

Sustainable Development and Agricultural Economics: Focus on the Current Trends, Challenges, and Opportunities

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Abstract - The current research aimed at addressing the trends, challenges, and opportunities in agricultural economics. The constant development in agricultural economics warrants a better understanding of such changes to help with effective decision making in agriculture. Consecutively, a review of literature has enabled the research to identify three trends; organic farming, agroforestry, and climate-smart agriculture. The research used secondary data and primary data when conducting the thematic analysis. The findings from the analysis revealed that opportunities such as consumer demand, profitability, and government subsidies motivated the farmers into undertaking sustainable practices. Meanwhile, the challenges such as time constraint, farm size, and access to equipment and expert skills acted as barriers that prevented the farmers from adopting sustainable practices.

Keywords – Sustainable development, agricultural economics, organic farming, agroforestry, climate smart agriculture.

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1. Introduction

Sustainable development represents a principle geared towards accomplishing human growth initiatives while simultaneously providing conducive environment for natural systems to thrive. The concept revolves around achieving interdependence between sustainability's social, ecological, and financial dimensions [1]. Thus, sustainable development entails meeting today's needs without compromising future generations' capability to accomplish theirs. On the other hand, agricultural economics evaluates allocations, dissemination, and utilization of resources used and commodities generated via farming. The analysis in the previous researchers that have explored the association between sustainable development and agricultural economics identified the robust correlation between sustainable growth and environmental protection [2]. The authors highlighted the significance of agricultural policies aimed and conserving the environment in guaranteeing sustainable development. Another article aimed to establish an approach for a long-term sustainable development strategy in Poland's agriculture indicated that the transformation into sustainability would require developing a policy intervention program in the agriculture domain [3]. The socio-economic transformations visible in Ukraine may have been triggered by the sustainable development of agriculture [4]. The evaluation results revealed that the prevailing conditions in Ukraine's agriculture sector were unfavorable to fostering sustainable growth. Another study relevant to the research topic had a primary objective which was to examine the prevalence of sustainable development in Ukraine's agriculture sector by developing a componential method to manage sustainability [5]. The study outcomes indicated that the indicator standardization approach was suitable for assessing sustainability in agriculture. Thus, further exploring the relationship between sustainable development and agricultural economics is necessary to gather additional relevant insights.

Moreover, this study is essential as it will educate the public, particularly individuals engaging in agriculture, on the relationship between sustainable development and agricultural economics. This knowledge will enable farmers to understand why sustainable development is essential, encouraging them to focus on achieving the same during their farming activities. The information generated through this review will also benefit various agricultural companies by highlighting the opportunities they can exploit to achieve profits and sustainable development simultaneously. Thus, they can develop products and machines that increase yield without harming the environment, increasing the preservation of natural resources for future generations. Researchers in the field of agricultural economics may use the findings of this work to guide their studies in the domain by either using the article as a supporting reference or criticizing the argument. Lastly, this study contributes to the existing literature by providing an updated account of the current trends, challenges, and opportunities in sustainable development and agricultural economics. This information will avail literature that agricultural economics students can use to guide school projects. The primary goal of this study is to study the association between sustainable development and agricultural economics. The following objectives will help to fulfill this aim:

- What are the current trends in sustainable development and agricultural economics?
- What are the challenges in the domains of sustainable development and agricultural economics?
- What opportunities are present in the sectors of sustainable development and agricultural economics?

2. Literature review

Over the years, numerous sustainability developments and agricultural economics have risen and have been heavily utilized and explored during that period. In recent years, there have been a few of these trends that have been repeatedly focused upon by many works of literature. These trends include organic farming, agroforestry, precision agriculture, climate-smart agriculture, community-supported agriculture, and urban agriculture.

Organic farming is among the trending sustainability developments that may benefit agricultural economics. A previous study has pointed to organic farming as a method placing importance on the utilization of natural tools and techniques to grow crops and farm animals, instead of depending on artificially produced pesticides and fertilizers [6].

Based on the findings by another research some of the most often used materials in organic farming include cow manures, food wastes, and even other barren grass and crops [7]. The techniques may involve crop rotation and biological pest control to control pests and diseases, thereby increasing the health of the soil and crop yields. As the required materials for organic farming could be produced within the farm, this trending method has been used primarily as a sustainable means of farming [8]. Irradiation and genetically modified organisms (GMOs) are forbidden under organic farming. The removal of these two factors that reflect negatively on the soil's health has assisted in keeping the land fertile for a longer period of time. The value of the organic food and beverage market stands at \$97 Billion [9]. The demand is expected to grow further in the future. Relatively, there is also a growth in organic farmland. This indicates that the farmers as well as the economy stand in favor of the organic farming trend.

