

Local Knowledge and the Adoption of Science Knowledge in Cocoa Cultivation Community in East Kolaka Regency

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Abstract— This study aims to analyze the existence of local farming knowledge by cacao farmers community and their integration with science knowledge from outside. The results showed that local knowledge in cacao cultivation is based on customs and traditions as well as the insistence of family life which has been the custom of farmers and then processes through repetitions which then form a farming experience. Science knowledge in cacao cultivation is formed based on the response to the decline in productions and user preferences and the innovation in farming technology which is introduced to users through technology transfer by researchers, extension agents and plantation assistants. The acceleration of technological innovation by the government was not followed by the speed and utilization of science knowledge by cacao farmers, and the weaknesses are in the delivery subsystem and the recipient subsystem. It takes a continuous bridge between research institutions as suppliers of science technology/knowledge with their users, so that the resulting science knowledge is guaranteed to be followed by users on an ongoing basis.

Keywords— local knowledge, science knowledge, cultivation, cocoa.

I. INTRODUCTION

Science starts from human curiosity, from this curiosity makes humans always observe the existing natural symptoms and try to understand them. The word science means knowledge which consists of the science of social science (social science) and natural science (natural science) (Syukri., Et al. 2015). Knowledge is the information that has been combined with understanding and the potential to act; which then sticks to someone's mind. Knowledge has meaning only after it has been placed in a particular social network (Collins, 1990; Collins and Pinch, 1998; Jasanoff, 1990) in (Carolan, 2006).

Drucker (1998) defined knowledge as information that changes something or someone, so that knowledge is considered as a power to master others. In line with Drucker's opinion, Sveiby (1997) defines knowledge as the capacity to act. Foucault (2012) explained that the power to create knowledge and power and knowledge influence each other directly. Wisdom is the fruit of knowledge and knowledge generated from human perception of the world through their senses or intuition (Geertz, 1983). Furthermore, Kenickie and Mphahlele (2002) stated that indigenous knowledge is an accumulation of knowledge that has been created for decades, reflecting creative thinking and action of various generations in individual communities, in a permanent ecosystem of residence in an effort to deal with an ever-changing agroecological and socio-economic environment.

Warren (1993) stated that local knowledge is unique in a culture or society. The end result of indigenous psychology is knowledge that describes local wisdom, which is a picture of attitudes or behavior that reflects the original culture (Ridwan, 2006). Ali (2000) pointed out that knowledge owned by farmers is named by experts with different names. According to Forsyth (2004) local meaning in terms of local knowledge refers to knowledge that is limited by space in a particular area, or may also be based on certain cultural and ethnic aspects. This means that local knowledge is something that is specifically tied to a particular person or place. According to Chamber (1987) local knowledge is often also referred to as folk science, ethnoscience, rural science, and there are also those who use the term indigenous technical knowledge.

II. RESEARCH METHODS

Paradigm, Type and Research Approach

This research paradigm uses the post positivism paradigm, where discourse and knowledge are seen as social reality. This type of research is descriptive. The

approach used is qualitative research (qualitative research) which is a method to explore and understand the meaning by a number of individuals or groups of people considered come from social or humanitarian problems, aims to reveal the process, interpretation of meaning and lead to the disclosure of individual circumstances or behavior who are holistically obsessed.

Location and Time of Research

This research was conducted in the location of the program of the National Movement for Production Improvement, Cacao Productivity and Quality (*Gernas Kakao*), specifically in Penanggosi Village, Lambandia District, East Kolaka Regency for 3 months.

Data Collection and Analysis Techniques

The data collection of this research is done by: interviews, observation, documentation and archival records. The techniques in exploring these problems are described as follows: (1) Inventorying local knowledge information and science knowledge (2) Documenting it in the form of unitary statements. (3) Accumaliting the statements into connected pattern to draw a model of local knowledge and science knowledge in cocoa cultivation. (4) Making discourses in acquiring knowledge, disseminating knowledge, and utilizing local knowledge and scientific knowledge in cocoa cultivation. (5) Interpreting the discourse

Results and Discussion

Cocoa plants have long been known by the people of Southeast Sulawesi, the development of cocoa was launched since the Gersamata program in 1980 through the Makmur Merata Village Movement, abbreviated as Gersamata. The program's approach at that time was reforestation of regions and the environment grew in Kolaka Regency, Southeast Sulawesi Province. At that time, cocoa was distributed to the farming community in the form of fresh fruit which is then nursed and planted by farmers in their gardens individually.

