

Innovation and technology diffusion in agricultural sector

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Abstract. Technology utilization in agricultural sector has an impact on the improvement of the performance and provides various added-values. In order to give a greater influence of technology utilization, it is necessary to make a good process of innovation and technology diffusion for farmers. This article is based on the literature review. The purpose of this article is to describe the process of innovation and technology diffusion for farmers. Innovation is the process and/ or the result of knowledge, skill and experience development, utilization/ mobilization to create or improve a new product, a process and/ or a system providing significant added-values. The process of innovation and technology adopted in agricultural sector generally includes several phases, namely: awareness, interest, evaluation, trial, adoption, and confirmation. This study recommends that the process of innovation and technology diffusion for farmers consider the aspects of community structure, culture, and farmer capacity.

1. Introduction

Improvement and development in any field are inseparable from technological advancement[1]. Agricultural revolution is supported by the invention of new machinery and ways in agriculture. The presence of technology has provided added value to the management of human activities in meeting their needs of life[2][3][4]. In agriculture, the concept of innovation and technology is implemented as a tool, way, or method used for processing agricultural input to produce effective and efficient output/ agricultural yields.

Technology plays a significant role in developing the potency of agricultural resources. Technology created from a research or study will be useful if it is applied in the field, especially in the efforts relating to farmer community empowerment. Therefore, it is required a concept considering innovation and technology diffusion in agricultural sector.

Decision in technology and innovation adoption is a process when an individual/ another decision-making unit begin with the first knowledge of an innovation to make preference to it, to make a decision either to adopt or to reject it, to apply the ideas, and then to confirm their decision [5]. The



purpose of this article is to explanation about stages or strategies of innovation and technology diffusion in agricultural sector, for communities working as farmers.

2. Methodology

Methodology used as an analysis tool in this article is qualitative approach, discussing about stages or strategies of innovation and technology diffusion, using literature review of main sources of the discussion. For verifying and validating the results of the discussion, Focus Group Discussion (FGD) involving 12 faculty members of UIN Sunan Gunung Djati Bandung has been conducted.

3. Result and discussion

Based on the authors' understanding of the research topic in this article, authors decide to use the modification of innovation diffusion stages developed by Mundy (2000) [5], stating that the process of innovation and technology diffusion passes through several stages as presented on Figure 1.

Before starting the process of innovation and technology diffusion, agricultural policy makers have to choose the right innovation to be diffused to targeted farmers. The characteristics of the innovation and technology to diffuse should consider certain criteria[6] [7], namely: considered a need of most farmers; able to provide concrete advantages for farmers; compatible with resources owned by farmers; able to solve the limited resources; utilizing available resources; affordable for farmers; simple, easy, and user friendly.

3.1. Awareness

Adoption process begins with the introduction of the innovation to farmers to grow their awareness of certain innovation or technology. Awareness is indicated by the increasing knowledge of farmers about any innovation or technology. Knowledge is farmers' condition in knowing or recognizing the presence of any innovation/ technology and in understanding how the innovation/ technology works [2][8].

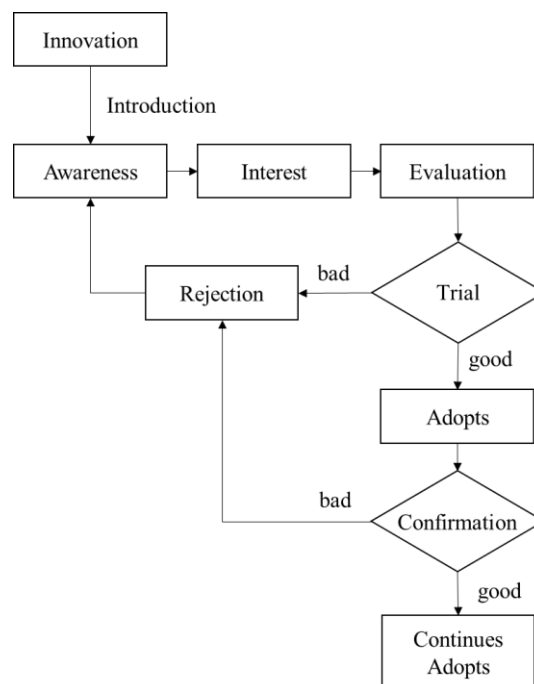


Figure 1. Stages of technological innovation adoption (Mundi model modification) [5].

One of the assumptions elaborated in this article is that farmers are a group of people no longer receiving any formal education. Thus, an effort to increase their knowledge should be made through

initiative intervention from the government, company, or NGO with good understanding of innovations in agriculture. It is in line with Suradisasrta (2017) stating that if agricultural development initiative is made by an institution or organization, it will have higher chance of success [9].

