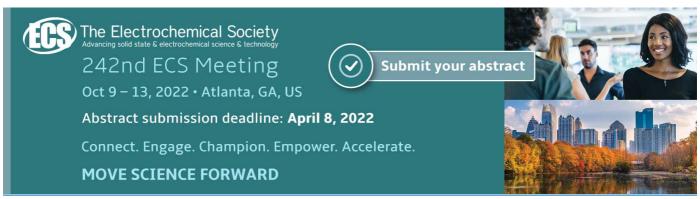**PAPER • OPEN ACCESS**

# ICTs for small scale farmers in Indonesia: how to make it possible?

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# ICTs for small scale farmers in Indonesia: how to make it possible?

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**Abstract.** The effort to digitalized agricultural process has been started since the 1980s to maximize the food production, yet this effort majorly targeted agricultural industries or state-supported farmers group. In Indonesia, the number of small independent farmers is high. These small farmers have little access to ICT infrastructure to support their farming activities. This paper seeks to propose strategies for improving small independent farmers' access to and utilization of ICTs for agriculture. Qualitative method is used to identify the problems and needs of small farmers and their perception of ICTs for agriculture. Using multi-sites ethnography strategy in gathering data, we conducted in-depth interviews with 22 small farmers from 12 regions in Indonesia. We also observed the day-to-day activities of small independent farmers in two villages in Bogor and Yogyakarta, Indonesia. We found that several strategies have to be considered for developing ICTs for small scale farmers, which are (1) analysing small farmers perception about technology; (2) identifying local-specific issues; (3) involving small farmers in planning digital agriculture system; (4) facilitators of new technology must have communicative competences or communicative skills so the planning of digital agriculture system is done through participatory approaches.

Keywords: small scale farmers, local-specific issues, perception, ethnography

## 1. Introduction

ICT for agriculture has been developed to increase yields and outputs and improving the efficiency and effectiveness of agricultural inputs. However, the beneficiaries of this technology is majorly agriculture industries or government-supported farmers group. Digital divide or the globally skewed distribution of information and communication resources makes small farmers living in rural area have little to no access to technology infrastructure [1,2]. The world thought that the solution of this problem is by delivering infrastructure from rich to poor, instead of empowering the people by involving them in improving the quality of their own lives [3]. Simply distributing tools to people would not guarantee a prosper live. Small scale farmers seldom feel the impact of digital agriculture, either because they have no access to ICT or because they are poorly disseminated [2].

Research about ICT for small scale farmers has been majorly limited to improving the adoption rate of ICT for agriculture. Several studies found barriers in delivering ICT for agriculture, because small scale farmers are: illiterate and poor [2,4], have no trust to innovation [1], lack of awareness of ICT benefits and lack of confidence in using ICT [5] hence, they do not need complex digital agriculture infrastructure [2,6,7]. Several studies also stated that digital agriculture provider did not design the ICT to meet small scale farmers needs [6–10], it did not give impact to their live [11], it did not provide

proper training for small scale farmers in using ICT [2,11,12], the ICT did not use local language so it was hard to use for small scale farmers [4,13], and agricultural ICT is not yet integrated with other development programs to address the numerous related problems faced by farmers [2].

The constraints showed that the problem of digital agriculture utilization by small scale farmers is the lack of small scale farmers input or participation in designing the ICT system itself. Many studies recommended that the design of ICT have to use participatory process where small scale farmers do not only act as end user but also part of planner of the ICT system planning [14–18], however there are several studies showed that participatory approaches is hard to do when actors involved have no commitment [16], farmers have no understanding in decision-making in practice as well as delivering their needs [17], the lack of competences, approaches and scientific disciplines needed in developing a sustainable ICT for agriculture [17], challenges on local adaptation and lack of farmers who could analyse data [19]. These findings shows that there are still challenges even though ICT for agriculture has been developed or assessed in participatory research, yet these challenges also explained that the purpose for doing participatory approach is to, first and foremost, to adapt local need and issues in the development of ICT for agriculture. This research project proposes an analysis of communicative competences needed to conduct participatory approach, especially with small scale farmers, so that there is a guide for facilitators in discussing the needs of small scale farmers in developing ICT for agriculture. This article is a part of bigger research that already published two articles [20,21].

