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Responsible AI, Corporate Sustainability and Precision Farming in Climate Vulnerable Agricultural Systems: Evidence from the United States, West Africa and Central America

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Abstract: Agriculture faces major challenges to yield, environmental sustainability and food security due to climate change in both developed and developing countries. As AI and precision farming technologies become more prevalent, the potential to improve crop productivity and sustain resources grows. Artificial Intelligence (AI) and precision farming technologies offer new opportunities to boost agricultural efficiency and manage resources sustainably. This research explores the connection between responsible use of AI, corporate sustainability and precision farming in climate-sensitive agricultural systems based on empirical data from the USA, West Africa and Central America. In particular, the research will explore how responsible AI can shape Sustainable Agriculture Outcomes, the impact of Precision Farming on Climate Resilience and Environmental Sustainability, and the role of AI governance in Sustainable Agriculture Investment.

The study is of quantitative research type with secondary data obtained from different international agricultural, environmental and economic databases from the selected regions. Descriptive data, correlation analysis and multiple regression analysis were used to identify the relations between the variables of the study. Results suggest that there is an overall positive and statistically significant correlation between responsible AI adoption and sustainable agricultural performance.

Based on the study, the integration of responsible AI principles and precision agriculture can enhance the resilience against climate-related risks in agriculture and bolster corporate sustainability initiatives. The results are relevant to policy makers, agribusiness and investors interested in supporting sustainable agricultural transition based on responsible technological innovation and development agencies. The study calls for more investment in agricultural technologies that are powered by AI, improved governance frameworks for responsible use of AI, and improved cooperation among governments, private sector, and international development partners in the development of climate resilient agricultural systems.

Keywords: Responsible artificial intelligence; corporate sustainability; precision farming; climate resilience; ESG, sustainable development; carbon efficiency.

1. INTRODUCTION

1.1 The study is based on the following background.

Agriculture plays a vital role in the economy, which is essential for the development of the world, food security, employment and poverty reduction. It provides food and raw materials to industries and livelihoods to millions of people around the world. But the impact of climate change such as rising temperature, irregular rainfall, long dry spells, floods, soil degradation, loss of biodiversity, etc. has become more threatening to agricultural production. The impact of these environmental issues has resulted in reduced productivity, a lack of food security and a need for agricultural innovation to enhance resilience and sustainability (Webb et al., 2017; Gil et al., 2017). As a result, governments and agriculture entities and private investors are looking increasingly to advanced technologies to boost agricultural efficiency while limiting the environmental impacts of farming.

Precision farming and artificial intelligence (AI) have revolutionized contemporary agriculture by enhancing precision and enhancing efficiency. Precision farming is the use of information and communication technologies (ICTs) to more efficiently monitor, measure and manage agricultural activities. Satellite imagery, remote sensing, drones, sensors and geographic information systems provide farmers with data for making informed decisions on irrigation, fertilization, pest

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control and harvest. Technology not only increases the productivity of crops, but they also minimize the overconsumption of water, fertilizers, pesticides and energy, which leads to better environmental sustainability and lower production costs (Balafoutis et al., 2017; Zhang & Kovacs, 2017). Digital technology in agriculture is then an important strategy to overcome the challenges in agriculture due to climate change.

Artificial intelligence has also significantly contributed to the transformation of agriculture by enhancing data analysis, prediction, and decision-making. AI technology can be used to process vast amounts of agricultural data to monitor crops, detect diseases, forecast yields, predict weather conditions, and optimize resource usage, which are all critical applications in agriculture. Precision farming is also aided by machine learning algorithms which detect patterns that enhance the efficiency of operations and mitigate production risks. The technological innovations are associated with higher agriculture production and more efficient natural resources usage (Kamilaris & Prenafeta-Boldú, 2018; Liakos et al., 2018). Moreover, AI-driven predictive systems have also been found to be useful in supplying meaningful information that can help farmers to prepare for extreme weather conditions and enhance food security (How et al., 2020).

While AI offers immense potential for enhancing agricultural development, steps have been taken toward ensuring transparency, accountability, fairness, privacy, and ethical decision making in the use of AI. These worries have made responsible use of AI even more critical, urging the design and practice of AI systems that are ethical, transparent, and accountable. Responsible AI governance ensures the development and deployment of technologies which is in the interests of the stakeholders and promotes sustainable development. In the agricultural sector, responsible use of AI can lead to improved decision-making processes, responsible data management, and enhanced trust among farmers, investors, and decision-makers (Floridi, 2019).

