



Transformation Knowledge and Skills of Agriculture Business Through Clean Air Agriculture Training of Trainers

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ABSTRACT

Transformation of Knowledge and Skills through Clean Air Agriculture Training of Trainers was carried out to prepare Village Facilitators/Village Companions/Village Environmental Heroes in 10 villages in Sanggau Regency, West Kalimantan. The impact of Training of Trainers (ToT) on increasing participants' knowledge and skills related to Clean Air Agriculture techniques and Community Organizing Management was evaluated using the Mix-Method method. Quantitative data were collected participatorily using a questionnaire after the training, the assessment used a score of 1-10. Qualitative data were collected through interviews with ToT participants after the training, and the data were processed descriptively. The results of *the Training of Trainers* had a significant impact, on knowledge of Clean Air Agriculture Techniques increasing by 68.2% and knowledge and skills of community facilitation and community organizing increasing by 55.4%. Training of Trainers with an adult education method and learning experience, can involve full participant participation, and can transform the knowledge and technical skills of Clean Air Agriculture and Community Organizing effectively.

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A. INTRODUCTION

Agriculture is a very important sector for the world economy and food security, but it is also a significant contributor to environmental degradation, including increased air pollution, soil degradation, and greenhouse gas emissions. One of the agricultural practices that is often carried out in many countries, especially in Indonesia, is land burning to clear land or clear crop residue after harvest. The practice of burning not only damages soil quality and reduces fertility, but also causes severe air pollution and worsens climate change. According to research conducted by the World Bank (2016), land burning is one of the main sources of carbon dioxide emissions and fine dust particles (PM_{2.5}) which are harmful to human health and ecosystems.



As awareness of the negative impacts of land burning increases, many efforts are being made to find more environmentally friendly and sustainable alternatives. One of them is the Clean Air Agriculture technique, which prioritizes agricultural techniques that do not involve land burning, and focuses on environmental sustainability, input efficiency, and improving air quality. This is where the importance of transforming the knowledge and skills of farmers to switch to more environmentally friendly methods.

Training of Trainers conducted by PT. Carbon X Bumi Harmoni-PT. CMI in collaboration with the FIELD Foundation-Clean Air Indonesia Program aims to train Village Cadres/Facilitators/Village Environmental Heroes to be able to utilize non-timber forest products (through a forestry partnership scheme), utilize environmental services, restore the environment, and absorb and/or store carbon in an area of 20,645 hectares in 10 villages (Engkangin, Sekendal, Sepangah, Mawang Muda, Sungai Ilai, Thang Raya, Nekan, Engkahan, Kenaman, and Raut Muara Villages) in Air Besar, Beduai, Entikong, and Sekayam Sub-Districts in Landak and Sanggau Districts, West Kalimantan Province, Indonesia. With a total population of 25,028 people in 7,070 families.

The culture of Agriculture communities in these villages still applies the burning culture before starting agricultural activities. As an effort to mitigate climate change by reducing carbon emissions, PT CMI provides training and practice of No-Burn Agriculture with a Clean Air Agriculture approach.

The challenge in implementing zero-burn agriculture with a clean air agriculture approach is not only in changing the mindset and habits of farmers themselves. In many areas, land burning is still seen as a quick and cheap way to clear land and manage crop residues. Therefore, an effective training approach is urgently needed to introduce alternative Agriculture techniques that are more sustainable, and easier, cheaper, less labor intensive and can increase yields.

Clean Air Agriculture

Zero Burn farming with a Clean Air Agriculture approach is an agricultural practice that avoids land burning. Land burning has negative impacts on the environment, health, socio-economics, air pollution, climate change, and soil degradation. Therefore, the concept of clean air Agriculture emphasizes sustainable Agriculture with technologies that minimize air pollution and agro-ecological impacts.