Local Knowledge About Cocoa Cultivation

Various local knowledge in cocoa cultivation which is conventionally practiced by farmers described as follows:

Land Preparation

Land preparation for cocoa plantation development and settlement by farmers was done by exploring and clearing the forest which is locally termed as "*pammulanna majjama dare or mabbele*". In the beginning, as the preparation to open a new location for planting cocoa, because the majority of farmers were buginese community (transmigrants), the steps began with the traditional habits/rituals which is aimed to prevent disturbances from *gost* (local believe) when opening a new land for cocoa cultivation and also asking for successful farming to God.

Local knowledge of land clearing that they understand both individually and in groups is by cutting off all large and small trees gradually by using machetes and "*banci-banci*" (axes) which is brought from their native land (South Sulawesi). A few days after it is estimated that they have dried slowly then they burn it completely. This kind of practice is traditionally gained from the experiences and hereditary knowledge from their ancestors. Hence, it can be concluded that the land preparation knowledge is an original knowledge which is based on daily experiences. However, this kind of practice does not concern the environmental damage due to the burning of the land in opening a new farming location and this has been a great discussion in postmodernity.

Nursery and Planting Materials

One of the ways to determine the planting materials is done by visual selection, farmers usually see ripe cocoa fruits which have large fruits and stem as well as considering its physical growth and health, regardless the type and the origin of the cocoa. This way of selection is purposively done because it is more practical, free and can be done by the farmers themselves, this is also because there is no outside access or other alternatives to obtain planting material.

Cocoa beans are spread on burlap sacks that have been prepared to germinate for 5 to 7 days in an empty room at farmers homes. At the same time, while waiting for cocoa seeds to germinate/the root out, they have prepared a nursery medium in the form of white plastic that has been cut into various sizes, i.e. 10 cm x 10 cm or 12 cm x 12 cm.

Shade Planting

Shade planting or known as cocoa crop protectors. Farmers have never thought about giving shade between cocoa plants, coincidentally at that time, various types of plants grew around the cocoa plants by themselves at farmers' gardens after cocoa cultivation.

Pruning

Local term in the practice of cocoa pruning is known as "*Mapparoning*" which means cleaning. Method used in pruning cocoa plants is by cutting branches and twigs that grow thickly at random, the pattern and timing of pruning is done at any time, and pruning is done when the plants bear fruit or do not bear fruit. Pruning is done because the branches of the cacao plant are very tight to one another and pruning starts when the plants are at least 3 years old. The equipment that is used is a machete.

Planting Space Determination and Planting Holes

Determination of planting space and planting holes is done by farmers after the land has been cleared from woods and shrubs. Usually the planting process begin by determining the planting distance by using equipment such as ropes from banana stems and bark,

then making *pengajiran* or "Mabecci". Before making the planting holes, the farmers make sure the place where the cocoa is planted first, by pulling the rope perpendicularly with 4 meters long for each, the rope is marked with a tie knot, and each 4 meters distance is marked with a wooden mark as the sign of the planting hole spot. This is done to make sure that the lines of cocoa plants are neat / straight and at the same spacing line. The equipment for making plant holes are hoe and *Pattiba*. *Pattiba* is a traditional tool made by farmers which is designed to make planting holes. According to the farmers, the use of *Pattiba* is preferred because it works fast and can break large wood's roots in the ground, while the hoes sometimes break and slower when used in making planting holes. The size of the planting hole made by the farmer is 20 cm x 15 cm or locally termed as 1 hoe eye. As for the spacing that is made varies which is 4 m x 4 m. Farmers knowledge in sizing the hole and distance obtained from neighbor village farmers who had previously planted cocoa.

planting

Cocoa planting by farmers in Penanggosi village is known as "*mattaneng*". Usually planting is done when cocoa is 3 - 7 months old seeded or conditioned with available time. Planting activities are carried out individually by family groups and planting is carried out at the beginning of the rainy season. This is done so that young cocoa / new seeds can grow immediately and no longer need to be watered. Planting time is adjusted to farmers belief which is should be performed in a good day (according to Islamic Calendar) and it is done in the early morning before the sun rises or before the time passes trough 9:00 o'clock a.m.