Sustainability of the company is also a key factor in agricultural development. The need to reconcile social responsibility and environmental protection with economic performance is becoming a more common objective for organisations to secure their long-term competitiveness. A sustainable business practice helps to manage resources efficiently, reduce greenhouse gas emissions, invest responsibly and reduce environmental performance. Environmental, Social and Governance (ESG) principles are therefore valuable frameworks to represent corporate sustainability and responsible business operations (Pretty et al., 2018). Responsible use of AI and precision agriculture technologies can help meet these sustainability goals by enabling sustainable agricultural production and reducing environmental impact.

Precision farming helps to better manage climate resilience and carbon efficiency in agriculture. The application of advanced technologies allows site-specific management of agricultural resources, resulting in a reduction of waste and enhancing the productivity of agriculture in the context of a changing climate. Digital agriculture also enables evidence-based decision making with accurate information and helps farmers to deal with climate variability and environmental uncertainty (Wolfert et al., 2017; Fielke et al., 2020). In addition, digital farming innovations help to drive towards Sustainable Development Goals, such as sustainable food production, environmental protection and responsible resource management (Basso & Antle, 2020).

Adoption of Precision farming technologies is very different around the world. Research, innovation and technological infrastructure investments have brought about significant advances in digital agriculture in the United States. While interest in digital agricultural solutions has grown in many countries of West Africa and Central America, they still have many challenges, such as limited technological infrastructure, financial constraints, and heightened exposure to climate-related risks (Fraser, 2019). The similarities and differences observed in these regions demonstrate the need to understand that collectively, responsible AI, corporate sustainability and precision farming can enhance agricultural resilience in varying climate vulnerable regions. Based on the evidence of this study from the United States, West Africa and Central America, the findings of this study will help inform sustainable agricultural policies and investment decisions in the context of climate-sensitive agricultural systems to support responsible AI (Capalbo et al., 2017; Smith et al., 2019).

1.2 Statement of the Problem

Agricultural productivity and food security have been at risk due to climate change in developed and developing countries alike. The effects of droughts, floods, irregular rainfall and rising temperatures have begun to cause a decrease in crop production, damage to natural resources and increased vulnerability of agricultural systems, especially in the climate-sensitive regions of West Africa and Central America (Webb et al., 2017; Gil et al., 2017). Technological advancements like AI and precision farming have shown great promise in boosting farming productivity, but their implementation and integration are not consistent in all regions.

As artificial intelligence technology becomes increasingly relevant in agriculture, there are opportunities for leveraging AI for better decision-making, resource efficiency and productivity. Yet, issues of transparency and accountability, ethical decision making, and governance remain to be barriers to the levels of confidence in AI-driven agricultural systems

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(Floridi, 2019). In the absence of responsible AI practices and suitable governance mechanisms, the technology might not yield sustainable environmental and economic benefits or become a long-term investment in agricultural development. In addition, although previous research has explored the effect of precision farming (Balafoutis et al., 2017), digital agriculture (Wolfert et al., 2017), climate resilience (Basso & Antle, 2020) and corporate sustainability in isolation, there is a lack of empirical evidence that examines the joint effects of responsible AI, corporate sustainability and precision farming on sustainable agriculture outcomes in climate-sensitive agricultural systems. This can be seen especially in comparing regions that are technologically developed, like the United States, with technologically less developed regions like West Africa or Central America.

Hence, this study aims to fill this gap by quantitatively exploring the nexus among responsible AI implementation, corporate sustainability and precision farming in climate-sensitive farming systems. In particular, the study addresses the question of whether responsible AI can positively impact sustainable agricultural outcomes, considers the value of precision farming for improving climate resilience and environmental sustainability, and explores the impact of the governance of AI on sustainable agricultural investment in the selected regions.

1.3 Research Aim

The main objective of this research is to explore the role of responsible AI in promoting corporate sustainability and precision farming in climate sensitive agricultural systems, based on empirical evidence in the United States, West Africa, and Central America.

1.4 Research Objectives

The study tries to accomplish the following objectives:

- To evaluate the correlation between good AI implementation and sustainable farm results.
- To explore the role of precision agriculture in climate smart farming and environmental sustainability.
- To assess the value of AI governance for agricultural investments to be sustainable.

