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Environmental Sustainability through Agriculture: Perspectives of Extension Agents on Adoption of Sustainable Practices

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Abstract. Agriculture is an integral part of the world's economy and global food security, but excessive use of fertilizer and improper use of pesticides are harmful to the environment. This creates the importance of encouraging farmers to practice sustainable agriculture to decrease environmental impacts and conserve natural resources. Increasing the rate of adoption requires an understanding of the farmer's process of transition from conventional to sustainable agriculture. Extension agents play an important role as they are trained to provide information towards the process of transition. Therefore, the purpose of this paper is to explore barriers to the adoption of sustainable agriculture through the perspectives of extension agents that worked with farmers. This qualitative study is based on in-depth interviews with 20 extension agents from the agricultural department in Johor, gathered through purposive sampling. Three stages of deductive content analysis were used, consisting of preparation, organizing, and reporting phases. The process of coding was carried out using Nvivo software. Findings from this study highlighted barriers such as lack of knowledge of sustainable practices and insufficient labor have mainly hindered adoption. Approaches such as providing a platform for farmers to connect, learn, and share techniques of sustainable agriculture could help alleviate the barriers identified in the study.

Keywords: sustainable agriculture, sustainability, adoption, extension agents

1. Introduction

Agriculture is the most widely practiced form of land management throughout the world and a critical source of achieving the world's food security. However, the practice of conventional farming since the 1960s has resulted in a heap of problems that have contributed to the unsustainable development of the agricultural sector, particularly in developing countries. Soil productivity decline, deforestation, water scarcity, and climate change are all problems associated with many of today's farming systems [1][2]. Excessive use of agricultural input such as fertilizer, inappropriate amount of pesticide use, and heavy machinery use causes soil degradation through loss of organic matter, heavy metal and agrochemical pollution, compaction, and erosion. These practices also contaminate water and increase greenhouse gas levels in the air [3][4]. These harmful negative impacts of conventional agriculture has strongly highlighted the importance of agriculture being practiced in sustainable manners.



The concept of sustainable agriculture first emerged in the early 1980s [5]. Agricultural sustainability is based on the idea of meeting current needs without jeopardizing the ability of future generations to achieve similar outcomes. Sustainable agriculture encompasses a variety of non-conventional agricultural practices that are referred to as organic, or low-input agriculture, among other terms. Instead of relying on purchased materials such as fertilizers, a sustainable farm makes as much use as possible of beneficial natural processes and renewable resources that can be obtained from the farm's surroundings [6]. Such practices are proven to be helpful to the environment. For example, the practice of sustainable agriculture such as conservation tillage improves water infiltration, reduces erosion, increases surface soil organic matter and carbon content, and suppresses weeds. It also reduces greenhouse gas emissions and reduces diseases and pests through the stimulation of biological diversity [7]. Adoption of sustainable practices decreases the use of harmful inputs such as chemical fertilizer and pesticides, thereby reducing the occurrence of food contamination. Sustainable agriculture is also advantageous to numerous stakeholders as it strongly emphasizes the efficient use of natural resources and lessens the dependence on artificial inputs [8][9]. However, particularly in developing nations, adoption rates of sustainable agricultural practices remain low despite their benefits [10].

To increase the rate of adoption of sustainable practices, it is important to understand the farmers' process of transition from conventional to sustainable agriculture. Extension agents play an important role in this transition as they are trained to provide beneficial information towards change processes. The agricultural extension can be defined as the ongoing process of providing farmers with useful information and assisting them in acquiring the knowledge, skills, and attitudes necessary to use information and technology to increase productivity. They are also responsible for helping farmers arrive at logical conclusions and make good decisions through the provision of important information [11][12]. Therefore, the purpose of this paper is to explore the barriers to the adoption of sustainable agriculture from the perspective of extension agents that have worked with farmers in the field.

2. Adoption of Sustainable Agricultural Practices

Studies as early as Padel and Lampkin (1994) have discovered institutional and social barriers to adopting sustainable agricultural practices. It was also found that perceptions, access to information, and cultural, as well as legal barriers have managed to hinder farmers' transition towards sustainable practices such as organic farming [13][14]. Even further back in time, Young (1989) and Norman et al. (1989) has pointed out the barriers to the supply of information, which include the fact that knowledge and information need change quickly, farmers don't have enough information, and extension agents don't have enough information and knowledge [15][16].