Fertilization

The efforts to increase cocoa production have been carried out through fertilization to regain soil fertility. In the early years of planting (1-2 years), farmers do not use fertilizer because they think that the land is still fertile and loose. Fertilizers begin to be given when the plants are 3 years old or more, this is based on the reason that young plants before producing fruits do not need to be fertilized because the soil is still fertile and loose. This is also done because according to them there is already capital from cocoa plants that have already produced fruits and need to maintain soil fertility. Fertilizers used for cocoa plants in the location of this study are Urea, ZA, TSP and KCL and NPK. The general method of fertilization is the fertilizer is scattered under

the cacao trees around the stem by cleaning the leaves and dried stems around the trunk first.

Sanitation

In farmers native language, sanitation refers to term "*mapparakai*" or cleaning the grass that grows wild around the plants. Therefore, farmers knowledge about sanitation in this study location is limited to cleaning all types of grass / weeds and cutting off branches that grow into other plants. Cleaning is carried out at any time manually by using equipment such as hoe and *subbe*.

Pest and Diseases Control

Pests and diseases that are concerned by farmers are cocoa fruit borer (PBK) and VSD and cocoa stem borer. These pests and diseases make cocoa fruit hard so it is very difficult to separate between the pod and cocoa beans, another effect is the decrease in cocoa productivity resulted by the attacks from pests and diseases, even it can cause death in cocoa plants if the plans experience the severe attack.

Basically the knowledge of farmers about pests and diseases in cocoa plants gained after the phenomenon where farmers found their cocoa fruit hardens when it split and some fruits are rotten. This symptom resulted in actions to overcome the pests and deseases by smoking the cocoa plants with burning twigs and leaves around the garden and maintaining red ants around the garden. This way is done in order to make adult pests are not free to move and develop normally through smoke and ants as their natural enemies. Some farmers also used chemical substance by spraying pesticides to pests such as pest and disease control practices on rice fields. Pesticides are obtained from cocoa brokers / buyers who buy cocoa from farmers as well as offering these drugs.

Harvest

The application of cocoa harvesting practices is the determination of harvesting which is done visually, in slecting fruits to be harvested farmers can do it simply by looking at the color of the fruits that are yellow or orange. The fruit picking equipment using tools made by themselves namely machete and *pakekadang* / stacker which is a knowledge that has been developed from generation to generation by the cocoa farming community.

The descriptions of cocoa community development based on local knowledge as previously described can be extracted as presented in the following table:

Table.1: Local Knowledge In Cocoa Cultivation Community at Penanggosi Village

No.	Cocoa Cultivation Aspects	Local Knowledge
1.	Land Preparation	Traditional (burning land)
2.	Nursery and Planting Materials	- Seed from the garden itself and not certified

		- Nurseries use soil on plastic media, nursery time 3-7 months.
3.	Shade Planting	Productive plants for daily consumption are bananas, tomatoes, chilies and lamtoro trees
4.	Determination of Distance and Planting Holes	Size of spacing: 4 m x 4 m Hole size according to the size of the nursery media
5.	Planting	Early rainy season
6.	Fertilization	Slope in the ground
7.	Pruning	Irregular
8.	Sanitation	Cleaning weeds using machetes and <i>subbe</i>
9.	Pest and Disease Control	Manual and chemical
10	Harvest	Visually, when cocoa fruit is yellow or orange. Harvesting equipment: homemade machetes and <i>pakkadang</i> / sticks.

Science Knowledge About Cocoa Cultivation

Science knowledge in this case is the knowledge of cocoa cultivation carried out by the government. Various programs have been promoted in developing cocoa community, such as the Integrated Pest Management School Field and the National Movement for Cocoa Production and Productivity Improvement (Gernas Cocoa). This activity aims to increase cocoa production, productivity and quality on an ongoing basis through rejuvenation, rehabilitation and intensification of cocoa (Pedum Gernas Kakao, 2012).