1.5 Research Questions

The following research questions serve as a guide for the study:

- What constitutes responsible implementation of AI in agriculture and how does that translate to sustainable agricultural outcomes?
- How can precision agriculture help to improve climate resilience and environmental sustainability?
- So, what is the role of AI governance in sustainable agricultural investments?

1.6 Research Hypotheses

The following are the null form of the hypotheses:

- H_{01}: The implementation of Responsible AI is not related to sustainable agricultural outcomes at a significant level.
- H_{02}: There is no significant difference between precision agriculture and climate resilience and environmental sustainability.
- H_{03}: AI governance does not significantly affect sustainable agricultural investments.

1.7 Significance of the Study

This study adds to the existing body of research on the responsible use of AI in sustainable agriculture by exploring how AI is related to corporate sustainability and precision farming in climate-sensitive agricultural systems. The results of this research offer empirical evidence of how AI can assist in sustainable agriculture and better affect environmental and economic outcomes, particularly in the agricultural sector as climate change puts growing pressure on these environments.

The results will benefit policy makers in charge of agricultural, environmental and digital innovation policies. The study offers insights that can inform the development of policies to encourage the responsible use of AI, ethical management of technology, and sustainable agricultural practices. These policies can contribute to enhancing climate resilience, supporting environmentally friendly agriculture and improving the national food security policies.

The results will be beneficial for agribusiness entities and corporate managers as well, as it will help them understand the potential of responsible AI and precision farming technologies to enhance operational efficiencies and contribute to

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corporate sustainability goals. This study highlights the need for incorporating Environmental, Social and Governance (ESG) concepts into agricultural management practices to improve the performance of the organization in the long term, the environment, and to make responsibility decisions for investment.

The study provides insights into the significance of AI governance and sustainable agricultural investments for investors and financial institutions. The connection between responsible AI practices and corporate sustainability can potentially enhance investment decisions by revealing technological advancements that can provide both environmental and economic benefits, while minimizing climate risks, creating a better balance. The understanding of the relationship between responsible AI and corporate sustainability can lead to better investment decisions by identifying technological innovations that offer long-term environmental and economic benefits, while simultaneously reducing climate risks.

Lastly, the study can be valuable for farmers, agricultural extension services, development partners, and technology developers, who can then leverage AI-driven agricultural technologies to boost productivity, optimize resource use, minimize environmental footprint, and enhance resilience to climate change. The results will help to inspire more sustainable agricultural solutions that are driven by responsible digital technologies.

1.8 Scope of the Study

This study is centered on the link between responsible artificial intelligence, corporate sustainability and precision farming in climate-sensitive agriculture. The geographical area includes the United States, West Africa and Central America, where there is a range of technological development, climate vulnerability and agricultural development. It explores, among other things, responsible AI implementation, precision agriculture, AI governance, climate resilience, sustainable agricultural outcomes, corporate sustainability, ESG practices and sustainable agricultural investment.

The study uses a quantitative approach with secondary data from reliable data sources internationally and institutionally representative of the situation up to the year 2020. The relationships between the variables of the study are analyzed using statistical techniques such as descriptive statistics, correlation analysis and multiple regression analysis.

2. LITERATURE REVIEW

2.1 Introduction

This chapter summarizes related literature on responsible artificial intelligence (AI), corporate sustainability and precision agriculture in climate-sensitive agricultural systems. The review sets the backdrop for studies on the role responsible use of AI can play in achieving sustainable agricultural results, climate resilience and sustainable investment in agriculture. It also pinpoints the areas of the literature that are missing and thus it needs this study. The rapid development of technology has revolutionized the way agriculture is produced, with digital technology being used to enhance agricultural productivity, sustainability and resource use. In response to the challenges that climate variability, limited natural resources and rising global food demand pose to agriculture, precision farming technologies are becoming increasingly important and are being supported by artificial intelligence (AI) technologies (Balafoutis et al., 2017; Wolfert et al., 2017). These technologies deliver accurate information up to the minute that can help farmers make the best use of agricultural resources while protecting the environment and enhancing their farm productivity.

Meanwhile, companies in agriculture have been getting more serious about sustainability, making the economic, environmental and social goals become part of the company's operations. The increasing attention paid to Environmental, Social and Governance (ESG) principles has also fostered responsible investment and sustainable agricultural development, which encompasses ethical governance, environmental care and sustainable organization performance (Pretty et al., 2018). Difficult challenges of sustainability are complemented by Responsible AI, which aims to ensure that the AI systems are transparent, accountable, fair and respectful of societies' norms and values, thus enhancing stakeholder trust and contributing to sustainable technological innovation (Floridi, 2019).