The presence of extension in this stage, awareness, plays a significant role. Extension plays an important role in improving the process of innovation or technology adoption to farmers. The success of extension depends on the right model according to the farmers' need, i.e. the right material, method and media used[7][10]. The use of extension with dissemination process using multimedia should be considered the main method in extension for innovation and technology diffusion. Many researchers believe that the use of multimedia in dissemination process of science and technology is able to give significant impact on improving the learning objects (farmers)' understanding[11–17].

3.2. *Interest*

In this phase, after knowing/ receiving information about an innovation, farmers are motivated to look for further information about the innovation. Persuasion determines their preference to the innovation[8]. In this process, the persuasion of agricultural extension plays an important role as an informant in disseminating the innovation and technology to farmers. Extension should be done using dialogic, democratic, and participative approach through work mechanism and method according to the needs and condition of farmers[18].

3.3. *Evaluation*

Evaluation is the stage of innovation and technology diffusion in where farmers consider trying the innovation. The adoption of an innovation of an individual or organization passes several considerations [19], and the evaluation of the adoption of an innovation considers several criteria as follows:

3.3.1. *Relative advantages*. i.e. Do these new ways or ideas give certain relative advantages for the prospective recipients?

3.3.2. *Compatibility*. i.e. Is the innovation that will be diffused compatible with the prior values, belief system, and ideas, needs, taste, and the costume of the community related?

3.3.3. *Complexity*. i.e. Does the innovation consider complicated? In general, the community is not/ less interested in complicated things because beside it is hard to understand, it is also considered an extra burden for them.

3.3.4. *Trial-ability*. i.e. an innovation will be accepted faster if it can be tried on small scale before it is used thoroughly. This is a reflection of human principle that tends to always avoid taking big risk.

3.3.5. *Observability*. If an innovation and its result can be observed directly through bare eyes, people will be easier to accept it, rather than if it is an abstract thing, that can be realized in mind or can be imagined only.

3.4. *Trial*

This stage, farmers try the innovation to improve their presupposition about a value of an innovation or technology. The result of this trial leads them to make a decision based on their understanding and experiences on the innovation and technology. This decision-making phase is the stage to choose either to adopt or to reject the innovation and technology [6] [20].

3.5. *Adopt*

This stage is the stage where an individual or organization makes a decision to accept the innovation and technology [8]. The adoption of an innovation is farmers' preference to use the innovation fully and regularly.

Some factors that make farmers hard to adopt the innovation and technology can be seen from the aspects as follows:

3.5.1. Technical matters. i.e. the influence of technology on the improvement of the yields and/ or income/ benefit has not fully trusted by farmers, moreover, lack of information networks and infrastructure hampers the information and knowledge from outside to farmers

3.5.2. Knowledge. i.e. lack of agricultural technology dissemination system (extension/ plotting/ technology degree) and low level of education/ knowledge of farmers make the advantages of new technology hard to translate.

3.5.3. Social. i.e. in general, poor farmers are afraid to take risks and worry that they may be blamed by their peer farmers for any failure in the future due to their decision. Hence, the adoption of technology is generally the result of deliberation among members of farmer groups or among peer group farmers. Technological change often means the needs of additional the workforce, except the adoption of technologies capable of reducing it.

3.5.4. Economy, technological change also often means the need to raise the cost of production, while the capital is an obstacle for poor farmers.

3.6. Rejection

Rejection is the result of consideration taken by farmers if the result of trial and confirmatory of the implementation of the innovation and technology is not in accordance with their calculation and expectations. In some cases, farmers will try to look for additional information to improve their understanding of the innovation or technology. In another case, farmers will confidently abandon and forget the innovation and technology if they think the implementation of the innovation or technology does not have any significant impact on improving added value.

3.7. Confirmation

Confirmation is the process of seeking reinforcement for decisions that have been previously taken [6]. In this stage, farmers may still change their decisions in implementing an innovation or technology, depending on their consideration and understanding of the impact of the use of the innovation and/ or technology. Decision that may be made from this stage is either rejection or reinforcement of the decision to implement innovation or technology.

4. Conclusion

Agricultural innovation and technology are the tools, ways, or methods used in processing/ managing agricultural inputs to produce effective and efficient output/ agricultural yields. The process of adoption of innovation and technology in agricultural sector generally includes several stages, namely: awareness, interest, evaluation, trial, adoption, rejection, and confirmation. The important role of all stakeholders in agriculture will determine the success of the innovation and technology diffusion to farmers. Relating to the success of the innovation and technology diffusion. The characteristics of the innovation and technology to diffuse should consider certain criteria, namely: considered a need of most farmers; able to provide concrete advantages for farmers; compatible with resources owned by farmers; able to solve the limited resources; utilizing available resources; affordable for farmers; simple, easy, and user friendly.

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