Land Preparation

Knowledge about land preparation which is recommended by government is very difficult to be accepted by farmers, because farmers prefer to use their traditional way which is opening a new farming land by cutting off (wood and shrubs) and immediately burned when it is dry. Farmers usually open a new farming land in dry season. This habit is difficult to be changed although this way can cause environmental damage, but because of time, energy, limited costs, wild animal treat such as snakes and limited modern farming equipments availability, farmers incline to maintain their traditional way of land preparation which has been inherited in their family farming habits

Planting and Nursery Materials

Nursery and planting materials are received from a cocoa rejuvenation program carried out by the government. The program that offered for certified planting material are in the form of Somatic Embryogenesis (SE) cocoa seed assistance comes from Clones: Sulawesi-1, Sulawesi-2, ICCRI-3, ICCRI-4 and Scavina-6, and 2) Assistance for cocoa Entres from cocoa Entres gardens which is recommended by the Southeast Sulawesi Province Plantation and Horticulture Agency. It is expected that with this program, farmers' habits of preparing planting materials from their own gardens can be abandoned.

The use of planting material in the form of SE cocoa seeds recommended by the government is not well

received by farmers, because the fruit is small and it is susceptible to pest and disease attacks. Farmers prefer homemade seeds because they are better suited to the local climate. The nursery delivered by the government through researchers and extension workers is also difficult to implement by farmers because the costs, energy and time are quite large, while farmers prefer practical ones but the results are also maximum. However, the selection of planting media in the form of black polybags has been followed by farmers, as well as the government assistance programs programmed by the government have been well received, but the government grafting knife is not well received because it is easily damaged and take longer time while used.

Shade Planting

Shading plants for cacao plants are *gamal* and banana plants which has generally been well received by cocoa farmers. The concept of providing banana as shading plant is the local knowledge of the farmers followed up by the government support with the provision of plant spacing, where the banana plant as a life support during cocoa yields. Temporary shading plant space (banana) is 3m x 6m and a permanent shade range (*gamal*) is 6m x 6m. Research results by Agung A and Shahabuddin (2014), that Percentage of beans damaged in the monoculture shade was not significantly different from the polyculture shade

Determination of Planting Space and Planting Hole

Knowledge of technology introduction offered by the government is the determination of distance and planting holes in cocoa plants delivered by extension workers with the size of planting holes 60cm x 60cm x 60cm and the size of the planting distance of 3m x 3m and the making of planting holes 2-3 months before planting and manure on planting hole. Science knowledge is still difficult to be accepted by farmers, because it requires a lot of money, energy and time. On the other hand farmers want more practical and fast farming.

Planting

Planting can be done if cocoa seeds and planting holes are ready in the field in accordance with the provisions. Technique and planting method is by using polybag which is slashed first, the plant is inserted into the planting hole, after that the soil is compacted so that it does not fall easily and provides security poles and fence in order to keep the plants thrive and productive as expected. The provision of organic fertilizer in the form of cow / goat manure as the nutrient reserves for young plants has not been followed by farmers because organic fertilizer is not freely available. Therefore, to provide organic fertilizer, a livestock assistance program is needed for farmers who are integrated with the cocoa plantation. This program will create a symbiosis mutualism where animal manure becomes fertilizer for cocoa plants and shading plants, then cocoa skin can be processed as animals' feed.

Fertilization

The efforts to maintain the sustainability of cocoa are carried out by increasing the effectiveness of fertilizing the cocoa plants through the Gernas Cocoa approach by the use of NPK Special Formula based on soil analysis results namely N: 19%, P₂O₅: 8%, K₂O: 10% MgO: 3% and K₂O : 2%. Fertilization has an impact on increasing soil fertility and causing more stability level of crop production so that maximum crop production can be achieved. The provision of manure and organic fertilizer is significantly different from farmers fertilizing practices (control), but the best treatment is found in the combination of inorganic fertilizer (P3) which shows growth and the highest production number of fruits (Azri, 2015).