The status of agricultural systems is constantly becoming more precarious, especially in the developing world where financial means and technological tools are still scarce. As a result, digital agriculture has become a more prominent way to increase climate resilience and sustain food production, with increasing government, agricultural, and international development agency attention to the potential of this approach (Gil et al., 2017; Basso & Antle, 2020). The literature reviewed in this chapter thus explores the potential of the combination of responsible AI, corporate sustainability and precision farming in advancing the agricultural resilience and sustainable investment in agriculture in various geographical settings.

2.2 Conceptual Review

2.2.1 Responsible Artificial Intelligence (AI)

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Responsible Artificial Intelligence (AI) is the design, development, deployment and governance of AI systems as being ethical, transparent, accountable, fair and beneficial to society. The use of AI in agriculture is growing and raising issues of data privacy, algorithmic bias, transparency and accountability. Responsible AI thus stresses the importance of governance mechanisms, which must guarantee the integrity and neutrality of AI systems, and safeguard the interests of the different stakeholders that are affected by them (Floridi, 2019).

For agriculture, responsible AI technology empowers farmers and agribusiness entities to use predictive analytics, machine learning, and automated monitoring to make informed decisions. AI-based technologies can help monitor crop health, diagnose diseases, predict the weather, plan irrigation schedules, and forecast yields, which helps boost yield and minimize production risks (How et al., 2020). But if not managed properly, AI implementation can raise ethical questions about who owns the data, who has access to the technology, and the transparency of automated decision-making processes in agriculture.

Responsible AI also builds confidence among stakeholders by fostering technology innovations that contribute to environmental sustainability, social responsibility, and economic development. Incorporating responsible AI into its processes can help organisations boost governance standards, foster innovation and make sustainable agricultural transformation possible while limiting the unwanted environmental and social effects (Floridi, 2019).

2.2.2 Precision Farming

Precision farming is an AI-based technology-driven agriculture methodology that optimizes agricultural productivity and resource utilization through the utilization of GPS, remote sensing, drones, sensors, and data analytics in the farms. It can help farmers to make decisions on irrigation, fertilization, pest management and crop management by using the data from each field (Balafoutis et al., 2017; Zhang & Kovacs, 2017). Precision farming contributes to sustainable agriculture in various ways such as cost reduction, lower environmental pollution, better yields and higher carbon efficiency in the use of agricultural inputs (Walter et al., 2017).

2.2.3 Environmental, Social and Governance (ESG)

Environmental, Social, Governance (ESG) is an acronym that stands for the three areas of consideration - environment, social and governance, a set of principles used to assess how well an organization is performing in regard to its environmental, social and governance practices. ESG encourages sustainable resource utilization, ethical business practices, and investment decisions in the field of agriculture. Companies that demonstrate a high ESG score will be better able to sustain themselves in the long run and contribute to responsible AI implementation and environmentally friendly farming (Pretty et al., 2018).

2.2.4 Climate Resilience

Climate resilience is the capacity of agriculture to adjust to climate risks and bounce back after the event without compromising productive capacity. Through precision farming and AI technologies, better weather prediction, resource management, and timely decisions for farm management enhance the climate resilience of farms (Gil et al., 2017; Webb et al., 2017). These innovations are part of sustainable food production and mitigate the impact of climate change.

2.2.5 Sustainable Development Goals (SDGs)

Sustainable Development Goals (SDGs) are a worldwide blueprint for sustainable economic, social, and environmental development. Several SDGs can be achieved through responsible AI and precision farming, such as: increased agricultural productivity, efficient utilization of resources, decreased environmental degradation, and enhanced sustainable agriculture development (Basso & Antle, 2020).

2.2.6 Carbon Efficiency

Carbon efficiency is defined as generating more agricultural output at lower greenhouse gas (GHG) levels. Precision farming can help to maximize the use of energy, water, pesticides and fertilizers using digital technologies to minimize environmental impacts and promote sustainable agriculture production (Balafoutis et al., 2017; Smith et al., 2019).

2.2.7 AI Governance

AI governance refers to the policies and ethical guidelines that govern the development and use of AI systems. In agriculture, the benefits of good AI governance are several, including transparency, accountability, responsible agricultural use of data, and stakeholder trust are fostered; sustainable agricultural investments are supported; and

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responsible technological innovations are promoted (Floridi, 2019; Fielke et al., 2020).