Communicative competence is the ability to grasp language code and knowledge to deliver information in any kind of condition to someone based on their social and culture knowledge so that they could use and interpret the information in linguistic form effectively [22,23]. Communicative competences or communicative skills are needed by people who deliver the ICT to be able to do participatory approach in developing ICT. This article analysed a social movement organization of small scale farmers that put participatory approach as one of organization value. By using Ethnography Communication (EO), we observed organization meetings and day-to-day farming activities and also conducted in-depth interviews with the members to discover the communicative competences needed by the organization members to do participatory approach.

## 2. Methods
This study used qualitative case study method [24]. The case study of this article is Serikat Petani Indonesia (SPI), a social movement organization based in Jakarta, Indonesia. SPI consists of small scale farmers spread out through 19 provinces in Indonesia, from provinces in Sumatera Island to East Nusa Tenggara Island. SPI supports participatory approach in designing collective actions based on local needs to achieve organization's main goal: food sovereignty. SPI members are majorly traditional farmers who practice agroecology, which refuse to use agriculture industrial inputs. They promote the practice of local wisdom, local seed, and alternative markets (direct selling from producer to consumer).

Ethnography of communication (EO) is used to discover the meaning of ICT based on small scale farmers perspective, to discover the communication process inside farmers groups in discussing the use of ICT in their farming practices, and to discover communicative competences used by members of farmers group in the decision making process. Hymes stated that communication and interaction do not appear in a vacuum, but depend on a particular context or case [25].  In EO, observation and in-depth interview are techniques in collecting data. Observations were made during organizational meetings, such as public discussions, meetings, or conferences. Interviews, in EO, were conducted to deepen or clarify the observations results to participants.

The 'SPEAKING' grid is used as a systematic collecting data method [22]. The 'SPEAKING' is an abbreviation of: settings, participants, ends, act sequence, keys, instrumentalization, norms, and genre (table 1). The data collection based on the 'SPEAKING' grid could guide us to identify how to conduct a participatory approach: does it need to be in certain settings? Who are the most important participants to be involved? In what language or in what manner to conduct participatory approach? Are there any

local norms that we have to understood to conduct participatory approach effectively? These type of questions could help us in breaking down things to be aware of when conducting participatory approach.

**Table 1.** The 'SPEAKING' Grid.

| SPEAKING | Description |
|---|---|
| S: Setting and Scene | Situation and physical condition during a meeting |
| P: Participant | Describes the participant and its social status, also its relationship status |
| E: Ends | The purpose of the meetings and also the purpose of the participant |
| A: Act Sequence | Explains the sequence of the meetings and also the topic that played out through the meeting |
| K: Key | The tone and attitude of the meetings |
| I: Instrumentalization | The form and style of communication, such as written or oral, languages, dialects, and over-use phrase |
| N: Norm | Rules and values of the meetings |
| G: Genre | The type of communication, such as discussion or lecture. |

Observation of day-to-day farming activities was conducted as a technique to gather data about the use of ICT in farmers live. The observation was conducted in Dramaga and Cijujung, Bogor and Sleman, Yogyakarta for 3 weeks. Other than day-to-day activities, we also observed SPI meetings (both in national and local level) in 2016-2017 to understand how participatory approaches is implemented as a decision making process. We also participated in Whatsapp group organized by the members of SPI. It consists of 256 members to discuss organic farming. This technique was used as a way to identify the information needed by farmers. Other techniques conducted was in-depth interviews with 22 farmers from 12 regions in Indonesia to understand their information needs and their perception about ICT for agriculture.

We used multi-sites ethnography approach to select the sites and informants. Multi-sited ethnography solves the need for a method to follow a story or a process and ideas that extend over multiple locations or through time and space [26]. Multi-sited ethnography allow us to understand a variety of perspectives from a single idea. In this paper, the multi-sites ethnography helped us to trace the various communication practices within SPI in doing participatory approach. This approach guided us in choosing study sites and informants. The study sites were determined based on meetings that are attended by small scale farmers in 2016 until 2017. We found five observable meetings (table 2) and through these meetings we met 22 local peasants from 12 regions from North Sumatra, South Sumatra, Bengkulu, Riau, Lampung, Jambi, West Java, D.I. Yogyakarta, Central Java, East Java, Southeast Sulawesi and Central Kalimantan, as our informants. The in-depth interviews were conducted in several ways: face-to-face, telephone, and instant messaging so we could consistently follow the stories of ICT for agriculture utilization in their daily life and also how did participatory approach conducted within SPI.