Agroforestry is another trend that has been the focus of many researchers on sustainable development and agricultural economics. Agroforestry has been defined as a trending method that involves the plantation of trees and other vegetation into the agricultural land, to turn it into a forest-like environment [10]. The purpose is to increase soil health and biodiversity. The farmers who adopt this method can plant trees in crop fields, incorporate bushes and shrubs into pastures, or make use of woodlots for fuel or as building materials [11]. Since agroforestry shall include produces from multiple trees and crops of different varieties, it also offers additional income streams for the farmers. Using the agroforestry method, fertile land can yield up to 20% to 100% more than what could be yielded with the help of traditional farming methods [12]. This makes agroforestry a trending method that supports sustainable development in agricultural economics.

Climate-smart agriculture is a more recently adopted method of sustainable development in agriculture economics. The method has been referred to as one that takes into consideration climate change and its influence on agriculture [13]. Various works of literature on climate-smart agriculture have particularly focused on the increase in resilience and the decrease in greenhouse gas emissions as the results of the method. Particularly, few studies have stated that every agricultural practice that makes use of conservation and water management to develop resilience against floods, droughts, and similar disasters caused by climate changes [14] [15].

The current research shall focus on these three trends and attempt to reveal the opportunities and challenges faced by the farmer when adopting these trends.

3. Methodology

In this chapter, the researcher states and justifies the chosen research design, data collection techniques, and data analysis methods, ensuring transparency of the study. By delving into the methodology employed, insights can be gained into the rigor and validity of the research process.

Research design

The research has been conducted under the qualitative design. As a subjective design, it aims at finding the underlying meaning behind the phenomenon. The primary advantage in using the qualitative research design is that it explores in-depth the reasons as to why an event has occurred [16]. The current research attempted to understand why the sustainable development trends are utilized in the agriculture industry and whether they could be improved in offering their benefits to the industry. With the help of literature review, three primary trends were recognized in sustainable practices; organic farming, agroforestry, and climate-smart agriculture. The research has opted to employ a thematic analysis to further identify the challenges and opportunities under these sustainable developments.

Data collection

The research conducted the analysis using a combination of both secondary data and primary data. Secondary data are information acquired indirectly from the source, via articles, journals, and books [17]. For the current study, the secondary data was acquired from works of literatures related to sustainability development and agricultural economics. For the works of literature to be qualified for review in the current study, they were set to satisfy the following criteria.

1. It must be related to sustainability development and agricultural economics
2. It must have been peer reviewed
3. It must have been carried out within the last 5 years (2017 to 2022)

The literatures that satisfy these criteria are reviewed to find out the most recent trends in sustainable development, the opportunities that are available because of these trends, and the factors affecting their implementation and effectiveness.

Primary data, on the other hand, was acquired directly from the primary sources such as participants or targeted population (Paradis et al. 2016).

With the help of a semi-structured interview, the primary data required for the analysis was collected from the participants.

Semi-structured interview is a data collection method that allows the research to ask follow up questions in addition to a structured questionnaire [18]. The current research recruited the participants met the following criteria.

1. Must have a profession in agriculture (Such as farmer, agricultural worker, forest scientist, and gardener)
2. Must have adopted one or more of the identified sustainable developments in their agricultural land

Thus, both primary and secondary data were acquired from the literatures and agricultural professionals, for conducting the analysis.

Sampling technique

The current research adopted the saturation technique for acquiring the samples. Under this technique, the review of literature stopped, when it is believed that no additional data could be gained [19]. The same technique was used for collecting the samples in the case of secondary data as well. When the research came to the conclusion that no more additional data can be founded from new samples the data collection process stopped. This ensured quality of the data and enabled the research to acquire all the related data.

Data analysis

The current research conducted an analysis on the collected data using a thematic analysis approach. Thematic analysis is a widely used method in the social sciences. It can be used for analyzing data from a variety of sources, including interviews, focus groups, and written texts. The process typically includes several steps: familiarizing with the data, breaking it down into smaller segments or codes, organizing those codes into related categories, identifying patterns and themes, and then writing a report that describes and interprets the themes that emerged from the data [20]. With help from the analysis, the relationship between the sustainable development and agricultural economics has been established. Additionally, the analysis may have been helpful in recognizing the available opportunities and threats with respect to the trending sustainable development methods.

4. Analysis

The analysis is conducted in two parts; an analysis of the works of literature related to each of the identified sustainable practices and a thematic analysis on the data collected through a semi-structured interview.

