



Diffusion and Adoption of Biochar Innovations in Agriculture at Gunungsari Village, Bumiaji Subdistrict, Batu City, East Java, Indonesia

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ARTICLE INFO

Published online:
25 April 2022

ABSTRACT

Biochar is a solid material obtained from the carbonization process of biomass. In the process of making biochar one of them can be done by using cow animal feed waste such as corn nuggets. The process of diffusion and adoption of biochar innovations by using bonggol (janggal) corn ini is very suitable for areas that have large types of livestock such as dairy cows as done in Gunungsari Village, Bumiaji Subdistrict, Batu City. For this reason, the focus of this research study is to analyze in depth related to diffusion proses and the adoption of farmers' biochar innovations in adopting biochar in Gunungsari Village, Bumiaji District, Batu City. The type of research used in this study is to use qualitative methods with phenomenological approaches. The results showed that the elements of the innovation diffusion process in biochar were known that one of the biochar innovations was the right way to overcome various existing problems. There are two main problems that can be overcome by innovation, namely alleviating the problem of animal feed waste that exists, and overcoming the scarcity of fertilizer that occurs in the community of Gunungsari Village. Then in terms of communication channels, it is done by providing knowledge to Gunungsari farmers, so as to grant the trust and attention of the recipients of this innovation. Furthermore, in the existing social system in Gunungsari there is a social structure that provides levels of social status to its members. Gunungsari village leaders are the first people to be targeted in conducting communication patterns. In his sosialisasi, sanggat village leaders played a role in convincing to conduct trials first at the head of the farmer group. So, in the end, this biochar innovation can be accepted by the community and used well even through a long period of time.

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KEYWORDS: Diffusion, Adoption, Innovation, and Biochar

I. INTRODUCTION

The journey of agricultural development in Indonesia until now is still unable to show maximum results when viewed from the level of welfare of farmers and their contribution to national income. Agricultural development in Indonesia is important from the overall national development. There are several things that underlie why agricultural development in Indonesia has an important role, including: the potential of large and diverse natural resources, the share of national income that is large enough, the large share of national exports, the large population of Indonesia that depends on this sector, its role in providing community food and becoming a growth base in the countryside.

Indonesia's agricultural potential is large, but in fact from data from the Central Static Agency (BPS) in February 2021, it is known that the number of poor households in Indonesia mostly comes from the agricultural sector, rumah Poor ladders working in the

agricultural sector contributed the largest contribution, namely, 46.30%, while the industrial sector amounted to 6.58% and other sectors by 32.10%. This indicates that the government is not only less empowering but also towards the agricultural sector as a whole.¹

Over time, the government tried to create several ways that could improve the economy of farmers by providing policies that could increase agricultural production and increase the cost of agricultural production., one of them is through Permentan No. 49 of 2020 concerning the provision of subsidized fertilizer for farmers, there are 6 types of fertilizers that receive subsidies from the government, namely Urea, SP36, ZA, NPK and organic fertilizers.

¹<https://nasional.kontan.co.id/news/ini-10-kementerianlembaga-dengan-pagu-anggaran-terbesar-di-apbn-2021>

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Fertilizer is one of the things that has an important role to increase the productivity of agricultural commodities. Of course, in its authority and management involves many stakeholders. The Head of Corporate Communications of Pupuk Indonesia said that the authority of the Ministry of Agriculture is to distribute the allocation of subsidized fertilizer to all provinces through the Regulation of the Minister of Agriculture (Permentan). This is intended so that subsidized fertilizer can be distributed according to the allocation set by the government.²

In its distribution, distributors and official kiosks are involved that are guided by Permentan to the Decree (SK) of the Provincial and Regency Agricultural Office. Based on Permentan No. 49 of 2020, the target allocation of subsidized fertilizer for 2021 is 9.04 million tons. However, the realization of distribution has reached 2.22 million tons or about 24.6 percent. The stock of subsidized fertilizers from Line I (Producer) to Line III (Distributor) currently reaches 2.29 million tons. To note, related to the authority and responsibility of subsidized fertilizers are in several ministries, such as the Ministry of Agriculture (Kementan), the Ministry of Finance, and the Ministry of SOEs in this case PT. Indonesian fertilizer.³

The policy related to the provision of subsidized fertilizer eventually caused polemics among the petani community, one of which was related to scarcity to obtain the subsidized fertilizer. This can be seen from the scarcity in a number of warehouses in Blora Regency, Central Java, where currently the stock is abundant. However, the petani community still finds it difficult to get the subsidy fertilizer. According to the Chairman of the DPC of the Indonesian Tobacco Farmers Association (APTI) Blora Regency, revealed that the scarcity of fertilizer even though the stock is abundant is caused by the carut marutnya the process of distributing subsidized fertilizer.⁴

In addition to Blora Central Java, the scarcity of subsidized fertilizer also occurs in Montasik District, Aceh Besar Regency. Based on the research, the impact of the scarcity of subsidized fertilizers that occurred in Montasik Subdistrict caused the non-rationing of the amount of subsidized fertilizer available, the inappropriate use of the types of subsidized fertilizers used by farmers, and not exactly the time in the distribution of subsidized fertilizers.⁵

²<https://www.antaranews.com/berita/2005209/bps-catat-household-poor-largest-derived-from-sector-agriculture>

³<https://www.liputan6.com/bisnis/read/4537810/pupuk-indonesia-allocate-904-million-ton-fertilizer-subsidized-in-2021> Accessed on May 28, 2021 at 13.03 WIB.