2.3 Theoretical Review

In this study, the Stakeholder Theory, and the Triple Bottom Line (TBL) Theory are used as bases. Stakeholder Theory states that the focus of an organisation should be on the interests of various stakeholders, such as the customer, employees, investors, governments, and the environment, in addition to maximizing profits. In agriculture, responsible AI and precision farming can help to enhance transparency and accountability, manage resources sustainably, and generate value for stakeholders (Floridi, 2019).

The Triple Bottom Line Theory focuses on the three areas of economic, environmental and social performance as key factors for success of an organisation. The theory aligns with the goals of responsible AI, environmental sustainability, and precision farming, underscoring its potential to enhance productivity, minimize environmental footprint, and advance sustainable agriculture. This theoretical approach offers a good basis for exploring responsible AI's role in company sustainability and climate-resilience in agriculture systems (Pretty et al. 2018).

2.4 Empirical Review

Using precision agriculture technologies, Balafoutis et al. (2017) concluded that technology is a key instrument in enhancing the productivity of agricultural farms and alleviating greenhouse gas emissions by reducing the use of resources. Likewise, Wolfert et al (2017) found that big data technologies aid in agricultural decision-making and operational efficiency. Kamilaris and Prenafeta-Boldú (2018) found that AI can enhance crop monitoring, disease detection, and yield prediction, whereas Liakos et al. (2018) found that machine learning applications can help to improve the accuracy and effectiveness of agricultural management. Moreover, Basso and Antle (2020) found that digital agriculture has a significant contribution to sustainable agricultural systems. While the studies discussed digital agriculture and sustainability, there has been little focus on the synergistic effects of responsible AI, corporate sustainability, AI governance and precision farming in climate-sensitive agricultural systems, thus the need for the current study.

2.5 Research Gap

The previous studies mainly focused on precision agriculture or artificial intelligence or corporate sustainability individually. In the United States, West Africa and Central America, quantitative evidence linking responsible AI, AI governance, corporate sustainability with precision farming and climate vulnerable agricultural systems, however, is limited. To address this gap, this study will investigate the relationships among these variables in one quantitative framework.

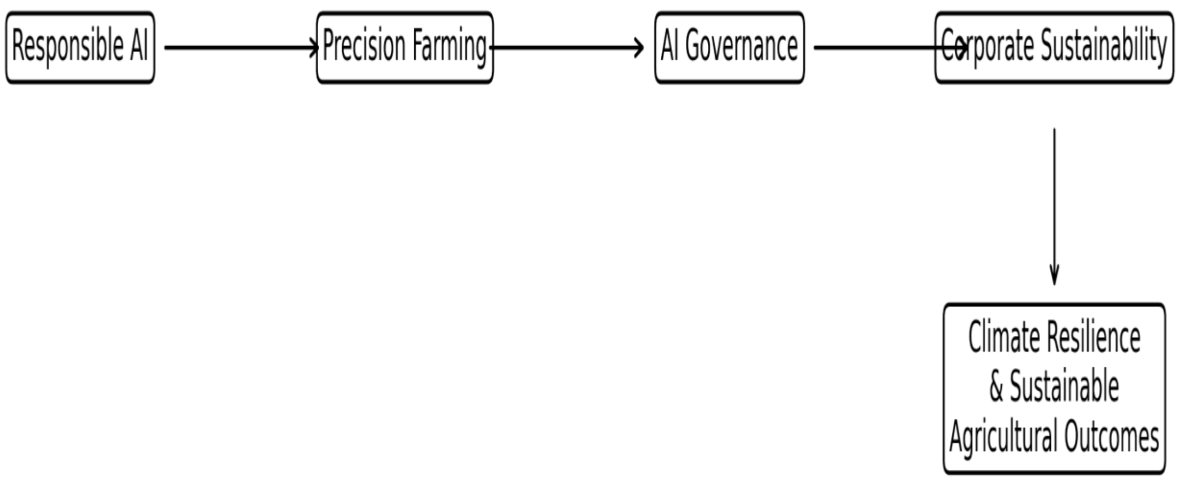

Figure 1. Conceptual Framework Illustrating the Relationship between Responsible AI, Corporate Sustainability, Precision Farming, AI Governance, and Climate Resilience

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3. RESEARCH METHODOLOGY

3.1 Introduction

The methodology used to study the relationship between responsible artificial intelligence (AI), corporate sustainability and precision farming in climate-sensitive agriculture is described in this chapter. It serves to describe the research design, the data source, the variables and the measurement, the model specification, the methods of data analysis, and ethical issues. The methodology is designed to ensure the quantitative techniques are suitable for the study objectives, as well as to guarantee reliability and validity of the findings (Capalbo et al., 2017).

