the form of Focus Group Discussion (FGD). With the implementation of this technology in these two catfish farmer groups, it was expected that these groups could become a pilot project center for the use of smartphone/Internet of Things (IoT)

based technology and a freshwater techno-science center in Aceh Province, especially Aceh Besar Regency. The details of the stages of empowerment activities are as follow.

### Stage 1 Socialization and training

This phase was aimed to provide a basic understanding of aquaculture, feed technology design, site construction, maintenance of fish and materials that can be used, and the formulation of appropriate feed ingredients/rations for domesticated fish.

### Stage 2: Practice or demonstration of installing smart feeders through a smartphones

This activity was aimed at training and directing the target farmers to carry out the installation starting from designing an automatic feed machine construction, operating, monitoring, problem solving related to machines and the knowledge of database based on the Internet of Things (IoT). The demonstration activity and installation of a smartphone/Internet of Things-based smart feeder machines was done in collaboration with e-fishery feeder companies that had had experience in coaching fish farmers and using automatic feeding machines.

### Stage 3: Evaluation through Focus group discussions

This evaluation was carried out by involving the entire team of fisheries experts, resource teams from various backgrounds, the target farmers, village officials, students, and fisheries stakeholders. In the FGD it was decided that the smart fish feeder technology would be developed further and made sustainable, and the team of the proposers and e-fishery feeders would always be available for assistance through communication via social media, chats, and visits when necessary.

## 3. RESULT AND DISCUSSION

There were four activities that were carried out by the community service team of Syiah Kuala University. These activities were as follow.

### 3.1 Observation and Information Session

The observation and socialization sessions were attended by the 20 people target communities consisted of 15 people of farming groups in Dham Pulo village, and 5 person from village officials (Figure 1). In this activity, the fish farmers were given an explanation of the stages of the activity, and they were given time to discuss among themselves what problems occurring in their cultivation sites. After thus discussion, it was found that the main problem for these cultivators was the problem related to feed. There was no proper feed calculation method, so they were not too detailed in knowing how much feed was spent per cycle. According to some literature, feed is one of the important factors in aquaculture businesses (Muhammadar *et al.*, 2019; Putra *et al.*, 2021; Putra, Nur, *et al.*, 2019; Putra, Rahmawati, *et al.*, 2019; Zubaidah *et al.*, 2021). Effective and efficient feeding can increase the productivity of aquaculture. The use of aquaculture mechanization is very useful for increasing yield productivity and fishery production capacity (Pratama *et al.*, 2021).



**Figure 1.** a) Observation activities and socialization of PKMB 2021 attended by catfish farmers. Discussion with one of the catfish farmers; b) Feeding the catfish; c) Discussion with the stakeholders



**Figure 2.** Providing CBIB training materials, digitizing fisheries, and applying IoT technology in aquaculture

### 3.2 Training and Counseling of the Catfish culture Best Management Practices

Training and counseling on how to cultivate fish properly and correctly is an absolute requirement in producing quality aquaculture production (Putranto et al., 2020; Slamet Priyono, 2021). This CBIB training was attended by the catfish culture groups and resource persons from the Universitas Syiah Kuala's Faculty of Marine Affairs and Fisheries, namely Mrs. Iko Imelda, M.Si, Mr. Nazaruddin, MT, and Dr. Ramzi Adriman, M.Sc (Figure 2). The material presented was related to the manual of Best management practices of catfish, fishery digitization, and the benefits and application of the Internet of Things (IoT)

in aquaculture business. In this activity the participants were very enthusiastic, and they discussed among themselves options in solving problems related to catfish cultivation in their village. From the results of the sharing and discussion, it was found that the problem of feed dominated in their catfish cultivation, and the participants agreed that one solution to solving this problem is to use the latest internet of things (IoT) technology. In this training, the participants were also given pretest and posttest through questionnaires to determine the knowledge absorption of fish farmers, who were the target community of the community service activity.

### 3.3 Handover and Installation of Smart Fish Feeder in the Pond

The practice or demonstration of installing smart feeders through a smartphone was aimed at training and directing the target farmers to carry out the installation starting from designing an automatic feed machine construction, operating, monitoring, problem solving related to machines and the knowledge of database based on the Internet of Things (IoT) (Figure 3). The demonstration activity and installation of smartphone/Internet of Things-based smart feeder machines was carried out in collaboration with e-fishery feeder companies that had had experience in coaching fish farmers and using automatic feed machines. This activity was concluded with a ceremonial handover of two smart fish feeder (e-fishery) machines to each of the two Gampong Lele and Lhok Krueg farming groups. This ceremony was witnessed by the village head and the head of the catfish cultivator group in Dham Pulo Village.



**Figure 3.** a) Demonstration of smart fish feeder installation; b) Handover ceremony to community service's target community



**Figure 4.** a) FGD involving the target farming groups, village apparatus, and babinsa. The team leader is presenting the program; b) The photo session with the village officials

### 3.4 Focus group discussion with stakeholders

The Focus Group Discussion (FGD) was attended by the community service team, the target catfish farming groups, and village officials consisting of the village head, village secretary, village officials, and *babinsa* (Indonesian Defense Forces village supervisory non-commissioned officers) by observing the health protocol. In this FGD, the village head expressed his profound appreciation to the USK community service team for the activities that had been carried out in his village. He was very grateful and hoped that the community service program organized by USK's Faculty of Marine Affairs and Fisheries could be continued by making his village a fostered village under the guidance the faculty. The *babinsa*, Mr. Afrizal, was also very supportive of this activity and he stated that he could guarantee the security of the community service team and the students of USK, so that they would be able to carry out this activity safely and comfortably (Figure 4).

An evaluation of this activity was also carried out. From the evaluation, it was suggested in the next occasion this activity should be made bigger in terms of its budget, so that the obtained benefits could be greater. Thanks to the smart fish feeder technology, there had been a significant difference in terms of productivity of catfish cultivation in Dham Pulo Village after it was implemented. According to the catfish farmers, their yield had increases by 50%. Previously, their catfish production was usually around 100 kg, but it had become 150 kg. The fish farmer community was also supportive and enthusiastic. The catfish farmers requested for other community service programs organized for them by the Faculty of Marine Affairs and Fisheries, University of Syiah Kuala. It was, therefore, suggested that Dham Pulo Village could be a fostered village for future community service activities.

## 4. CONCLUSION

The community service program Smart Fish Feeder Technology Based on the Internet of Things (IoT) in Dham Pulo Village, Aceh Besar was successfully done. The target community (the fish farmers and village) were really satisfied by this IoT-based smart fish feeder technology education program because they could enjoy the benefits gained from this technology. These benefits comprised safe feeding, increased productivity, and making all tasks related to feeding more effective and efficient.

## ACKNOWLEDGMENT

The authors would like to thank the head of Dham Pulo Villlage and all his staff for helping the community service team, do that this activity could run safely and smoothly. This activity was funded by the LPPM (Office of Research and Community Service) of Syiah Kuala University in accordance with the Letter of Agreement on Assigning Product-Based Community Service for 2021 Fiscal Year Number: 174/UN11/SPK/PNBP/2021 dated 22 February 2021. There had been a 50% increase in catfish productivity through the IoT method, so that this new method was proven better than the traditional method.

## CONFLICT OF INTERESTS

All the named authors declared that this manuscript entitled "Education of Smart Fish Feeder Technology based on internet of things (IoT) for Catfish Farming Groups in Dham Pulo Village, Aceh Besar" has no conflicts of interest and significant financial support. We also confirm that this manuscript has been read, proof-read, and approved by the authors. Furthermore, any concern during the editorial process, the corresponding author will be the contact person.

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