⁴<https://www.liputan6.com/regional/read/4418113/ada-yang-play-behind-the-scarcity-fertilizer-subsidized-di-blora>, accessed on May 28, 2021 at 13.03 WIB

⁵M. Radinal Kautsar, Sofyan, and T. Makmur. Analysis of The Scarcity of Subsidized Fertilizers And Their Effect On Rice Productivity (*Oryza Sativa*) In Montasik District, Aceh

According to the Director General of Infrastructure and Agricultural Facilities of the Ministry of Agriculture, the ministry of agriculture revealed the reason for the scarcity of subsidized fertilizer among farmers due to several factors ranging from supply to excessive use. According to Sarwo Edhy as Director General of Infrastructure and Agricultural Facilities of the Ministry of Agriculture said: "*The first is indeed the availability of subsidized fertilizer only about 45 percent of the needs, so only 9 million tons of the needs of 23.23 million tons*". Another factor is that the provision of subsidized fertilizer is not as full as possible in accordance with the planting jadwal of farmers.⁶

Due to the scarcity of subsidized fertilizers, farmers then look for new innovations, one of which is by diffusion innovation and adoption in the use of biochar charcoal animal feed waste treatment products as done by farmers in Gunungsari Village, Bumiaji District, Batu City. Biochar is a porous charcoal substance, often also called charcoal derived from living things, especially from plants. Soils containing biochar can provide a good habitat for soil microbes.⁷

Rogers defines diffusion as the process by which an innovation is communicated through a particular channel over a certain period of time among members of a social system. According to Rogers, there are four main principles in the process of diffusion of innovation, namely (a) innovation, (b) the ways and channels of communication used, (c) within a certain period of time, and (d) the character of individuals as members of social systems that are targeted by innovation diffusion activities. Innovation is an idea, work or object that is considered new by a person.⁸

Then from several studies related to the diffusion of innovations in agriculture, one of which is from research conducted by Gres Kurnia on the Diffusion of Burung Repellent Net Innovation in the Prosperous Source Farmer Group in Kalibelo Village, Gampengrejo District, Kediri Regency. The study aims to describe how information about

Besar Regency (*The Scarcity Analysis of Subsidized Fertilizer and Its Effect On Rice Productivity in Montasik Subdistrict, Aceh Besar Regency*). www.jim.unsyiah.ac.id/JFP. Journal Scientific Agricultural Student E-ISSN: 2614-6053 P-ISSN: 2615-2878 Volume 5, Number 1, February 2020

⁶ <https://www.antaranews.com/berita/2082026/kementan-beberkan-alasan-penyebab-scarcity-fertilizer-subsidy>, accessed on May 28, 2021 at 13.03 WIB

⁷ Gani, A., 2009, *Biochar Biochar Bio bio charcoal potential As a Repair Technology Compressor Agricultural Land Productivity*, Science and Technology of Food Crops Vol. 4 No. 1, Researcher of the Pe Great Hall Nelitian Rice Plant, Sukamandi.

⁸ Rogers Everett M.1995. *Diffusion of Innovations*. Fourth Edition. Free Press. York

bird repellent nets spreads among the Sumber Makmur Desa Kalibelo farmer group. The results of the study found that the picture of communication networks that occurred in the Sumber Makmur farmer group in 2013 was not ideal. The flow of information cannot flow effectively because of the relationship between *the opinion leader* and his voters, found a smaller chain of homophily compared to the heterophily chain in socioeconomic status. But so far information about the innovation of pest eradication techniques can be applied at every level of socio-economic status in the Sumber Makmur farmer group because of the subsidy assistance from the PPL (Field Agricultural Extension).⁹

Furthermore, from Sekar Pandan Wiratna's research related to the Diffusion of Organic Rice Innovation (Qualitative Descriptive Study of the Process of Diffusion of Organic Rice Innovation in Gempol Village, Karangnom District, Klaten Regency) it is known that the diffusion of organic agricultural system innovation in Gempol Village is taken through 4 stages that have characteristics from each stage. These stages are *Knowledge* (Knowledge Stage), *Persuasion* (Invitation Stage), *Decision* (Termination Stage), *Implementation Stage* (Application Stage), *Confirmation Stage* (Confirmation Stage).¹⁰

In addition to being used in agricultural innovation, the concept of innovation diffusion is also used in innovation, one of which is as well as research conducted by Sylva Alkornia related to the Diffusion of *Green House* Technological Innovation among Mango Farmers (Qualitative Study of *Green House* Development Efforts at SKB Situbondo). From the results of the research, it is known that communication channels dominate the diffusion of *green house* development innovations to mango farmers. Communication occurs face-to-face from SKB Situbondo and is then transferred to mango farmers. Other channels of communication are group communes, and mass media. Mango farmers in adopting *green house* development are not all through stages according to Rogers M Everett in sequence, namely knowledge, persuasion, decisions, implementation and confirmation. In this study, there are

five categories of adopters, namely *innovators*, *early adopters*, *early majority*, *late majority*, and *laggards*.¹¹

From some of the studies already listed above, researchers ensure that the research conducted has novelty and fundamental differences. This research emphasizes the existence of major problems, namely related to alleviation of existing livestock waste problems, as well as how to overcome the scarcity of fertilizer that occurs in farmers in Gunungsari Village. The condition of livestock in Gunungsari is divided into 3 types, namely large livestock, small livestock, and poultry livestock. For large livestock Gunungsari is indeed the most dairy farmer village in Bumiaji Subdistrict. In 2018, among them included horses with a total of 12 heads, beef cattle with 130 heads, and dairy cows with 1,439 heads.¹² This then makes Gunungsari Village has the largest average number of livestock products among other villages in Bumiaji Subdistrict. Thus, the utilization of animal feed waste in the form of corn nuggets into biochar innovations became interesting to study in this study. For this reason, the focus of this research study is to analyze in depth related to the process of diffusion and adoption of farmers' biochar innovations in adopting biochar in Gunungsari Village, Bumiaji District, Batu City.