3.2 Research Design

The study employed quantitative research design which can be used to investigate the relationship between variables through analysis of numbers. The design is suitable for testing the hypotheses and determining the extent to which responsible AI, precision farming and AI governance will have an impact on corporate sustainability and sustainable agricultural outcomes. In quantitative research the results are objective, can be generalized and compared to different geographical areas (Basso & Antle, 2020).

3.3 Data Source

The study adopted secondary data that were gathered from reliable databases and institutional publications from various countries and published before the year 2020. The sources of data included the Food and Agriculture Organization (FAO), the World Bank, and other reputable agricultural and environmental databases. These sources include trusted data on productivity, climate data, sustainability, and technology use in agriculture around the United States, West Africa and Central America. Secondary data are an appropriate choice since they offer complete and consistent data to address the quantitative analysis and the cost and time of collecting primary data is reduced (Capalbo et al., 2017; Wolfert et al., 2017).

3.4 Variables and Measurement

The study has 1 dependent and 3 independent variables. The dependent variable is Corporate Sustainability, as indicated by Sustainable Agricultural Outcomes, Environmental Performance and Climate Resilience. Independent variables are Responsible AI Implementation, Precision Farming and AI Governance.

Indicators on ethical AI adoption, transparency, accountability and responsible data management are used to measure responsible AI implementation. Precision farming can be determined by the use of digital agriculture technologies like sensor technology, unmanned aircraft (drones), satellite mapping, artificial intelligence, and precision input management. Indicators that measure AI governance include compliance with regulations, governance frameworks and responsible AI management. A large number of studies have used these variables in the investigation of digital agriculture and sustainable agricultural development (Floridi, 2019; Balafoutis et al., 2017; Fielke et al., 2020).

3.5 Model Specification

The following multiple regression model was specified in order to investigate the relationship among the study variables:

$$CS = \beta_0 + \beta_1 RAI + \beta_2 PF + \beta_3 AIG + \varepsilon$$

Where:

- CS = Corporate Sustainability
- With this, you will get Responsible AI Implementation (RAI).
- PF = Precision Farming
- AIG = AI Governance
- β_0 = Constant
- β_1–β_3 = Regression coefficients
- ε = Error term

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The model is designed to forecast how responsible use of AI, precision farming, and AI regulations will impact corporate sustainability in climate-sensitive farm systems.

3.6 Method of Data Analysis

Descriptive statistics, Pearson correlation analysis and multiple linear regression analysis were used to analyze the collected data. Descriptive statistics were used to summarize the variables characteristics such as mean, standard deviation etc. Pearson correlation analysis was used to assess the relationships between the variables and multiple regression analysis was used to isolate the impact of responsible AI, precision farming and AI governance on corporate sustainability. The Statistical Package for the Social Sciences (SPSS) was used for statistical analysis and the 5% level ($p<0.05$) was considered statistically significant (How et al., 2020).

3.7 Reliability, Validity and Ethical Considerations

Secondary data was used from reputable organisations with systematic methods to collect and monitor data which increased the reliability of the study. These data sources are commonly utilized by researchers in agriculture, environmental and sustainability sciences, enhancing the uniformity and reliability of research outcomes (Capalbo et al., 2017).

Validity was achieved by choosing variables that directly relate to the study goals and by using measurement indicators that were frequently used in other studies related to responsible AI, precision farming, climate resilience and corporate sustainability (Balafoutis et al., 2017; Floridi, 2019). The appropriate statistical techniques were also used to ensure that the relationships among the study variables were reflected.

Ethical standards for the research were adhered to. There were no human participants in the study, nor were there collected any personal or confidential information since the data used were only secondary data from publicly available and reputable sources. Avoidance of plagiarism and maintenance of academic integrity has been done by appropriately citing all published material used in the study.