**Table 2.** List of observed meetings (2016-2017).

| No. | Description of Meetings | Location |
|---|---|---|
| 1 | Natural Farming Training | Yogyakarta, Indonesia |
| 2 | Internal Meetings: Preparation for Plantation Conference | Jakarta, Indonesia |
| 3 | Internal Meetings: Preparation for Agroecology Conference held in Srilanka | Jakarta, Indonesia |
| 4 | Plantation Conference | Jakarta, Indonesia |
| 5 | Field Trip: Natural Farming Practices, Southeast Asia-China Sub-Regional | Yogyakarta, Indonesia |

After collecting data, we did the coding process using QSR Nvivo Pro 12, a qualitative research software [27]. We did two steps of coding process: (1) the 'SPEAKING' grid and (2) Miles, Huberman, & Sadana coding process which includes descriptive, in vivo, process, evaluation, emotion, and values coding [28]. The coding process helped us in explaining activities that needed to be conducted to support participatory approach.

## 3. Results
### 3.1. SPI as an organization
The main goal of SPI is to make food sovereignty as the main paradigm of agricultural and food system in Indonesia. Food sovereignty is a concept where agricultural system are heavily based on farmers knowledge and experience in farming activities, instead of agriculture industrial approach [29–32]. Food sovereignty supports the use of natural agricultural inputs and local farming activities while refusing the use of agriculture industrial inputs [31]. SPI consists of groups of small scale farmers who differentiate themselves from state-supported farmers groups. This conditions makes them have little access to agriculture development projects from governments, since government prioritize their development projects to state-supported farmers groups. Members of SPI are small scale farmers that already have bad experience with government's projects and the use of agriculture industrial inputs. Some of them even mention they suffer from a "trauma" to participate in government projects or use agriculture industrial inputs as it gave them a big loss instead of benefits. The farm size of members are varies, majority members from Java Island have farm less than a hectare while majority members from Sumatra, Sulawesi, and Kalimantan Island are more than 5 hectare yet they are prone to agrarian conflict. Some of members of SPI do not actively work as farmer anymore since their land is grabbed by agriculture industry.

There are two type of members in SPI: small scale farmers and organization staffs that had experience in farming activities. The organization staffs act as the facilitator to farmers in SPI. Organization staffs arrange meetings, provide information about agricultural practices, provide training and education to its members, and give access to any kind of training for its members as a part to achieve the main goal of SPI: food sovereignty.

SPI organize themselves in several levels: national, regions, districts, and villages. The secretariat office is located at Jakarta where national meetings are usually held. At region levels, each region have to organize 3 districts at minimum and each district have to organize 3 villages at minimum. National meetings are arranged by organization staffs in national level, while meetings at local level (region, district, and village) are arranged by organization staffs in local level and the schedule of meetings is based on its members' needs. Other than meetings held by its own members, members of SPI also have access to public communicative spaces such as public discussion with government agencies, trainings or workshops held by other organization or NGOs, and also field trip to at local level, national, and global level. These communicative spaces, whether public or internal, act as place where farmers could gain knowledge and plan collective actions in order to achieve food sovereignty.

The main concept of food sovereignty is independency. Members of SPI strive to be independent from agriculture industrial inputs, so they could be more adaptive or resilient to local problems and opportunities to support their farming activities. We found several groups of farmers that applied "multi-role peasants" [21]. Multi role peasants, basically, is a role division system than makes farmers work collectively to fulfill the pre-production, production, and distribution process of their farming activities. There are farmers who responsible to produce natural fertilizer and microbes, other farmers responsible to produce seedlings and organize the post-harvest process, and other farmers who builds alternative markets by directly visiting possible customers, or other farmers who raise cattle could sell milk and used its manure for making natural fertilizer. Multi role peasants system was able to drive farmers to

think critically about their farming activities so that they could overcome local problems by utilizing local opportunities and made them more adaptive and resilient.

SPI members had not yet use any ICTs for agriculture collectively, but they have practiced many innovations that could drive the members to be independent in conducting their farming activities. The only ICT they used to support their farming activities is through Whatsapp group. Members could ask anything in the group and if other members happened to know the answer or solution, then the members could explain it in the Whatsapp group. They also sell their products through this group. Even though our observation did not assess how to develop ICTs for agriculture in participatory approach, but we could identify how SPI conducted participatory approach in introducing innovations.