2. LITERATURE REVIEW

2.1 Definition of Biochar

Biochar is a solid bahan obtained from the carbonization process of biomass. Biochar is a porous charcoal substance, often also called charcoal derived from living things, especially from plants. Soils containing biochar can provide a good habitat for soil microbes for example for bacteria that help in the overhaul of nutrients so that the nutrients can be absorbed optimally by plants, but not consumed like other organic matter.¹³

Various research results show that biochar has the potential to improve soil fertility. The benefits of biochar lie in its two main properties, namely having a high affinity for

⁹ Brand new Kurnia. 2017. Thesis: *Diffusion of Bird Repellent Net Innovation in The Prosperous Source Farmer Group in Kalibelo Village, Gampengrejo District, Kediri Regency*. <http://lib.unair.ac.id>

¹⁰ Sekar Pandan Wiratna. 2019. Thesis: *Orga Rice Innovation Diffusionnik (Qualitative Descriptive Study of Organic Rice Innovation Diffusion Process in Gempol Village, Karangnom District, Klaten Regency)*. Communication Science Study Program, Faculty of Communication and Informatics, University of Muhammadiyah Surakarta

¹¹ Sylva Alkornia. 2016. *Diffusei Green House Technology Innovation among Mango Farmers (Qualitative Study of Green House Development Efforts at SKB Situbondo)*. KANAL (JOURNAL OF COMMUNICATION SCIENCES), 5 (1), September 2016, 75-86 ISSN 2302-6790 (print), ISSN 2541-2841 (online) Journal Link: <http://ojs.umsida.ac.id/index.php/kanal> DOI Link: <https://doi.org/10.21070/kanal>

¹² Data Processed from District Bumiaji deep number 2019

¹³ Martika, et al. 2018. *Pre Design To Build Biochar Fertilizer from Rice Husk with a Capacity of 1,100 Tons / Year using the Oven Main Tool*. eUREKA : Research Journal of Civil Engineering and Chemical Engineering Students, 2(2), 2018, page 230-237 Available online at <https://publikasi.unitri.ac.id/index.php/teknik> ISSN 2548-771X (Online)

nutrients and persistent in the soil. Both of these properties can be used to solve some important agricultural problems such as soil damage and food safety, water pollution by agrochemicals, and climate change. With long persistence makes biochar the top choice to reduce the impact of climate change. processing residues in the form of waste.¹⁴

The process of making biochar fertilizers generally consists of four stages, namely the stages of preparation of raw materials, reactions, separation and purification, and finally product handling. Below will be outlined every process, including as follows:¹⁵

1. Preparation of Raw Materials

The previous raw materials are dried first in the sun and or using an oven so that the moisture content reaches 10-15%. This drying aims to eliminate the excess water content contained in raw materials. In addition, the rolling also aims to speed up the combustion process in pyrolysis reactors (R-110) (R-111).

2. Pyrolysis Reaction

Pyrolysis is the process of chemical decomposition of organic matter through a heating process without or little oxygen, in which biomass material will undergo the breakdown of chemical structures into gas phases. The purpose of this process is to convert biomass into a high-value material so that it can burn easily. This reaction process occurs in reactors (R-110) and (R-111). The first raw materials accommodated in storage (F-111) were carried using Conveyer (J-112A) and (J-112B) to reactors (R-110) and (R-111). This pyrolysis process produces the main product in the form of charcoal with a temperature of 4000C for 2 hours (according to Siahaan, *et.al.*, 2013). While by-products in the form of liquid products (liquid smoke), tar and gas products (CO,CO₂, H₂,CH₄, C₂H₆, C₂H₄).

3. Separation and Purification

After the process of converting biomass to biochar is completed, then the process of separation and purification of biochar. Below will be outlined the processes.

a) Separation

After the combustion process in the pyrolysis reactor, the results of the pyrolysis

process are separated using Cyclone (H-113) so as to produce by-products in the form of tar and gas. The resulting tar is directly accommodated in storage (F-115) while the gas produced is then flowed to the Condenser (E-114).

b) Condensation

The next stage of gas entering the Condenser (E-114) is then condensed to produce liquid smoke. The liquid smoke produced by the surface is accommodated in storage (F-116).

c) Biochar Smoothing

Charcoal pyrolysis in pyrolysis reactors (R-110) and (R-111) is then carried using Srew Conveyer (J-124) which will then be destroyed with Chusher (C-125).

d) Biochar Sieving

The destroyed biochar is then sifted using a Vibrating Screen (H-126) with a particle size of 35 mesh. This sieving aims to facilitate the mixing of biochar with nitric acid in the Mixer (M -120).

e) Mixing

This stage of biochar that has been mashed and sifted will be mixed with nitric acid (HNO₃). The mixing process is carried out inside the Mixer (M- 120). The purpose of adding nitric acid to the biochar of rice husks is to enrich the nitrogen element in it. Biochar is supplemented with 25% nitric acid from Bin (F-123) and Bin (F-122) which are flowed directly from nitric acid storage (F-121). Mixing needs to be done ashomogenally as possible.

f) Soaking

Biochar that has been added and mixed with nitric acid is then woven in storage for 3 days continuously. Storage used as many as 3 pieces (F -131A, F-131B and F-131C). The purpose of this immersion is so that the content of nitrogen elements in nitric acid enters the biochar.

g) Filtering

After the biochar soaking process for 3 days, the biochar is then filtered using a Screen (H-132). This filtering aims to separate between the solid and liquid phases. The liquid phase is flowed back into the Bin (F-123), while the solid phase is accommodated in the temporary biochar Storage Hold (F-133).