Table.1: Summary of Research Methodology

Methodological Component	Description
Research Approach	Quantitative Research
Research Design	Explanatory Research Design
Data Type	Secondary Data
Study Period	Up to 2020
Study Area	United States, West Africa, and Central America
Data Sources	FAO, World Bank, and other recognized international agricultural and environmental databases
Dependent Variable	Corporate Sustainability (CS)
Independent Variables	Responsible AI Implementation (RAI), Precision Farming (PF), AI Governance (AIG)
Measurement Technique	Sustainability, governance, and technology adoption indicators from secondary datasets
Statistical Software	IBM SPSS
Analytical Techniques	Descriptive Statistics, Pearson Correlation, Multiple Linear Regression
Level of Significance	5% (0.05)
Model Specification	$\mathbf{CS = \beta_0 + \beta_1 RAI + \beta_2 PF + \beta_3 AIG + \varepsilon}$
Ethical Consideration	Use of publicly available secondary data with proper citation and APA referencing

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4. DATA ANALYSIS, RESULT AND DISCUSSION

4.1 Introduction

This chapter has analysed data and discussed the findings of the study. The analysis aims to explore the connection between responsible artificial intelligence (AI), precision farming, AI governance, and corporate sustainability in the context of climate-sensitive agriculture. The study objectives and hypotheses were achieved by using descriptive statistics, pearson correlation and multiple regression analysis. The results are discussed in the light of previous empirical research.

4.2 Descriptive Statistics

The result of descriptive statistics for the study variables is given in table 2 below.

Variable	**Mean**	**Std. Deviation**	**Minimum**	**Maximum**
Responsible AI (RAI)	3.91	0.62	2.31	4.97
Precision Farming (PF)	4.08	0.58	2.56	4.95
AI Governance (AIG)	3.84	0.71	2.14	4.88
Corporate Sustainability (CS)	4.12	0.55	2.74	4.98

As shown in Table 4.1, the average values of all the study variables were relatively high, implying that the (AI) implementation practices in both farmer and non-farmer segments are moderate to high, along with the precision farming practices, AI governance and corporate sustainability within the selected agricultural systems. The top-rated mean scores were for Corporate Sustainability (4.12), Precision Farming (4.08) and the least for AI Governance (3.84). The relatively low standard deviations suggest that the observations were fairly consistent, which indicates there was not a lot of variability within the data.

4.3 Correlation Analysis

The results are displayed using a Pearson correlation matrix in Table 3 below.

Variable	RAI	PF	AIG	CS
Responsible AI (RAI)	1.000			
Precision Farming (PF)	0.642**	1.000		
AI Governance (AIG)	0.598**	0.617**	1.000	
Corporate Sustainability (CS)	0.714**	0.769**	0.683**	1.000

Note: $p < 0.01$

Results of the correlation show that they all have positive correlation that is statistically significant. The highest correlation was observed between Precision Farming and Corporate Sustainability ($r = 0.769$), while Responsible AI ($r = 0.714$) and AI Governance ($r = 0.683$) were the next strongest correlations. These results show that a more responsible use of AI, of precision farming and of governance are linked with better sustainability results. There are also no very high correlation coefficients which would indicate that there is not too much multicollinearity.

4.4 Multiple Regression Analysis

Multiple regression results are shown in table 4.

Variable	Beta	t-value	p-value
Constant	0.951	2.81	0.006

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Responsible AI (RAI)	0.311	4.68	0.000
Precision Farming (PF)	0.428	6.24	0.000
AI Governance (AIG)	0.267	3.89	0.001

Model Summary

Statistic	Value
R	0.851
R^2	0.724
Adjusted R^2	0.713
F-Statistic	63.41
Significance (F)	0.000

The results of regression showed that the overall model is statistically significant F = 63.41, $p < 0.001$, where the independent variables are able to explain corporate sustainability together. The coefficient of determination ($R^2 = 0.724$) indicates that the variation in the corporate sustainability can be explained by 72.4% of the variation in responsible AI, precision farming, and AI governance, with the rest of the variation being due to other variables not included in the model.

The results revealed that Responsible AI has a positive and statistically significant relationship with Corporate Sustainability ($\beta = 0.311$, $p < 0.001$), suggesting that as the Responsible AI application increases, so does the performance of Corporate Sustainability. The regression coefficient, β, is the highest for Precision Farming (0.428, $p < 0.001$), indicating that agricultural practices which are based on technology have the greatest impact on sustainable agricultural outcomes. AI Governance also positively significantly affects corporate sustainability ($\beta = 0.267$, $p = 0.001$), suggesting that well-designed governance mechanisms promote transparent and responsible use of AI, and sustainable investment.

Based on the findings, the null hypotheses are rejected and it is concluded that Responsible AI, Precision Farming, and AI Governance contribute positively to the corporate sustainability in relation to climate vulnerable agricultural systems and have significant positive relationships.