Clean air agriculture also uses an agroecology approach that integrates the principles of agricultural ecology to create a more sustainable and environmentally friendly production system. Agroecology suggests the use of agricultural techniques that involve crop diversification, the use of natural control organisms, and wise management of natural resources to avoid burning land. This concept emphasizes the symbiotic relationship between plants and the environment, which can reduce dependence on destructive methods such as burning. (Altieri, MA, 2002; Gliessman, SR, 2007).



Natural resource management must be carried out wisely to maintain the sustainability of agroecology and natural resources for future generations. In the context of clean air agriculture, zero-burn agriculture, natural resource conservation is carried out to avoid destructive practices such as land burning which can cause loss of biodiversity, air pollution, and soil erosion. (Norton, BG, 2005; Baland, JM, & Platteau, JP, 1996).

FAO. (2018) noted that agroecological agriculture methods can increase resilience to climate change and restore soil quality without having to rely on burning. Lal (2004) also said that one of the important principles in sustainable agriculture is wise management of natural resources, including land management, and clean air.

According to Pretty et al. (2018), agroecological agriculture practices have the potential to increase agricultural yields sustainably while maintaining biodiversity. This is in line with the principles of clean air agriculture which prioritize the use of natural materials and technologies that have minimal negative impacts on the environment.

Training of Trainers

Training of Trainers is training of facilitators/cadres/environmental heroes to facilitate training knowledge and skills to the farmer community, includes Clean Air Agriculture techniques, as well as developing organizational skills needed.

John Dewey emphasized the importance of direct experience in the learning process. Effective ToT, trainers must involve participants in relevant direct experiences, so that they can connect theory with practice. Therefore, in Training of Trainers, trainers must be able to create a learning environment that allows participants to interact, experiment, and learn from their own experiences. (Dewey, J., 1938). In Dewey's learning, emphasizes the learning approach through problem solving. In the context of ToT, trainers involve participants in solving real problems that are relevant to the training topic. Problem-based training improves participants' analytical skills, creativity, and collaboration. (Barrows, HS, 1986). Kolb suggests that learning occurs through concrete experience, reflection, abstract conceptualization, and active experimentation. This model is relevant to ToT, where prospective trainer participants not only receive theoretical knowledge but are also given the opportunity to implement and test what they learn in real situations. In ToT, learning becomes a continuous cycle where trainers must hone their ability to adapt and develop their skills. (Kolb, DA, 1984).

Based on Constructivism theory, knowledge is built through interaction with the world and reflection on experiences. So in ToT, trainers must create learning experiences that allow participants to build their own knowledge, through discussion, exploration, and direct practice. (Piaget, J., 1970). also emphasizes the importance of the zone of proximal development (ZPD) which suggests that trainers help participants learn beyond their current ability level with appropriate support. (Vygotsky, 1978)



In Social Learning theory, Albert Bandura emphasized the importance of observation, imitation, and modeling in learning. In ToT, prospective trainers/facilitators learn not only from theory and direct practice, but also by observing how experienced trainers manage training sessions, interact with participants, and handle various situations. Effective training in this context often involves model-based learning where more experienced trainers demonstrate certain skills and techniques that can then be imitated by participants. (Bandura, A., 1977). According to Malcom (1984) in *Training of Trainers*, both using the Andragogy approach that focuses on adult learning, that adults learn better if they understand the direct benefits of the learning, and if the learning is relevant to their life experiences. The andragogy approach helps trainers understand the needs of older participants and adapt teaching techniques to meet their needs, including self-directed and collaborative learning. Collaboration between participants and facilitators is key to deepening understanding and skills. This model supports group-based learning and interaction between individuals, and allows participants to share best practices in training. (Johnson, DW; Johnson, RT, 1999).

Training of Trainers (ToT) helps to form a deeper understanding of how training can be delivered effectively, collaboratively and constructively, providing a different perspective on how trainers can better support in developing the skills and knowledge they need to be successful.

Based on a report by the International Food Policy Research Institute/IFPRI. (2019), investment in farmer education and training contributes significantly to increased agricultural yields and poverty reduction. By utilizing participatory approaches and community engagement, ToT not only empowers individuals but also strengthens farmer community networks to share knowledge and resources collectively, thereby encouraging broader innovation in local agricultural practices (Kassam et al., 2019).