4. Product Handling

¹⁴ Martika, et al. 2018. *Pre-Design to Build Biochar Fertilizer from Rice Husks with a Capacity of 1,100 Tons / Year using the Oven Main Tool*. eUREKA : Technical Student Research Journal Civil and Chemical Engineering, 2(2), 2018, pages 230-237 Available online at <https://publikasi.unitri.ac.id/index.php/teknik> ISSN 2548-771X (Online)

¹⁵ Ibid

- a) Drying
Biochar accommodated in a temporary biochar storage container (F-133) is then taken using a Chain Conveyor (J-134) to the Oven (E-130) for drying. The purpose of this drying is to reduce its moisture content to reach 10-15%.
- b) Packaging and Storage
Biochar fertilizers that have been dried are then ready to be packaged using sacks. This packaging aims to make the product have good and attractive marketing quality. As for the storage of biochar fertilizers stored in the storage of biochar products (F-135) until the biochar fertilizer is ready to be distributed.

2.2 Patterns of Diffusion and Adoption of Biochar Innovation According to Rogers

In his book *Diffusion of Innovations*, Rogers in Buddy explains that the stage of the innovation diffusion process consists of four elements, namely:¹⁶

- a) Innovation
Innovation is an idea or action that is considered new by a person or group. According to Rogers there are five characteristics of innovation, namely (a) *relative advantages* (relative advantages) is the extent to which innovation is considered better than other ideas that replace it. (b) *Compatibility* is the extent to which an innovation is considered consistent with existing values, past experiences, and the needs of those who adopt. (c) *Complexity* is the level of difficulty in understanding and using innovation. (d) *Triability* is the extent to which innovation can be tested by others. And (e) *Observability* (possibly observed) is the extent to which the results of an innovation can be seen by others.¹⁷
- b) Communication Channels
Communication Channels are tools for conveying messages of innovation from the source to the recipient of innovation. The means and channels of communication are the processes by which the actors involved create and convey messages to each

other with the aim of achieving the same understanding. While the communication channel is a means or intermediary used to convey the message of the communicator to the communicant. Communication channels are often referred to as communication media.

- c) Time
Time is an innovation decision process that starts from someone knowing to deciding to accept the innovation or even rejecting a communication. A given period of time *the innovations rate of adoption* is the relative speed with which an innovation is adopted by members of a social system. *The rate of adoption* is usually measured by the time it takes for a particular percentage of system members to adopt an innovation.
- d) Social System

Social system is a system implemented by a community or group to solve problems in order to achieve a common goal. In the social system there are social structures that provide levels of social status to their members. Based on the level they occupy, they are also required to play a suitable role. For example, as a community leader has a higher level of anggota ordinary people. Of course, his role is also other. The diffusion of innovation is also influenced by this social structure, while the diffusion of innovation can also affect the social structure in a social system.

Meanwhile, the stages of the decision-making process in the adoption of innovation are:¹⁸

- 1) Stage of knowledge (*knowledge*)
When an individual (or any other decision-making unit) is directed to understand the existence and benefits and how an innovation functions. According to Rogers, there are three types of knowledge, namely as follows:

- a) Knowledge of the existence of innovation (*Awareness-knowledge*)

It is the knowledge of the existence of innovation. This knowledge will motivate individuals to learn more about innovation and will then adopt it. At this stage innovation is trying to be introduced to the community but there is no definite information about the product. The lack of information is so that the community does not feel the need for such innovation. Rogers stated that to convey the existence of innovation will be more effectively conveyed through mass media such as radio,

¹⁶ Rogers, Everett M. 1995. *Diffusion of Innovations*. Fourth Edition. Free Press. York

¹⁷ Sylva Alkornia. 2016. *Diffusion of Green House Technological Innovation among Mango Farmers (Qualitative Study of Green House Development Efforts at SKB Situbondo)*. KANAL (JOURNAL OF COMMUNICATION SCIENCES), 5 (1), September 2016, 75-86 ISSN 2302-6790 (print), ISSN 2541-2841 (online) Journal Link: <http://ojs.umsida.ac.id/index.php/kanal> DOI Link: <https://doi.org/10.21070/kanal>

¹⁸ Morissan, et al. 2010. *Mass communication theory*. Jakarta: Ghalia Indonesia, p. 148

television, newspapers or magazines. So that people will more quickly know the existence of an innovation.

- b) Knowledge of how to use innovation (*How to knowledge*)

It is the knowledge of how to use an innovation correctly. Rogers considers this type of knowledge to be very important in the process of innovation decisions. To further increase the chances of using an innovation, individuals must have adequate knowledge with regard to the use of this innovation.

- c) Knowledge of the principles underlying how and why inovasi can work (*Principles-knowledge*)

It is the knowledge of the principles underlying how and why an innovation can work. A natural example of this is the idea of germ theory, which underlies the use of vaccinations and outhouses for village sanitization and health campaigns.