However, as technology advances and time passes, many of these barriers still exist and few have become irrelevant to modern times. For example, extension agents are now competent as change agents, and they have been an important factor in the success of uptake in practices of sustainable agriculture. They are significant in the relay of information needed for the process of transition among farmers [12]. Extension agents were important for adopting new practices, especially in the initial uptake period [17].

3. Methodology

This qualitative study is based on in-depth interviews with 20 extension agents from the agricultural department in Johor, gathered through purposive sampling. The technique of purposive sampling is chosen for data collection as it deliberately selects participants based on the qualities that the individual possesses. It is a non-random technique that does not require underlying theories or a fixed number of participants [18]. The researcher determines what must be known and then seeks out individuals who possess the necessary knowledge or experience and are willing to share it. This sampling technique suits the study well since it is utilized most effectively in qualitative research to identify and select information-rich cases for optimal use of available resources.[19][20]

Content analysis was selected as the method of analysis for this study as it was deemed to be the most appropriate given the data from in-depth interviews that had been collected. Approaches to content analysis that are inductive and deductive in nature are two distinct approaches to content analysis, and this study has chosen the process of deductive content analysis. Due to the abundance of previous studies in the field and the vast majority of previous findings, inductive content analysis was not chosen as it should only be used when there is a lack of prior knowledge about the phenomenon [21].

Figure 1 shows the three stages of deductive content analysis conducted in this study, consisting of the preparation phase, organizing phase, and reporting phase. The first phase of preparation requires the selection of units to be used according to the research question, and the collected data were analyzed roughly before going to the next phase. The second stage of content analysis consists of data coding according to related categories. The process of coding for this stage was conducted using Nvivo software. The data was compared with previous studies in the field of sustainable agriculture adoption. The last stage is the reporting phase, consisting of communication of the process for data analysis, results, and findings.

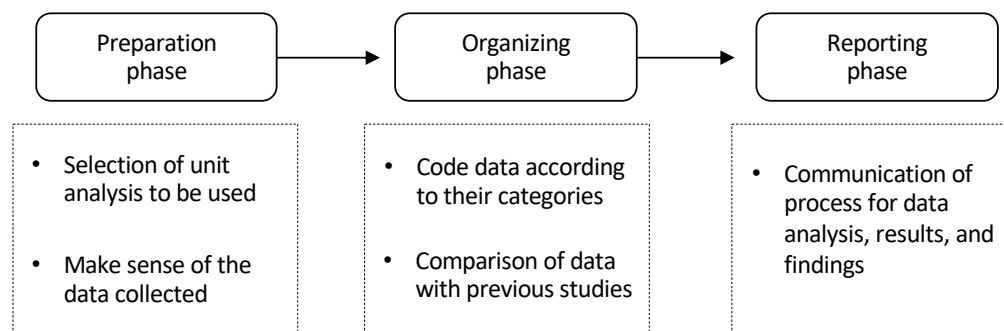


Figure 1. Process of deductive content analysis used in the study.

4. Results and Discussion

Findings from this study have highlighted both internal and external barriers to the adoption of sustainable practices. These barriers are shown in Table 1. The internal barriers consist of cognitive and psychological elements which are intention and habit, and perceived attributes. Intention and habit can be a barrier to adoption through the existence of friction in the process of transition from conventional to sustainable agriculture. The resistance to changing to new ways of farming is a barrier to adoption, emerging from the need for farmers to learn new techniques which are unfamiliar.

As for the perceived attributes, according to Rogers (2004), the adoption of new technology is influenced by the characteristics of innovation as perceived by the individuals [22]. Farmer's perception of low profitability and compatibility in carrying out sustainable practices creates an internal barrier that hinders adoption. Compared to conventional farming, sustainable agriculture requires reduced or an absence in the input of pesticides. This plays a role in farmers' perception of compatibility with carrying out sustainable practice, as pest management can be a challenge.

Table 1. Description of barriers to adoption of sustainable practices.