Pruning

There are 3 ways of pruning offered by the government, those are; trimming, production pruning and maintenance pruning. Trimming is carried out on cocoa plants aged 8-24 months, while production pruning is at the beginning of the dry season and the end of the rainy season, maintenance pruning is done on the sidelines of production cuts that are 2-3 months. Intensive pruning is carried out in a precise time and appropriate manner that aims to keep the branches of the plant organized, and more importantly to increase production and to control pests and diseases (Firdaus AB et al, 2008).

Sanitation

The concept of sanitation as a whole is in the form of weed control by using manual hoe and sickle equipment and the chemical methods are the actions by spraying with various types of herbicide with active contact / systemic ingredients according to the recommended dosage. The garden sanitation is in the form of making holes / *rorak* with a length of 1.5 m, width and depth is 50 cm, this is useful to accommodate the results of pruning in the form of leaves, twigs and branches of cocoa / shading plants as a source of organic fertilizer for plants. Besides it can be an organic fertilizer, this also a way to avoid pests and diseases which can cause a decrease in production and productivity. Another way of garden sanitation is done by making drainage around the cocoa garden to avoid flooding and high humidity around the garden during the rainy season.

Pest and Disease Control

Various pest and disease control programs on cocoa plants have been carried out through SL-PHT Cocoa and Gernas Cocoa. The method used is mechanical, chemical and biological control that has been conveyed to cocoa farmers both formally and non-formally in their gardens. However, this offered concept, although it can reduce pest and disease attacks and can increase production, but farmers still maintain their traditional ways of controlling pests and diseases, farmers are maintaining the use of chemical control by spraying using various types of insecticides and fungicides offered by traders / drugs sellers.

Harvest

The determination of cocoa fruit harvesting age is marked by changes in the color of cocoa pods which are yellow or orange or 5-6 months since flowering. Introducing the use of harvest equipment in the form of pruning shears and pole scissors, solely to avoid damage to the fruit bearing / next shelter and harvesting can be faster than using machetes as farmers traditionally do. Pruning shears and giant scissors have been received by farmers, but giant scissors are used to cut branches and not to harvest / to pick fruits because it will damage other fruits. The cocoa fruit breaking equipment which is recommended made from wood has not been received by farmers because of its slow working, especially while breaking the fruits attacked by CPB, so that the farmers still use their own method which is using machetes.

Table.2: Science Knowledge In Cocoa Cultivation Community at Penanggosi Village.

No.	Cocoa cultivation aspects	Science knowledge
1.	Land Preparation	Modern (without burning land)
2.	Nursery and Planting Materials	- Planting material from certified seeds Nurseries use a mixture of soil + sand + organic fertilizer (1: 1: 1), 4-6 months of nursery.
3.	Shade Planting	Gamal plants

4.	Determination of Distance and Planting Holes	Size of spacing: 3 m x 3 m Planting hole size: L: 60cm x inside: 60cm
5.	Planting	Early rainy season
6.	Fertilization	Immersed in the ground
7.	Pruning	Intensive (Trimming, trimming production, trimming maintenance)
8.	Sanitation	Weed control, making <i>rorak</i> and drainage
9.	Pest and Disease Control	Integrated Pest Management (PHT), namely mechanical, chemical and biological
10	Harvest	Age 5-6 months since flowering, harvesting tools and pruning shears

III. CONCLUSION

Local knowledge in cocoa cultivation is rooted in customs and traditions as well as the insistence of family life which is the habit of farmers and then processes through repetitions which then form a farming experience. Science knowledge in cocoa cultivation is formed based on the response to decreased production and user preferences. Sustainable development of cocoa plantations is carried out jointly by the government, farmers / smallholders and private communities. The government issued research and gave birth to a technology that was introduced to users through technology transfer by researchers, extension agents and plantation assistants.

The acceleration of technological innovation by the government was not followed by the speed and utilization of science knowledge by cocoa farmers, and the weakness of the delivery subsystem and the recipient subsystem. A follow-up plan and valid evaluation are needed between research institutions as suppliers of science technology / knowledge with their users, so that the resulting science knowledge is guaranteed to be followed by users on an ongoing basis.

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