- 2) Persuasion stage (*persuasion*)

When an individual (or other decision-making unit) forms a good or bad attitude. The persuasion stage occurs when individuals have a positive or negative attitude to innovation. But this attitude will not directly cause the individual to accept or reject an innovation. An individual will form this attitude after he knows about innovation, then this stage takes place after the knowledge stage in the innovation decision process. Rogers stated that *the knowledge stage* is more cognitive (about knowledge), while persuasion stage is affective because it concerns individual feelings, therefore at this stage the individual will be involved even further. The degree of distrust in the functions of innovation and social support will affect an individual's opinion and confidence in innovation.

- 3) Decision stage (*decisions*)

This stage arises when an individual or other decision-making unit engages in activities that lead to the selection of adoption or rejection of an innovation. According to Rogers *adoption* (accept) means that the innovation will be used in full force, while rejecting means "*not adopt an innovation*". If innovation can be tried partially, the baitnya on the existence of an individual, then innovation will be more quickly accepted because usually the individual first wants to accept the innovation. Even so, rejection of innovation can occur in every innovation decision process, there are two types of rejection, namely *active rejection*

and *passive rejection*. *Active rejection* occurs when an individual tries innovation and thinks about adopting the innovation but in the end he rejects the innovation. *Passive rejection* of the individual is not at all thinking of adopting.

- 4) Implementation stages (*implementation*)

When an individual or other decision-making unit determines the use of an innovation. At the implementation stage an innovation is tried to be practiced, but an innovation brings something new if the level of uncertainty will be involved in the adoption. The uncertainty of the results of these innovations will still be a problem at this stage. Then the user will need technical assistance from the change agent to reduce the level of uncertainty from the consequences.

- 5) Confirmation stage (*confirmation*)

When an individual or other decision-taking unit seeks reinforcement of the decision of acceptance or rejection of innovations that have been made previously. When an innovation decision has been made, this user will depend on individual support and attitude. Continuity is a decision to reject an innovation after previously adopting it. This unsustainability can occur during this stage and occurs in two ways: *First*, the individual's rejection of an innovation seeks another innovation that will replace it. This type of decision is called *replacement discontinuance*. *Second*, *disenchantment discontinuance* is that the individual rejects the innovation because he feels dissatisfied with the results of the innovation.

3. METHOD

The research method used in this research is using qualitative research methods. The selection of qualitative methods is because it is done to obtain in-depth information about a person's social experiences such as attitudes, motivations, beliefs, and behaviors from the point of view of the orang.¹⁹ This study used a type of phenomenological approach. The stages in the phenomenological approach, namely:²⁰ *First*, the *intuiting* stage is the stage where the researcher begins to enter completely or merge with the phenomenon under study. In order to feel what the informant feels, researchers always listen with empathy to all informant explanations and try to get clear and detailed

¹⁹ Polit, P.F, Beck, C.T & Hugler. 2001. *Essentials of nursing reaserch: Methods appraisal and utilization*. Philadelphia: J.B Lippincott

²⁰ Asih, I.D. 2004. *Indonesia Student experience of learning at an Indonesian University. School of Nursing and Midwivery Curtin University of Technology*. Master Project.Perth: Unpublished

information. *Both* stages of *bracketing*, are done so that informants are natural and free from the consumability of researchers. This is done by abandoning existing knowledge of the phenomenon under study. *Third, the analyzing stage*, researchers identify the essence of the phenomenon under study by exploring the relationship and interconnectedness of elements (keywords, categories, sub themes and themes). *Fourth, the describing stage*, at this stage the researcher makes a broad and in-depth narrative related to the phenomenon being studied.

4. DATA COLLECTION AND DATA ANALYSIS

In this study, engineering methods Data collection is part of a data collection instrument that determines the success or failure of a study.²¹ Meanwhile, according to Kriyantono, data collection is a technique or ways that can be used by researchers to collecting data²². In this study, the data collection technique used, namely observation, where this data collection is carried out by researchers by making direct observations in the field of the object being studied. The next technique is *wawancara mendalam* (*In-depth Interview*). This interview is a process of obtaining information for research purposes by way of Q&A while face-to-face between the interviewer and the respondent or with the interviewee, either using atau without interview guidelines.²³ The reason researchers use in-depth interviews is because the advantages of this method lie in the purity of the data obtained from an informant and not affected by outsiders. Then the last technique used adalah dokumentasi, this method is done by recording or copying data in the research site. Usually this data is in the form of secondary data or existing data, such as archives, photographs, annual reports, meeting results or doc.other men in the field related to this research.

Then the data analysis used in this research is *an interactive model of analysis*. Qualitative data analysis according to Bogdan and Biklen in Lexy Moleong²⁴ is an effort made by working with data, sorting it into manageable units, finding what is important and what is learned, and deciding what can be told to others. Then qualitative data analysis *of the interactive model of analysis* model itself

consists of 3 (three) components, namely²⁵ (1) *Data Condensity Compaction*, where data collected from the observation process in the field is outlined in a complete and detailed report description. Data compaction is carried out continuously during the research process. (2) *Presentation of Data (Data Display)*, this is intended to make it easier for researchers to be able to see the overall image of certain parts of the research data. (3) *Concluding Drawing*, in this case the verification of data is carried out continuously throughout the research process. Stages to draw conclusions from categories of data that have been reduced and presented to the next to the final conclusion that is able to answer the problems faced.