Analysis of the works of literature

In this analysis secondary data from the previous works of literature are identified and grounded to form themes and subthemes for the thematic analysis.

Three primary researches have been taken into consideration to conduct this part of the analysis. They include the following.

- Azam, M. S., Shaheen, M., & Narbariya, S. (2019). Marketing challenges and organic farming in India—Does farm size matter?. *International Journal of Nonprofit and Voluntary Sector Marketing*, 24(4), e1654.
- Jahan, H., Rahman, M. W., Islam, M. S., Rezwan-Al-Ramim, A., Tuhin, M. M. U. J., & Hossain, M. E. (2022). Adoption of agroforestry practices in Bangladesh as a climate change mitigation option: Investment, drivers, and SWOT analysis perspectives. *Environmental Challenges*, 7, 100509.
- Abegunde, V. O., Sibanda, M., & Obi, A. (2019). Determinants of the adoption of

climate-smart agricultural practices by small-scale farming households in King Cetshwayo District Municipality, South Africa. *Sustainability*, 12(1), 195.

Each of these works of literature is reviewed separately to identify the opportunities and challenges in organic farming, agroforestry, and climate-smart agriculture respectively.

Organic farming

Organic farming presents the farmers as well as the economy with many opportunities [21]. Most notable among them include an increase in demand for organic products, government subsidies, and the potential for increased biodiversity on the agricultural land [21]. With respect to the challenges concerning organic farming, research collected the following data.

Demographic details	Organic	
	N = 200	%
Gender		
Male	189	94.5
Female	11	5.5
Age		
Less than 20	11	5.5
21–40	51	25.5
41–60	96	48
More than 61	42	21
Education		
Illiterate	26	13
Primary	48	24
High School	81	40.5
Graduate	33	16.5
Postgraduate	12	6
Farm size		
Small	114	57
Medium	64	32
Large	22	11

Figure 1. Demographic data collected on organic farming

As could be seen from the table above, farm size is among the most significant challenge in adopting organic farming. It seems organic farming is easier to adopt in the case of small farms. As the farm size increases, it is difficult for farmers to implement organic farming into their agricultural land. Another challenge as has been recognized by Azam et al. is the education of the agriculturalist. Farmers and land owners with primary education or above have made use of organic farming in their respective agricultural lands. In accordance with their study, the farmers who have adopted organic farming achieved lower yields in comparison to the farmers who continued with conventional methods.

Based on the study, the current research has observed education and farm size as the challenges against the adoption of organic farming in agriculture.

Agroforestry

Another study focused on the adoption of agroforestry practices in Bangladesh [22]. The study particularly concentrated on the investment, drivers, and SWOT analysis perspectives concerning agroforestry. The findings of the study revealed that multiple factors had an influence on the adoption and effectiveness of agroforestry practices. The agroforestry model of sustainable development prioritizes the plantation of trees on agricultural land along with the crops [22].

The research considered a sample size of 240, and a majority of them (Over 53%) have agreed that there exists a huge market demand for the trees and their respective products.

On the other hand, the findings from the research have also identified a few challenges that make it difficult to adopt agroforestry. As could be seen from the table below, education does not have much influence on agroforestry.

Particulars	Level	Frequency	Percentage/value
Education	Illiterate	129	53.75
	Up to primary	56	23.33
	Up to secondary	36	15
	Beyond secondary	19	7.91
Age	20-30	77	32.08
	31-40	45	18.75
	41-50	41	17.08
	51- above	77	32.08
Gender	Male	204	85
	Female	36	15
Farming experience	Up to 10	66	27.50
	11 to 15	38	15.80
	16 to 20	30	12.50
	Above 20	106	54.20
Familiar with agroforestry	Yes	154	64.2
	No	86	35.8
Average cultivated land (decimal)			192.70
Average land under agroforestry (decimal)			38.77

Figure 1. Demographic data on agroforestry

However, the farming experience seems to have a notable influence. Since it would take at least a year for the trees to grow, Jahan et al. believe that this type of sustainable development model in agriculture is not for those who intend to make a profit in the short term. Additionally, it was also founded that there is a lack of government support for this type of agriculture owing to the lack of a proper structure. In this regard, the time constraint and lack of government support have been taken into consideration as challenges against sustainable development.

Climate-smart agriculture

In a different study conducted on the adoption of climate-smart agricultural practices in South Africa [23] [24].

The findings of their research showed a positive relationship between production efficiency and the implementation of climate-smart agricultural practices. When the farmers adopted the sustainable development model, it enabled them to produce the same quantity as in the conventional method, but with adverse conditions and by efficiently utilizing the available resources. Climate-smart practices such as the use of drip irrigation methods that allows the farmers to engage in water-conservative agriculture are environmentally friendly and earn a positive response in the form of subsidies from the government [23].