### 3.2. Information needed by SPI members: local-specific issues

Based on participation observation on Whatsapp group organized by SPI members, the Whatsapp group are majorly used to share knowledge about agroecology, to seek information and access to local seeds, and to promote their products. However, based on interview and observations, the most needed information by SPI members are very specific to local issues. Figure 1 shows the most dominant information needed by members from each region. For example, majority regions in Sumatra Island are really prone to agrarian conflict so the most needed information is about agrarian reform or legal steps to ensure that they have farm to cultivate. Members in Sumatra and Kalimantan needs informations about government policy and its law about agrarian reform. Several agrarian conflicts happened and made farmers lost their land and house because agriculture industry destroy their crops and houses without any prior effort to solve it in participatory manner. Agrarian conflict also limits farmers' access to food. Farmers rarely bought food as they can enjoy foods from their own farm, however agrarian conflict makes them have to buy food and the variation of food is also limited.
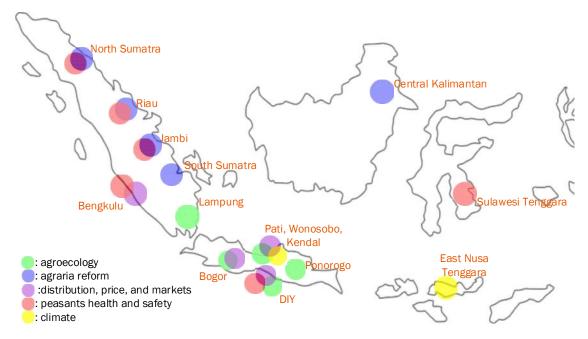


**Figure 1.** Information needed by members based on local specific issues.

In Java, the most needed information are agroecology practices and access to markets. Agroecology practices include polyculture practices, local seeds, organic farming, and also land preparation. Access to markets include distribution process, access to alternative markets, and price. While other regions, such as in East Nusa Tenggara the most needed information are climate as they usually suffered from climate change.

### 3.3. Small scale farmers' understanding on ICT for agricultures

Several members have access to ICT for agriculture, however they stated that the price is expensive even though they know the benefit of the technology. When asked whether they have used any ICT to support their farming activities, they only use Whatsapp and e-commerce apps to sell their products. They also answer that they have no knowledge to access other ICTs for agriculture and found that Whatsapp as the most convenient ICT as they could share knowledge with other farmers that they could not meet face-to-face. The use of e-commerce apps are also operated by organization staffs, since farmers stated that they do not really understand how to operate the apps. However, this answers could only be found in Java since they have more farming activities compared to other regions. They also have no access to government programs regarding the utilization of ICT for agriculture. Some farmers also stated that they have heard the use of ICT for agriculture, however they thought that the ICT are for agriculture industry as they have big land to cultivate not for small scale farmers who still farm traditionally.

### 3.4. Trusted sources of information

The most trusted sources of information are experienced farmers who have already practiced agroecology. SPI facilitate knowledge sharing between regions, where farmer-to-farmer learning method is used. Farmer-to-farmer learning method is a method where experienced farmers delivers their experience on innovation to other farmers. For example, experienced farmers from Bogor was invited to Sukabumi to discuss the preparation of agroecology practices. Other trusted sources of information are academic experts introduced by organization staffs or other experts who have the same concern with members. They stated that they do not think extension agents as the most trusted source of information since they do not understand anything about agriculture and they only sell agriculture industrial inputs, which do not fit with organization value. Even some of small-scale farmers have never met extension service agents. They won't seek more information if there were experts that promote the use of agriculture industrial inputs such as fertilizer, pesticides, and seeds. However, they do not limit their information seeking process as long as it serves the organization value, some members came personally to government agency to learn how to cultivate soil bacteria and microbes and as a result they could independently cultivate soil bacteria and microbes.

### 3.5. Communicative Competences for participatory approach in SPI

The success of SPI in driving its members to be independent are highly influenced by meetings and trainings organized by SPI. These meetings and trainings were conducted using participatory approaches where farmers could freely discuss their thoughts and doubts in doing collective acts. However, we found that communicative competences have to be possessed by organization staffs and also small scale farmers. The communicative competences possessed by these two types of member are categorized based on the purpose of meetings, which explained each purpose of meetings have its own communicative competences (table 3).