5. RESULTS AND DISCUSSION

Process of Diffusion and Adoption of Biochar Farmers Innovation in Gunungsari Village

As explained earlier, various research results show that biochar has the potential to improve soil fertility. The benefits of biochar lie in its two main properties, namely having a high affinity for nutrients and persistent in the soil. Both of these properties can be used to solve several important agricultural problems such as soil damage and food safety, water pollution by agrochemicals, and climate change.²⁶ The impact in changing soil fertility rates from the process of making corn bonggol biochar in Gunungsari Village can be seen from the soil hail sample.

Table 5.1 Soil Sample Analysis Results from Gunungsari Village

	Parameter Soil		
	pH KTK (me 100kg-1)	C-Organic (%)	N-Total (%)
Sample			
Ground (Low)	5.3 (Low)	18.90 (Medium)	0.84

Description: Based on the results of lab analysis (2019)

From the results of the table, it can be seen that soil PH tends to sour and the content of KTK, C-Organic and N tends to be low. Pemberian biochar of corn cobs enriched with nitric acid can increase the pH in sour soils. Then on the next data can be seen as follows:

²¹ Bungin, Burhan. 2007. *Kualit Research Methodsatif*. Jakarta: Kencana Prenada Media Group, p 121

²² Kriyantono, Grace. 2006. *Practical Techniques of Communication Research along with Practical Examples of Media Research, Public Relations, Advertising, Organizational Communication, Marketing Communication*. Jakarta: Kencana Prenada, p. 91

²³ Moleong, Lexy J. 2008. *Qualitative Research Methods*. Bandung: Rosdakarya teenager, p. 186

²⁴ Moleong, Lexy J. 2007. *Qualitative Research Methodology*. Bandung: Teen Rosda Karya, thing. 248

²⁵ Saldana, Johnny. 2014 *Qualitative, Data Analysis Miles And Huberman*. Arizona State University. thing. 307.

²⁶ Martika, et al. 2018. *Pre-Design to Build Biochar Fertilizer from Rice Husks with a Capacity of 1,100 Tons / Year using the Oven Main Tool*. eUREKA : Research Journal of Civil Engineering and Chemical Engineering Students, 2(2), 2018, pages 230-237 Available online at <https://publikasi.unitri.ac.id/index.php/teknik> ISSN 2548-771X (Online)

Table 5. 2 Effect of treatment on soil pH

Biochar	
Before	
After Biochar (Bio)	
Sample 5.50 A	5.73 B
LSD 5%	0.23

From the data above, it is known that the numbers followed by different letters show a real difference according to the LSD test at a level of 5% when viewed from the soil conditions in the basic analysis (Table 5.1) the provision of biochar corn cobs enriched with nitric acid can increase the pH in sour soils. Furthermore, the effect of corn nugget biochar on the soil can be seen in the following data:

Table 5.3 Effects of Treatment on The Soil

	Content Previous	After
PH	5.50 A	5.73 B
KTK A	17.99 A	20.39
C-Organic aAB	1.13 aA	1.17
N e (Medium)	total 0.195 cd (low)	0.205

Description: The numbers followed by different letters showed a marked difference according to lsd tests at a level of 5%

The results of the above analysis showed that the provision of corn bonggol biochar showed a higher value where biochar fortified with nitric acid gave a positive influence between C and Total Nitrogen in the soil which resulted in an increase in nutrients compared to treatment without biochar. Biochar administration is carried out for 6 months, all these treatments are applied to polybags containing 10 kg on each soil.

Then the process of making biochar used in Gunungsari Village is to use the *double jacket* furnace combustion method which includes the enumeration process. In the process of enumerating the remaining corn nuggets of animal feed are cut into pieces, this is intended to be easy when inserted in the furnace and the combustion process is more evenly distributed. The next process is combustion. After the corn nugget is cut into pieces and then put it in the furnace and after it is felt enough, then the furnace is closed tightly so that no oxygen or a liter of oxygen enters during the combustion process, when the

combustion process occurs the fire must certainly not be extinguished until the combustion process is completed with the intention that there is no decrease in temperature in the furnace so that there can be a complete bloom. The next process is grinding. Biochar charcoal resulting from combustion is removed and ground to be crushed in the form of grains and coarse powders. The last process in making biochar in Gunungsari is sieving. After the biochar charcoal is milled, the next is done sieving to get a powder-shaped biochar, this powder form is intended to make the biochar easier when sprinkled on the ground so that it is easier to absorb the soil.

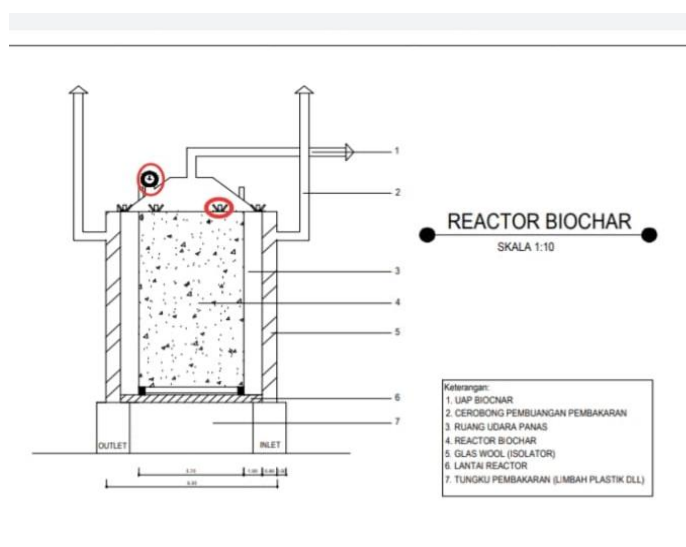


Figure 5.1 Biochar Furnace *double jacket* model

Therefore, the method of making corn bonggol biochar through the *double jacket* method in Gunungsari is more effective and efficient compared to other conventional methods. This is because the *double jacket* method can indeed be used optimally by farmers.