Similar to the other two methods of trending sustainable development in agriculture, climate-smart agriculture also has a few challenges as could be seen in the table below.

Variable	Mthonjaneni				uMhlathuze				Combined Analysis (KCDM)			
	Mean	Max	Min	SD	Mean	Max	Min	SD	Mean	Max	Min	SD
Age (years)	48.2	72	29	13.1	51.7	78	30	10.7	50.5	78	29	11.1
Education status (years)	5.7	15	0	5.2	7.4	16	0	5.1	6.5	16	0	5
Household size (number of members)	8.7	18	5	3.5	8.7	17	3	3.1	8.7	18	3	3.2
Farm income (US \$)	83.6	278.8	34	63.8	93.4	295.8	40.8	61.7	91.7	295.8	34	62.4
Off-farm income (US \$)	161.4	340	34	208.4	177.5	353.6	54.4	138.1	178.3	353.6	34	164.7
Farming experience (years)	13.3	46	5	10.6	13.1	50	4	9.7	13.1	50	4	9.9
Distance of farm to homestead (km)	0.6	2.5	0.1	0.5	0.6	2.4	0.1	0.4	0.6	2.5	0.1	0.5
Size of farmland (hectares)	3.5	4.5	2	2.6	3.2	4	2	2.2	3.5	4.5	2	2.5
Contact with extension agents (number of contacts)	6.9	24	0	5.7	8.1	26	2	5.1	7.7	26	0	5.3
Exposure to media (number of media outfits accessed)	2	4	0	0.8	2.1	4	0	0.8	2.1	4	0	0.8
Variable	Percentage				Percentage				Percentage			
Gender												
Male	44				41.7				42.5			
Female	56				58.3				57.5			
Production Activity												
Mixed farming	58.7				37.2				38.5			
One enterprise	41.3				62.9				61.5			
Membership of an agricultural-related group												
Yes	59.6				45.9				50.5			
No	40.4				54.1				49.5			
Perception of the effect of climate change												
Adverse effects	56.9				49.1				51.7			
No adverse impact	43.1				50.9				48.3			

Figure 3. Demographic data concerning climate-smart agriculture

Most significant of those challenges include production activity and membership in an agricultural-related group. Climate-smart agriculture is more suitable for single enterprises rather than for mixed farming. Since mixed farming includes multiple crops that require different types of attention such as differences in the level of water it is difficult to introduce climate-smart agriculture. Furthermore, earlier findings recognized that in the case of farmers holding membership to the agricultural-related group, it is easier to implement climate-smart agriculture as it allows access to technical equipment, knowledge, and resources from experts and governments [23]. Hence the research would take into consideration these two challenges.

Thematic analysis

The research has collected qualitative data through semi-structured interviews with 12 farmers. A thematic analysis will be conducted using these data to test the effectiveness of the opportunities and challenges in the recently trending sustainable developments in agricultural economics.

The research has identified two main themes from the literature review; opportunities to motivate farmers into adopting sustainable developments and challenges that prevent farmers from adopting sustainable developments. As the research is focused on the effectiveness of the opportunities and threats in influencing the implementation of sustainable developments, two subthemes have been created under each of the identified main themes. Under the first main theme, the subthemes are high motivation and low motivation. Under the second main theme, the subthemes are high prevention and low prevention. These are to be tested using primary data collected from farmers.

Main theme 1: Opportunities motivating the farmers

Through the review of the previous works of literature, four opportunities were recognized. This includes consumer demand, profitability, government subsidies, and environmental protection.

Sub-theme 1: High motivation

Among the recognized opportunities, three were recognized to be the highest driving forces behind the farmers' intention to adopt sustainability developments in recent years. They are consumer demand, profitability, and government subsidies. The following responses from two of the participants who participated in the semi-structured interview have enabled the research to identify the positive relationship between opportunities and adoption.

"I could generate more profit because of the continuous rise in demand for organic products among the consumers" – Interviewee 3.

"The subsidies provided by the government for implementing drip irrigation and water conservation methods enabled me to adopt the climate-smart agriculture" – Interviewee 5.

Hence, it could be said that consumer demand, profitability, and government subsidies are high motivational opportunities in the adoption of trending sustainability developments.