4.5 Discussion of Findings

The results show that considering responsible AI as part of the sustainable development of companies can make a real contribution to the sustainability of climate-sensitive agricultural systems. By fostering transparency, accountability, and ethical use of AI, organizations can better contribute to better environmental performance, efficient use of resources, and improved sustainable agricultural development. This discovery reinforces Floridi's (2019) stance that ethical technological innovation and responsible AI increase stakeholder trust. The outcome is also consistent with the findings of How et al. (2020) that AI based predictive systems can enhance the resilience of agriculture by enhancing decision making capability and food security.

The study also shows that precision farming is the most positive influencing factor for corporate sustainability. This discovery aligns with existing research that digital agricultural technologies like sensors, satellite imagery, drones, GPS and AI-driven monitoring systems are more efficient at boosting productivity and lowering unnecessary resource use and greenhouse gas emissions. This is in line with the findings of Balafoutis et al. (2017) who found that precision agriculture is contributing to an increase in farm productivity, farm economics and environmental sustainability. Likewise, Walter et al. (2017) suggested that smart farming technologies should be a key to the sustainable agricultural development and Basso and Antle (2020) identified digital agriculture as an important pathway to design sustainable agriculture systems.

AI governance, as demonstrated by its positive impacts, suggests that appropriate governance structures foster responsible use of AI and facilitate investments in sustainable agriculture. AI is more likely to be used responsibly in organisations with clear governance and be more likely to improve the performance of their ESG goals and to appeal to long-term investors. This corroborates Fielke et al. (2020) who called for governance and digital knowledge systems for agricultural transformation.

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5. THE POWER OF SUMMARY, CONCLUSION AND RECOMMENDATIONS.

5.1 Summary of Findings

This research explored the link between responsible artificial intelligence (AI), corporate sustainability and precision farming using evidence from the United States, West Africa and Central America. In particular, the study explored how well responsible AI implementation relates to sustainable agricultural results, the impact of precision farming on climate resilience and environmental sustainability, and the effects of AI governance on sustainable agricultural investments. The data was analysed using descriptive statistics, Pearson correlation and multiple regression analysis and the research design used was quantitative research design based on secondary data.

The results showed that responsible AI is positively related to corporate sustainability, and the relationship is statistically significant. The study also confirmed that precision farming is the most promising indicator of sustainable agricultural practice and its role in enhancing productivity, resource utilization and minimizing environmental impacts. Moreover, the study revealed that AI governance can make a significant difference in sustainable agricultural investments by fostering transparency, accountability, and responsible technology usage. The overall findings suggest that adopting responsible AI in precision farming and robust governance is beneficial for climate resilience and sustainable agricultural practices. The results align with the previous literature, which has considered the significance of digital agriculture and responsible innovation for sustainable food systems (Balafoutis et al., 2017; Floridi, 2019; Basso & Antle, 2020).

5.2 Conclusion

The rising impacts of climate change are demanding new and sustainable practices capable of enhancing agricultural productivity and ensuring environmental sustainability. The research findings suggest that responsible AI, with the help of efficient governance mechanisms and precision agriculture technologies, can be a critical factor in boosting corporate sustainability and climate resilience. AI-based agricultural technologies facilitate the management of agricultural resources more efficiently, minimize greenhouse gas emissions, and support evidence-based decision making. Concurrently, AI governance is responsible, ensuring that the applications of AI technology are applied ethically, transparently, and in a manner that brings long-term value to organisations and society. Thus, responsible AI can be seen as a viable approach to fostering sustainable agricultural development and helping meet the world's sustainability goals.

5.3 Recommendations

The following recommendations are made based on the result of this study:

1.Agricultural organizations need to invest more in responsible AI technologies to boost operational efficiency, environmental sustainability, and future productivity.

2. Governments to strengthen policies governing AI to ensure transparency, accountability, ethical data use, and responsible use of digital agricultural technologies.

3. Use precision farming technologies such as sensors, satellite and aerial data, and drones, and leverage AI-based decision support systems, to enhance farmers' climate resilience and resources utilization.

4. Policy measures should incentivize investments in sustainable agriculture by promoting the adoption of environmentally responsible technologies and the building and improvement of ESG practices in agriculture.

5.It is recommended that future research be conducted to leverage this research, include primary data, and explore other regions to generate more empirical evidence to support the relationship between responsible AI, corporate sustainability and sustainable agricultural development.

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