There are at least three purpose of meetings that we found, which are: (1) identifying needs of small scale farmers; (2) addressing misconceptions of the introduced innovations; and (3) decision making process. Building collective identity is an activities that needed to be embedded in each meetings as it is the activities that could drive the commitment and the sense of belonging for the members to do collective actions. In addressing misconception of the introduced innovations, the organization staffs could invite experienced small scale farmers who already used ICTs for agriculture so discussion about misconceptions with local small scale farmers could be conducted. The experienced small scale farmers also need to possess communicative competence, because this person have to explained his experience in using ICTs for agriculture clearly and objectively.

In practice, these meetings did not conducted sequentially nor could it happened in a short time. Sometimes, it is hard to gather people at designated time. Organization staffs have to personally visit

farmers to explain the importance of the innovation and ask the farmers to come. Some of organization staffs might quote local wisdom saying or religion saying that could drive the members to participate in the projects. These efforts also show the communicative competences needed by organization staffs or facilitators in conducting participatory approach.

**Table 3.** Communicative competences needed by small scale farmers and organization staffs in conducting participatory approach.

| Purpose of meetings | Communicative competences of organization staffs | Communicative competences of small scale farmers |
|---|---|---|
| Identifying needs of small scale farmers | - Able to explain to locals the purpose of the meeting<br>- Able to grasp local languages or vocabularies<br>- Able to use local languages or vocabularies when discussion occured, do not use terms that are hard to understand by locals<br>- Able to act as a listener, asked only when locals have problems in articulating their thoughts.<br>- Probe locals in explaining their needs by asking basic informations about farming activities in neutral manner, e.g.: Where did you buy seeds? Where did you seek informations about farming practices?<br>- Able to emphatize with locals, by expressing concerns | - Able to explain local problems<br>- Able to explain local opportunities<br>- Able to explain local wisdom for farming activities<br>- Able to explain solution taken to overcome local problems<br>- Able to explain trusted sources of information |
| Addressing misconception of the introduced innovation *needs an experienced farmers that already implemented the innovation | - Able to explain example of other small scale farmers or communities that succeeded in using the innovation and give a description how this example could be applied to local conditions<br>- Able to let farmers discuss the misconceptions of the introduced innovation, instead of driving or controlling farmers to specific issues<br>- Able to explain local conditions, so that the experienced small scale farmers could empathize with conditions of local small scale farmers | Experienced small scale farmers:<br>- Able to explain why he chose to use the innovation<br>- Able to explain the benefits and challenges of the innovation<br>- Able to compare the condition of farmers groups that used and did not use the innovation<br>- Able to show proves such as videos or photos of the implementation of innovation<br>- Quote statements from big figure in agriculture to ensure that the innovation is needed<br>Small scale farmers:<br>- Able to listen the experienced small scale farmers<br>- Able to express doubts, so that farmers can discuss or get more proves on the implementation of innovation<br>- Able to compare the implementation of innovation based on local conditions, e.g. explaining local conditions and ask whether this kind of conditions could also support the innovation |

| Decision making process in implementing the innovation | - Able to bring locals to have their conclusion about their needs in neutral manner, e.g.: so, based on previous discussions can we list problems and opportunities identified? Are there any misconceptions left? Are there still any doubts about the innovation?<br>- Able to help the locals in planning collective action, e.g. Which problems that have to be overcome immediately? When will we start the innovation? For how long the trial of innovation will be conducted? Who will be responsible for this project? How do we divide our job? | - Able to choose which problems that have to be overcome first<br>- Able to decide what kind of innovation will fit local conditions<br>- Able to critically adjust the schedule of projects with their farming activities |
|---|---|---|
| Building collective identity | - Able to facilitate the meetings in semi formal manner, e.g. lunch session by asking small scale farmers to bring their own crops to be cooked and eaten together; refreshing session such as singing or dancing together to local songs<br>- Able to drive small scale farmers to create easy to remember or localized slogans to emphasize the importance of farmers participation in the innovation, e.g. "women are the mother of food sovereignty!"<br>- Able to drive small scale farmers to creat a slogan that could explain the importance of the innovation so farmers are attached to the idea of using the innovation e.g. "agroecology is the way to achieve food sovereignty" | - Able to show empathy to the organization staffs the facilitate the meetings<br>- Able to use slogans when discussion gets boring or stuck |