Sub-theme 2: Low motivation

Environmental protection has less impact or a complimentary impact on the adoption and implementation of sustainable practices. Many of the participants during the semi-structured interview identified environmental protection as a driving factor but not the key factor. They see it either as a byproduct acquired during the process of implementation of climate-smart practices or as a factor that completes self-satisfaction. These findings were revealed particularly in the following responses gained from the participants.

"I was able to increase profitability through the agroforestry method and I heard that it prevents soil erosions as well. So I guess the method is environmental-friendly too" – Interviewee 1.

"I received a government subsidiary for climate-smart agriculture. I later learned that the government supports these practices because it safeguards the environment. I am happy about it." – Interviewee 8.

As it could be interpreted from these responses, environmental protection is a low motivational opportunity behind the adoption of trending sustainability developments.

Main theme 2: Challenges preventing the adoption of sustainable developments

The review of the previous works of literature has enabled the research to identify four challenges that prevent farmers from adopting sustainable practices. They include low yield, education, time constraint, farm size, and access to equipment and expert skills.

Subtheme 1: High prevention

The research has recognized time constraints, farm size, and access to equipment and expert skills as the most difficult challenges that the farmers had to face when deciding to implement sustainable practices. The crops that they produce under some of the sustainable practices take a long time to yield, which makes them unfavorable to the farmers who want to produce yields within a short time. In the case of farm size, many farmers believe that some sustainable practices could not be implemented in small-scale lands. Some of the participants have also stated that sustainable practices such as climate-smart agriculture require access to some costly equipment and expert knowledge. When this access is denied or difficult to attain, it becomes further difficult to implement those practices. The following statements reflect these interpretations.

"The trees and some of the plants occupy a lot of space within my very small land. I would have let them grow. But I could not as it takes for them at least 2 or 3 years to bring yield." – Interviewee 9.

"It is not easy to access equipment for sustainable practices such as drip irrigation, even government is willing to bear some of the cost for it" – Interviewee 12.

Hence, the three factors including time constraint, farm size, and access to equipment and expert skills are known to have a significant negative impact on the adoption of sustainable practices.

Subtheme 2: Low prevention

Low yield and education do not seem to present much difficulty in preventing the farmers from adopting sustainable practices. The responses from the interviewees have made the research identify that farmers are not bothered by the low yield as they sell them with a high-profit margin, because of the high demand for it. In the case of education, it is replaced often by experience in farming which makes it easier to adopt sustainable practices. The following responses are examples of these findings.

"There is high demand for organic products. As such, I was able to sell my low produce at a high-profit margin" – Interviewee 6

"I do not have high-level education but I learned farming through experience" – Interviewee 10

In this regard, Low yield and education are recognized to have less impact on the adoption of sustainable practices.

5. Conclusions and limitations

The current research aimed at identifying the recently trending sustainable developments in agricultural economics and the related opportunities and challenges.

Based on the research, it is concluded that organic farming, agroforestry, and climate-smart agriculture are the most frequently used sustainable practices in recent years. The thematic analysis conducted by the research has further identified consumer demand, profitability, and government subsidies as the primary opportunities and environmental protection as the secondary opportunity that drives the farmers into adopting sustainable practices. On the other hand, it has also been founded that time constraints, farm size, and access to equipment and expert skills may hugely influence the farmers and prevent them from undertaking sustainable practices. It is recommended that agricultural economists focus their attention towards these three significant factors when attempting to design new models for sustainable development in agriculture.

The research is heavily limited by the knowledge of the researcher in interpreting the responses of the interviewees. The research has overcome this limitation by acquiring in-depth knowledge through a literature review and by identifying the core problems and opportunities in sustainable agricultural practices. However, as it is qualitative research, the considered sample size is small. It is possible that the results might change in quantitative research. However, as there is limited information in relation to the statistics concerning the current sustainable practices, it may not be appropriate to use a quantitative research approach. Future researchers may attempt quantitative research centered on the opportunities and challenges recognized in the current research, to present further understanding of sustainable practices.

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Appendix:

Questionnaire used in the semi-structured interview:

1. How many acres of land do you currently farm?
2. What types of crops do you grow?
3. How long have you been farming?
4. Do you use any sustainable farming practices such as organic farming, agroforestry, and climate-smart agriculture?
5. How do you currently manage pests and weeds on your farm?
6. What methods do you use to improve soil health and reduce soil erosion?
7. Have you adopted any conservation practices on your farm such as water management, energy efficiency or biodiversity preservation? If so, please specify.
8. How do you currently market and sell your products, and do you have any certifications for sustainable farming practices?
9. Have you faced any challenges as a farmer in the past year related to sustainability or environmental issues? If so, please describe.
10. Are you interested in learning more about sustainable farming techniques or technologies? If so, please specify.