Barriers	Description
Internal barriers	
Intention and habit	The friction of changing to new ways of farming from conventional practices

Barriers	Description
Perceived attributes	Farmer's perception of low profitability and compatibility compared to conventional farming
External barriers	
Local element	Insufficient labor supply on the farm to carry out sustainable practices, weather conditions, difficulties in managing pests on a big farm
Market related	Absence of differences in selling price for products in the market compared to conventional farming
Social	Low influence from other farmers in social circles practicing sustainable agriculture
Economical	Financial constraints and uncertainty around the economic viability of practicing sustainable agriculture
Informational	Lack of knowledge in the techniques to carry out sustainable agriculture, lack of awareness of benefits of practicing agriculture sustainably.

The external barriers to adopting sustainable practices consist of local elements, market related, social barriers, economical, and informational. Barriers under the categorization of local elements focus on the challenge of insufficient labor supply on the farm to carry out sustainable practices, weather conditions, as well as farm characteristics. Attack of pests has always been a challenge to growing healthy crops, and the level of difficulty in managing them increases with the size of the plot. Farmers with bigger plots of land for growing crops find it hard to manage pests without pesticides, thus finding it easier to use pesticides instead of practicing integrated pest management on the farm.

As for market related barriers, the highlight is the absence of differences in the sale price of produce in markets as compared to crops that were grown through conventional farming. Farmers are reluctant to practice sustainable agriculture since the demand from the consumers focuses on produce at a cheaper price. There are also occurrences whereby farmers would have to match or decrease the sale price of their produce, just to compete in the market. This creates a barrier to increasing the adoption rate of sustainable practices, since farmers have perceived that profitability would not be one of the guaranteed outcomes of practicing agriculture sustainably.

Social and economic barriers to adoption include low influences of sustainable practice from other farmers in social circles and the financial constraints and uncertainties around the economic viability of practicing sustainable agriculture. Farmer's social circles play an important role in the spread of information regarding practices that are sustainable. The process of knowledge transfer is effortless among social circles as it is reinforced by social capital such as trust and norms. This makes social structures influential in promoting the rapid diffusion of innovations [23].

As for the informational barriers, it consists of a lack of knowledge of the techniques to carry out sustainable agriculture, as well as a lack of awareness of the benefits of practicing them. Figure 2 shows the conceptual framework portraying the internal and external barriers to the adoption of sustainable agricultural practices. The study has discovered a connection between external and internal barriers, where the lack of information plays an influential role in farmers' perceived attributes of sustainable agriculture. Farmer's perception of sustainable agriculture can be influenced by informational input from external sources. The effort of tackling the lack of knowledge in the technicalities of sustainable agriculture among farmers is able to change their perceived ease and perceived compatibility with the practice.

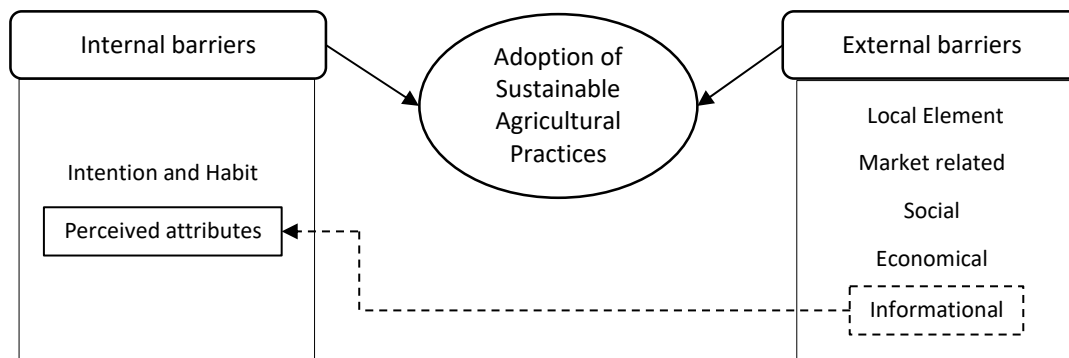


Figure 2. Conceptual framework of internal and external barriers to adoption.

5. Conclusion

The process of transition from conventional agriculture to sustainable practices requires a gradual process of change. Despite the environmental benefits that sustainable agriculture promises, increasing the rate of its adoption requires time and effort. A deeper understanding of the barriers that hinder the adoption among farmers is needed, in order to encourage more uptake of practice. Approaches such as providing a platform for farmers to connect, learn, and share techniques of sustainable agriculture and programs dedicated to spreading awareness of the benefits of the practice could help alleviate the barriers identified in the study. The findings of this study can be used to improve future guidelines and policies that are aimed at increasing the uptake of sustainable agricultural practices in the agricultural industry.