Based on the results of research that has been done, it can be known that the process of diffusion and adoption of farmers' biochar innovations in Gunungsari can be analyzed by developing rogers innovation diffusion theory. In terms of the decision-making stage, the first thing to do is the stage of the emergence of knowledge, namely by providing knowledge and understanding to farmers by making experimental tools. In this experiment, the results obtained were quite satisfactory with the media that became obyek is a vegetable plant. However, at the beginning of this experiment not all farmers were willing to give it a try. This experiment was only conducted with the head of the farmer group, then followed by another farmer group after getting satisfactory results in the experiment. In addition to conducting experiments, there are several other things that are ways to introduce farmers related to this biochar, namely through *focus group discussions* with farmers. In this FGD agenda, in addition to discussing with farmers, there is also

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a direct example, namely by doing examples of biochar burning.²⁷

Next from the next decision-making stage the Persuasion Stage. In this stage of persuasion it takes some time to convince citizens in the use of this Biochar. Doubts about the failure in the use of biochar are felt by farmers. Farmers make them choose to see first the results that will be obtained from the use of this biochar fertilizer. But after some time and the results can be seen, farmers began to be interested in using it and flocked to provide their land facilities in the trial period.

The next stage of decision making is the Decision Stage. This decision-making was taken by the chairman of the farmer group who was brave and able to be an example in the use of biochar innovation in Gunungsari so that other farmers were willing to take the same decision to use this biochar. The head of the farmer group not only invites verbally but sets an example so that the decision taken by the head of the farmer group can be well received by farmers. The next stage of decision making is the Implementation Stage. In convincing farmers there are several stages that are carried out so that farmers can use biochar, namely as follows:²⁸

- a. Doing FGD, this FGD is done several times to support the cultivation to the practice that will be carried out by the farmer group, the initial stage is the provision of information related to the benefits of this biochar until the making.
- b. Show the machinery and the manufacture of the expansion land. There are two concepts or methods of combustion in the manufacture of this biochar. The first is the conventional method which takes a long time and a large area of land in its implementation. This is because it takes a burning hole in this innovation. The second is a new method that uses machines. This method is simpler aren amme requires a relatively short time and does not require a large area of land.
- c. Taking biochar fuel from the farmer's feed waste. This fuel is a chunk of jangung that there are many in the community
- d. Biochar manufacturing. In the manufacture has several stages, in the conventional stage ranging from retrieval, enumeration, burning drying to enrichment. In conventional methods this takes a relatively long time, because it takes time to dry

and depends on the weather. Unlike conventional methods, new motode using furnaces does not require drying time. Because the material that is chopped can be directly burned using the tool. It takes a relatively short time.

- e. Applying trials to several lands owned by the head of the farmer group.
- f. Garden produce. After waiting 1-3 months the desired results can only be seen.

Then at the last decision-making stage is the Confirmation Stage. In this confirmation stage is how to see the reaction of farmers in a group to biochar innovations that have been carried out. In the implementation, there is no rejection from farmers regarding the innovation of the use of this bichar. Although indeed the residents are only waiting for the results because at the beginning they still have doubts about this biochar.

Furthermore, in terms of elements of the biochar innovation diffusion process carried out, it is known that this biochar innovation is considered appropriate in overcoming various existing problems. There are 2 main problems that can be overcome with this innovation, namely alleviating the problem of animal feed waste, and overcoming the scarcity of fertilizer that occurs in the people of Gunungsari Village. Then the communication channel becomes one of the important keys in the success of an innovation, this communication begins with communication with related parties and then continues communication in the form of providing knowledge to through FGD. Good communication will get good results as well, because it will cause trust and attention from the recipients of this innovation. In the communication stage starting from socialization using *a key informant* who can connect with *the stake holder* located in Gunungsari village.

Meanwhile, the time needed in sosylyzation and communication of the use of Biochar in Gunungsari is quite long. Because it takes 1 to 3 months for people to use this Biochar evenly. In the 3 months, there were several steps taken, ranging from providing information to testing the use of biochar on the land of the head of the farmer group. to use as a pilot for farmers to be willing or interested in adopting biochar.

Furthermore, in the existing social system in Gunungsari there is a social structure that provides levels of social status to its members. Gunungsari village leaders are the first people to be targeted in conducting communication patterns. In his association, sanggat village leaders played a role in convincing to conduct trials first. The experiment was conducted at the head of the farmer group. So, in the end, this biochar innovation can be

²⁷ Dioalah from result interview Researchers with Eny Dyah selakau head team that bargainRight Innovation biochar di Gunungsari at 22 January 2020 hit 10:13 a.m.

²⁸ Dioalah from result interview Researchers with Eny Dyah selakau head team that offer Innovation biochar di Gunungsari at 22 January 2020 hit 10:13 a.m.

accepted by the community and used well even through a long period of time.²⁹

6. CONCLUSIONS

Based on the results of research, it is known that the biochar manufacturing process carried out in Gunungsari Village is by using the *double jacket* furnace combustion method which includes enumeration, burning, milling, and sieving.