## 4. Discussion

The findings showed that, *first*, the development of ICTs for agriculture cannot be design uniformly in Indonesia. Each location have its own needs. The top-down approach of agricultural projects are still used by Indonesian governments, that makes farmers could not utilize these aids. Several aids from government such as distribution of 41,000 tractors to farmers in Indonesia [33], yet government do not do any initial mapping to understand the dynamic of local agricultural practices where tractors delivered could not be used by every farmers. This finding basically proved that top-down approach is not the effective way in delivering ICTs for agriculture. *Second*, there will be misconceptions from any kind of innovations, including ICTs for agriculture. To clarify the misconception, facilitator needs to invite trusted source of information. Several studies showed that trusted source of information for small scale farmers are: peer-group or fellow farmers groups, opinion leaders, extension service agents, popular radio that use local language, and NGO staffs [11,12]. Our findings showed that independent small scale famers do not consider extension service agents as trusted source of information. They only trust people who shared same notion with the struggle of small scale farmers to become independent.

*Third*, participants of the project of developing ICTs for agriculture need to possess basic communicative competence in doing participatory approach. Our findings showed that both organization staff and small scale farmers have its own communicative competences which explained that participatory approach could not be conducted from the perspective of facilitators only or small

scale farmers only. It needs a collaboration from both type of participants to conduct an effective participatory approach. The designer of ICTs for agriculture could learn to possess the communicative competence of organization staff as they have to build ICTs for agriculture based on local small scale farmers' needs.

*Fourth*, there are lots of challenges that are already identified by previous studies, where farmers are illiterate, have no trust to innovations, and lack of local adaptation. These challenges shows that the participatory approach was not conducted properly or facilitator and small scale farmers have no communicative competence to do participatory approach. For example, if farmers are illiterate, teaching them to read and write is not the only solution. Facilitator might use symbols, picture, or videos to deliver information or in developing ICTs for agriculture. This is where the competence to empathize is important, what kind of solution is needed by farmers? If they are reluctant to learn how to read and write, then facilitators have to empathized and be more creative in addressing this challenge. Have no trust to innovations meaning that there are no communicative space to address any misconceptions about innovations, which shows that our conclusion in addressing misconceptions of innovation is highly needed in developing ICTs for agriculture. *Fifth*, several studies showed that farmers have lack of commitment in doing participatory approach, we showed that participatory approach is not only about identifying local needs and addressing misconception of innovation but also have to build collective identity to drive a sense of belonging in implementing the project. Efforts to emphasize the need to collaborate and to be committed in the project is also important.

Our findings might be limited since it does not clearly reflect the process of participatory approach in designing ICTs for agriculture, however SPI has introduced many innovations that support the idea of food sovereignty and could change the behaviour of its members that used to farm in conventional way to agroecology farming, or members used to have no knowledge how to get their land back but now they understand the legal process and could fight to have their land back, or at first they only think that their products have to be sell to market, but now they know how to approach other alternative markets. All of these behaviour changes could be achieved by using the participatory approach and we could learn from this case study to implement the participatory approach in developing ICTs for agriculture.

## 5. Conclusion

Our article showed at least two important things: participatory approach in designing innovation could lead small scale farmers to be independent and participatory approach gives more benefit and impact to small scale farmers than implementing top-down approach in designing innovation. The implication of this research that governments agency need to facilitate more communicative spaces that make small scale farmers could participate in designing agriculture projects, especially projects of developing ICTs for agriculture. Agriculture projects can not only be designed by policy makers or programmers, but also by involving small scale agriculture who knows the reality of their day-to-day farming activities.

Communicative competences that we found for conducting participatory approach also showed that competent facilitator is urgently needed in designing and delivering agriculture projects, especially ICTs for agriculture. Indonesia has been decreasing the number of extension services agents by implementing cyber extension, however the implementation of cyber extension in Indonesia has not yet showed satisfying results [34–36]. Government should also pay attention that Indonesia needs facilitator that not only possess agriculture knowledge, but also possess communicative competences so that they are able to empathize with local small scale farmers.

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## 6. Acknowledgements