Transformation of Knowledge and Skills.

Knowledge and skills transformation is the process of how knowledge and skills are acquired, processed, and applied in different contexts, and how they can develop through different stages. Transformation involves aspects of learning, teaching, and applying knowledge and skills in broader contexts, including professional, social, and personal life.

Constructivism theory emphasizes that knowledge is built through active interaction with the environment and new experiences. In the transformation of knowledge and skills, constructivism emphasizes how individuals build new knowledge based on existing knowledge, and how they adapt skills through experience and reflection (Piaget, J., 1970; Vygotsky, L., 1978).

Social learning emphasizes the importance of observation, imitation, and modeling in the learning process. The transformation of knowledge and skills occurs not only through direct experience, but also through social interaction and observation of the behavior of others. New skills can be learned by observing and imitating others, as well as through social reinforcement. (Bandura, A., 1977 & 1986).



John Dewey (1938) emphasized the importance of experience in learning. The process of transforming knowledge and skills occurs through reflection on experience, which allows individuals to connect theory with practice. Dewey believed that good education combines theory and direct experience that is relevant to the lives of learners.

Transformation according to Mezirow will focus on the process of changing individual views through reflective experiences. Transformation of knowledge and skills involves changing a person's perspective or outlook on the world, which can enrich and change their understanding and skills. This process is very relevant in adult education and lifelong learning. (Mezirow, J., 1991 and 2000). Transformation of knowledge and skills according to Kolb is an ongoing process involving direct experience which is then analyzed and applied to new situations. (Kolb, DA, 1984).

The training approach uses the Andragogy Education approach which focuses on adult learning. Adults are more likely to learn if they can relate new knowledge to their life experiences or work experiences. The transformation of knowledge and skills in the context of andragogy focuses more on the application of knowledge that is relevant to everyday life and professional contexts. (Knowles, M., 1984).

B. METHODS

This evaluation was conducted on 22 training participants using the *MixMethod approach*. Quantitative data taken using a participatory questionnaire, after completing the training, where participants assess themselves before and after training with a score of 1-10. Qualitative data related to knowledge and skills and the learning process during the training, were taken using interview techniques. then the research data was processed descriptively.

C. RESULTS AND DISCUSSION

Training of Trainers (ToT) with adult education methods (Andragogy) and learning from experience can effectively transfer knowledge and skills of environmentally friendly clean air agriculture techniques, such as land management without burning with a clean air agriculture approach, agroecological principles, and how community organizing is carried out, especially those related to land, plant, pest, and disease management, and management of food crop and agroforestry agriculture businesses, as well as management starting from planning, organizing, implementing, controlling.

The challenge faced in implementing clean air agriculture is how to change the behavior or culture of land burning in the community, because the community thinks that land burning is often considered easy and efficient, in addition to the limited knowledge and socio-economic factors that influence the adoption of new technology.

Clean air agriculture technology is an efficient and effective technology, cheap, easy, low labor, and increased crop yields such as its application in Mulch-No Tillage,



(MNT), Hugelculture, Deep Litter Chicken, and Foliar Fertilizer Eggshell. Clean air agriculture technology can be easily applied by farmers.

Transformation of knowledge and skills in clean air agriculture and community organizing training, shows significant changes in knowledge and skills in training participants. The average score of participants before training was 2.5 and after training the average score increased to 7.8, so there was an increase in score of 5.3. The range of increase in training participants' score was between 53-73%, with an average score increase of 68.2%. This shows that there is a change in the way of thinking, both in terms of clean air agriculture techniques and in land management. Details of the increase in training participants' score are as follows:

Table 1: Clean Air Agricultural Technique Evaluation Results

No	Clean Air Agricultural Variables	Average Pre-Test Score	Average Post-Test Score	Increase in Knowledge Score`	Percentage Increased (%)
1	Knowledge and Practice of Soil Microorganism Testing	2.2	7.6	5.4	71
2	Knowledge and Practice of Soil Water Retention Capacity Testing	2.7	8.0	5.3	66
3	Knowledge and Practice of Fertilizer Loss Testing	2.6	8.2	5.6	68
4	Knowledge and Practice of Soil Aggregate Testing	2.4	7.8	5.5	70
5	Knowledge and Practice of Soil Temperature and Moisture Testing	2.7	7.9	5.2	66
6	Knowledge and Techniques for Making Mulch No Tillage	2.2	8.2	6.0	73
7	Knowledge and Techniques for Making Hugelculture	2.3	8.0	5.8	72
8	Knowledge and Techniques for Making Deep Litter Chicken.	2.1	7.7	5.6	73
9	Knowledge and Techniques for Making Foliar Fertilizer Egg Shells	2.4	8.0	5.5	70
10	Plant Nutrition Knowledge	2.5	7.5	5.0	66
11	Agroforestry Knowledge	2.5	7.5	4.9	66
12	Plant Pest and Disease Knowledge	3.1	7.2	4.1	57
	Average score	2.5	7.8	5.3	68.2

In terms of knowledge and skills of community organizing management, there has also been an increase. The average score before training was 3.4 and after training the score increased to 7.8, so there was an increase in score of 4.3 (55.4%). The lowest



increase in the score of community organizing management was 47% and the highest was 69%. The details of the Community organizing management value are as follows:

Table 2: Community Organizing Management Evaluation Result

No	Community Organizing Management Variables	Average Pre-Test Score	Average Post-Test Score	Increase in Knowledge Score`	Percentage Increased (%)
1	Agroforestry Management	2.5	7.9	5.4	68
2	Conservation Management	2.9	7.9	5.0	64
3	Community Empowerment	3.8	7.6	3.8	50
4	Community Organizing	3.8	7.3	3.5	48
5	Building Group Dynamics	3.9	7.8	4.0	51
6	Leadership	4.3	8.0	3.7	46
7	Planning	4.0	7.6	3.6	47
8	Training Management	2.5	8.0	5.5	69
	Average score	3.4	7.8	4.3	55.4

The increase in the average score of participants' knowledge and skills on Clean Air Agricultural Techniques and Community Organization Management is in accordance with what has been felt by the training participants, that ToT has provided a lot of knowledge. As conveyed by participant Claudia Evatrio Wanda from Raut Muara Village, Sekayam Sub-District, Sanggau District, West Kalimantan, "*after attending the training, I gained a lot of new knowledge. The training also made me aware of the negative impacts of burning crop residues, I hope to inspire other farmers to switch to more environmentally friendly Agriculture methods.*"

This is also felt by Sukiyanus Latef from Kenaman Village, Sekayam Sub-District, Sanggau District, also felt the same way, after the training he gained new knowledge. "*I am very happy to be able to take part in the training, because many things that I previously did not know are now new knowledge. The trainers provide a lot of useful knowledge, all knowledge is very valuable, and I hope to be able to share it with farmers and villagers. I will practice this method (Clean Air Agriculture) to convince the village community that this method is very good and sustainable.*"-

Factors that will influence the success of knowledge and skills transformation to rural communities are the level of farmer participation in the village, government support, and local culture that supports the adoption of new clean air agriculture methods.

D. CONCLUSION

Training of Trainers with an adult education approach (Andragogy) and learning from experience, has a significant impact on increasing the knowledge and skills of



training participants. The transformation of knowledge and skills that occurs will encourage behavioral changes and open critical awareness in adapting to climate change

E. AUTHOR CONTRIBUTIONS

Author Contribution in the Clean Air Agriculture Training of Trainer: for preparation: Sigid Ariyanto, Sandi, Winda. Facilitators of training: Dalyono, Sitor, Arief Lukman Heru Setyoko, Hakim, Kuswana, Miranda Stefani, Muniri, Salim. Journal Writing: Heru Setyoko and Sigid Ariyanto.

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