Meanwhile, in terms of elements of the biochar innovation diffusion process carried out, it is known that biochar innovation is considered appropriate in alleviating the existing animal feed waste problem, as well as overcoming fertilizer suspicions that occur in Gunungsari Village farmers. Then the communication channel becomes one of the important keys in the success of an innovation, this communication begins with communication with related parties and then followed by communication that forms the provision of knowledge to farmers who are ada in Gunungsari through FGD. Then for the time needed in sosalization and communication the use of Biochar in Gunungsari is quite long. Because it takes 1 to 3 months for people to use this Biochar evenly. Within 3 months, several steps were taken, ranging from providing information to testing the use of biochar on the land of the head of the farmer group to as a pilot bagi farmers to be willing or interested in adopting biochar.

In addition, in the social system of the community in Gunungsari Village, the head of the farmer group is the first person to be targeted in carrying out communication patterns. In his sosalization, the head of the farmer group played a role in convincing farmers to be willing to conduct trials first. The experiment was conducted at the head of the farmer group. So, in the end, this biochar innovation can be accepted by farmers and used well.

REFERENCES

1. Alkornia, Sylva. 2016. *Diffusion of Green House Technology Innovation among Mango Farmers (Qualitative Study of Green House Development Efforts at SKB Situbondo)*. KANAL (JOURNAL OF COMMUNICATION SCIENCE), 5 (1), September 2016,75-86 ISSN 2302-6790 (print), ISSN 2541-2841 (online) Journal Link: <http://ojs.umsida.ac.id/index.php/kanal> DOI Link: <https://doi.org/10.21070/kanal>
2. I.D. 2004. *Indonesia Student experience of learning at an Indonesian University. School of Nursing and Midwivery Curtin University of Technology*. Master Project.Perth: Unpublished
3. Bungin, Burhan. 2007. *Kualitatif Research Methods*. Jakarta: Kencana Prenada Media Group
4. Gani, A., 2009, *Biochar Biochar Bio bio charcoal potential as a technology for improving agricultural land productivity*, food crop science and technology Vol. 4 No. 1, Researcher of the Center for Rice Plant Research, Sukamandi
5. Gres Kurnia. 2017.Thesis: *Diffusion of Bird Repellent Net Innovation in Prosperous Source Farmer Group in Kalibelo Village, Gampengrejo District, Kediri Regency*. <http://lib.unair.ac.id>
6. Kautsar M. Radinal, Sofyan, and T. Makmur. 2020. Analysis of the Sustainability of Subsidized Fertilizers and Their Effect on Rice Productivity (*Oryza Sativa*) in Montasik District of Aceh Besar Regency (*The Scarcity Analysis of Subsidized Fertilizer and Its Effect On Rice Productivity in Montasik Subdistrict, Aceh Besar Regency*). www.jim.unsyiah.ac.id/JFP. E-ISSN Agricultural Student Scientific Journal: 2614-6053 P-ISSN: 2615-2878 Volume 5
7. Kriyantono, Grace. 2006. *Practical Techniques of Communication Research along with Practical Examples of Media Research, Public Relations, Advertising, Organizational Communication, Marketing Communication*. Jakarta: Kencana Prenada
8. Martika, et al. 2018. *Pre-Design to Build Biochar Fertilizer from Rice Husks with a Capacity of 1,100 Tons / Year using the Main Tool oven*. eUREKA : Research Journal of Civil Engineering and Chemical Engineering Students, (2), 2018, pages 230-237 Available online at <https://publikasi.unitri.ac.id/index.php/ISSN2548-771X> (Online)
9. Moleong, Lexy J. 2008. *Qualitative Research Methods*. Bandung: Rosdakarya Teen
10. Moleong, Lexy J. 2007. *Qualitative Research Methodology*. Bandung: Teen Rosda Karya
11. Morissan, et al. 2010. *Massa communication theory*. Jakarta: Ghalia Indonesia
12. Rogers, Everett M.1995. *Diffusion of Innovations*. Fourth Edition. Free Press. York
13. Saldana, Johnny. 2014 *Qualitative, Data Analysis Miles And Huberman*. Arizona State University
14. Polit, P.F, Beck, C.T & Hugler. 2001. *Essentials of nursing reaserch: Methods appraisal and utilization*. Philadelphia: J.B Lippincott
15. Wiratna, Sekar Pandan. 2019. Thesis: *Diffusion of Organic Rice Innovation (Qualitative Descriptive Study of Organic Rice Innovation Diffusion Process in Gempol Village, Karanganom District, Klaten Regency)*. Communication Science Study

²⁹ Processed from result wawancaRa Researchers with Hendra Imam Wahono As Head Group Farming at village Gunungsari at 13 June 2020 hit 1:33 p.m.

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Other Sources

1. Bumiaji District in 2019 figures
2. <https://nasional.kontan.co.id/news/ini-10-kementerianlembaga-dengan-pagu-anggaran-terbesar-di-apbn-2021>
3. <https://www.antaraneews.com/berita/2005209/bps-catat-rumah-tangga-miskin-terbesar-berasal-from-the-agricultural-sector>
4. <https://www.liputan6.com/bisnis/read/4537810/pupuk-indonesia-alokasikan-904-juta-ton-pupuk-subsidized-in-2021> , accessed on May 28, 2021 at 13.03 WIB.
5. <https://www.liputan6.com/regional/read/4418113/ada-yang-bermain-di-balik-kelangkaan-fertilizer-subsidized-di-blora>, accessed on May 28, 2021 at 13.03 WIB
6. <https://www.antaraneews.com/berita/2082026/kementan-beberkan-alasan-penyebabkelangkaan-fertilizer-subsidy> , accessed may 28, 2021 at 13.03 WIB