6. References

- [1] Reddy S. Organic farming: status, issues and prospects—a review. *Agricultural Economics Research Review*. 2010;23(347-2016–16927):343–58.
- [2] FAO. The future of food and agriculture—Trends and challenges. *Annual Report*. 2017;296:1–180.
- [3] Keller T, Sandin M, Colombi T, Horn R, Or D. Historical increase in agricultural machinery weights enhanced soil stress levels and adversely affected soil functioning. *Soil and Tillage Research*. 2019;194:104293. [[crossref](#)]
- [4] Rodriguez E, Sultan R, Hilliker A. Negative effects of agriculture on our environment. *The Traprock*. 2004;3(5):28–32.
- [5] Harwood R. A history of sustainable agriculture. In: *Sustainable agricultural systems*. CRC Press; 1990. p. 3–19. [[crossref](#)]
- [6] Reganold J, Papendick R, Parr J. Sustainable Agriculture. *Scientific American*. 1990 Jun 1;262:112–20. [[crossref](#)]
- [7] Hobbs P. Conservation agriculture: what is it and why is it important for future sustainable food production? *Journal of Agricultural Science-Cambridge*. 2007;145(2):127. [[crossref](#)]
- [8] Reganold JP, Elliott LF, Unger YL. Long-term effects of organic and conventional farming on soil erosion. *Nature*. 1987;330(6146):370–2. [[crossref](#)]
- [9] Wezel A, David C, Ferrer A, Letort A, Féret S, Peigné J, et al. *Agroecological practices supporting the provision of goods and services in agriculture: Examples from France and Europe*. Lyon: ISARA. 2014.
- [10] Tey YS. The adoption of sustainable agricultural practices: an integrative approach for Malaysian vegetable farmers. [PhD Thesis]. 2013. [[crossref](#)]

- [11] Rahim M. Empowering of agricultural extensionists through knowledge and skill of the extension profession. In: International Conference on Agricultural Extension, AGREX. 2010.
- [12] Shah JA, Asmuni A, Ismail A. Roles of Extension Agents Towards Agricultural Practice in Malaysia. *International Journal on Advanced Science, Engineering and Information Technology*. 2013 Sep 10;3(1):59. [[crossref](#)]
- [13] Padel S, Lampkin N. Conversion to organic farming: an overview. *The economics of organic farming: An international perspective*. 1994;295–313.
- [14] Dubgaard A, Holst H. Policy issues and impacts of government assistance for conversion to organic farming: the Danish experience. *The Economics of Organic Farming*. 1994;383–91.
- [15] Norman D. Defining and implementing sustainable agriculture. 1997;
- [16] Young DL. Policy barriers to sustainable agriculture. *American Journal of Alternative Agriculture*. 1989;4(3–4):135–43. [[crossref](#)]
- [17] Krishnan P, Patnam M. Neighbors and extension agents in Ethiopia: Who matters more for technology adoption? *American Journal of Agricultural Economics*. 2014;96(1):308–27. [[crossref](#)]
- [18] Patton M. *Qualitative research and evaluation methods*. Thousand Oaks, Cal: Sage Publications. 2002;4.
- [19] Etikan I. Comparison of Convenience Sampling and Purposive Sampling. *AJTAS*. 2016;5(1):1. [[crossref](#)]
- [20] Bernard R. *Research methods in anthropology: Qualitative and quantitative approaches*. Rowman & Littlefield; 2017.
- [21] Elo S, Kyngäs H. The qualitative content analysis process. *Journal of advanced nursing*. 2008;62(1):107–15. [[crossref](#)]
- [22] Rogers EM. A Prospective and Retrospective Look at the Diffusion Model. *Journal of Health Communication*. 2004 Jan;9(sup1):13–9. [[crossref](#)]
- [23] Isham J. The effect of social capital on fertiliser adoption: Evidence from rural Tanzania. *Journal of African economies*. 2002;11(1):39–60. [[crossref](#)]

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